SFD Report

Hakimpara (Camp 14)
Cox’s Bazar, Bangladesh

Final Report

This SFD Report -Intermediate- was prepared by
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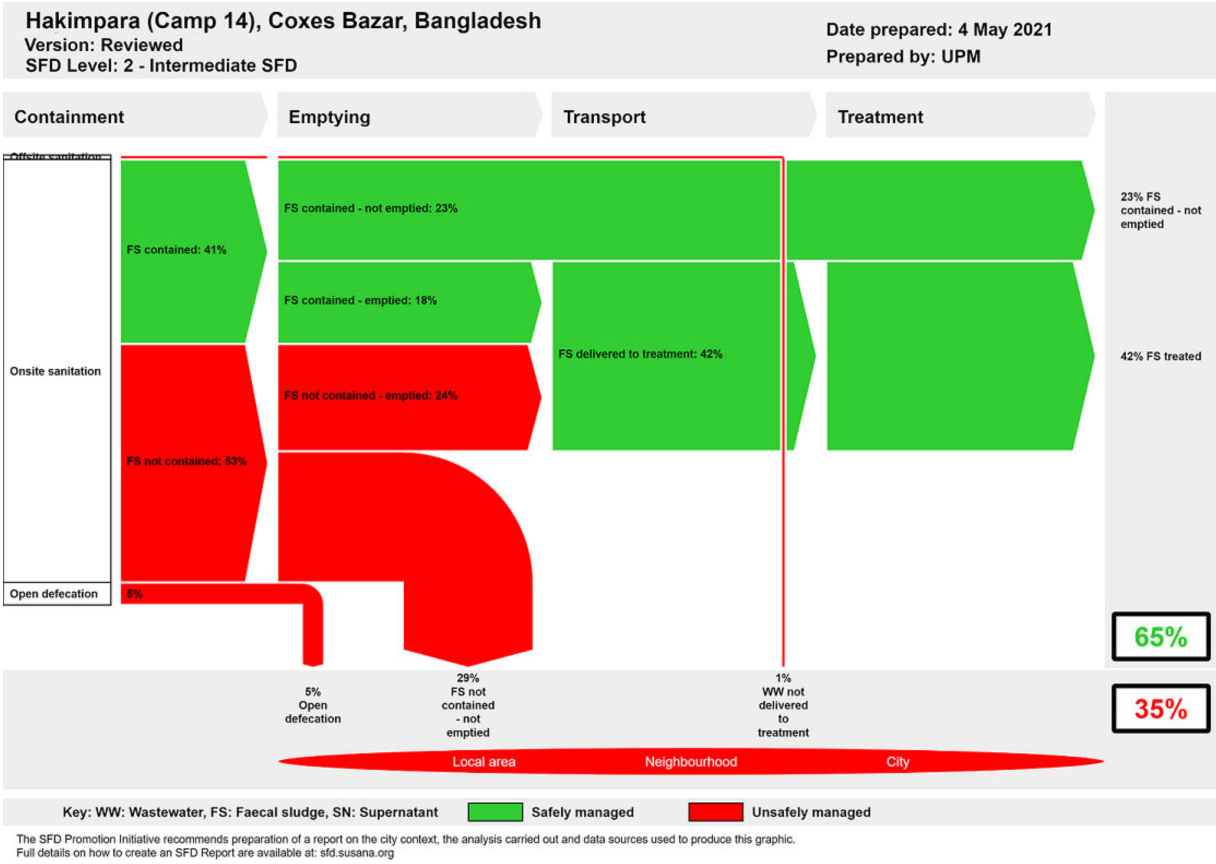
1. The SFD Graphic



2. Diagram information

SFD level:

Intermediate. Level 2 report.

Produced by:

UPM Umwelt-Projekt- Management GmbH (UPM)

UPM is very grateful to all partners & consultants working on the "Technical Assistance for Sanitation/FS Management in the context of Rohingya Refugees' Crisis", who have helped to collect the information used for this report.

Collaborating partners:

UNICEF and BRAC NGO – WASH Humanitarian Response Team in Cox's Bazar.

Status:

Final SFD report.

Date of production:

29/05/2021

3. General city information

This SFD report looks at Hakimpara, Camp 14, a sub-division of a larger Rohingya refugee camp site in Palong Khali union, Teknaf upazila, Cox's Bazar District (CXB District) in Bangladesh. As for end February 2021, there were 32,815 people registered in Camp 14 and over 870,000 people (Inter Sector Coordination Group - ISCG 2021 & UNHCR 23.03.2021) registered in total in the 34 sub-camps and in surrounding host-communities, making the overall refugee camp site the largest one in the world. The population density is extremely high, with 60,000 individuals per square kilometre on average, although variations exist between the 5 blocks and 30 sub-blocks in Camp 14. In Camp 14 – Hakimpara –, around 20 m² of camp area is available per person (ISCG 2019). Space is limited mainly due to the sandy and hilly terrain in the area. The region, located on the eastern side of the gulf of Bengal, has a tropical climate with four seasons, including a monsoon season from June to September and a dry season from December to February. Highest temperatures are reached during pre-monsoon season from March to May (GoB, 2019b). Due to the heavy rainfalls during the monsoon season, many camp sites are affected by landslides.

4. Service outcomes

BRAC is the leading NGO responsible for Water, Sanitation and Hygiene Services (WASH), including Faecal Sludge Management (FSM). Solidarités International (SI), and Janoseba Kendra (JSK), are secondary WASH services implementers in Camp 14.

There are 1,161 toilet sites with 2,490 toilet cubicles in the camp 14: 698 single unit cubicles and 1,792 multiple unit cubicles with overall 340 gender specific cubicles for female. The shared toilet cubicles are arranged in 462 blocks with 2 to 6 cubicles (WASH-Sector CXB, 2021) . Of the total sum of these cubicles, 2,138 are latrines with a lined walls pit made of reinforced concrete rings and an open bottom (Stakeholder 2). As these are permeable, the SFD graphic shows that 53% of the faecal sludge (FS) is not contained, of which further 29% never get emptied, but infiltrates into the soil; likely causing a risk of pollution for the groundwater.

Additionally, 352 cubicles are recorded to be connected to septic tanks, with an overflow probably connected to the drain field as per the unified standard design in used in the camp area.

The open defecation (OD) rate is calculated at 4%. This is the average OD rate for the whole camp in CXB and includes unsafe disposal of (children's) faeces (ibid). Another unsafe practice is the ongoing use of self-made pit latrines, which accounts for 1%.

Overall, the results of the graphic are that 65% of excreta and FS is managed in a safely manner. The results are based on the assumptions that 87% of toilets are covered by FSM services (FSM Service Maping Camp 14, 2020)[1]. Yet 100% of these 87% toilet facilities are being emptied and the FS is delivered to the Faecal Sludge Treatment Plants (FSTPs) within the camp. The FSTPs include four ABR systems connected to constructed wetlands and polishing ponds, and one lime treatment station operated by BRAC, one upflow filter constructed by Gana Unnayan Kendra (GUK) and currently operated by Janoseba Kendra (JSK), and one Geo-tube system, operated by SI. The assessment of their efficiency and environmental impact is not part of the scope of an SFD report.

58% of all latrines are considered to be in the area with high groundwater pollution. This assumption is based on the REACH findings, that identified that 58% of all latrines are built closely to the tube well across the camps.

Furthermore, it is noteworthy that 6% of the unsafely managed excreta may be caused by unsafe practices of the residents themselves, mainly due to open defecation, unsafe disposal of excreta and additionally the use of sub-standard self-made latrines including toilets discharging directly to 'don't know where'.

5. Service delivery context

In the last two decades Bangladesh has indeed made great efforts and improvements towards providing water and sanitation services to its population. For instance, one milestone is the reduction of open defecation rate from 34% in 1990 to 1% of the national population in 2018. Also, since 2017, Institutional Regulatory Framework for Faecal Sludge Management (IRF-FSM) puts an emphasis on the heavily reliance of the country on onsite sanitation and the need for management of faecal sludge. Additionally, as a country prone to various kinds of disasters, the need for not only responses but also disaster risk reduction (DRR) has become prevalent. Under the Ministry of Disaster Management and Relief (MoDMR), there is a National Disaster Management Institutional Framework in place which comprises the Disaster Management Act (2012), the Disaster Management Policy (2015) and already two National Plans for Disaster Management (NPDM) (2010-2015 and 2016-2020). Moreover, already since 1997 the Standing Order on Disaster is in place which was revised in 2010 under the then called Ministry of Food and Disaster Management (MOFDM).

Combining the efforts for FSM and DRR, the Environmental and Social Management Framework, as well as the Resettlement Policy Framework were published in December 2019 under the MoDMR, the Local Government Engineering Department (LGED) and the Department of Public Health Engineering (DPHE). Both frameworks clearly address the need to further invest into infrastructure for FSM in combination with climate vulnerability and disaster risk reduction, including trainings on these topics (GoB, 2019a; GoB, 2019b).

Within the humanitarian response sector, a number of documents and strategies aiming at joining efforts in the response were published in particular by the WASH Cluster coordination (i.e., WASH Sector Strategy Cox's Bazar, 2018).

[1] The initial coverage was than updated by BRAC.

6. Overview of stakeholders

In Bangladesh, the mandate for Water and Sanitation is regulated by the 2009 Local Government Act (amended in 2010)[2] mandating responsibilities towards overseeing the development of water and sanitation services to the Ministry of Local Government, Rural Development and Cooperatives (MLGRDC). The MLGRDC is encouraged to set up a unit dedicated to FSM and to collaborate with the LGED and the DPHE in the matters, as well as relevant institutions. When it comes to Disaster Management, the MoDMR oversees coordinating efforts across all agencies involved, which are, amongst others, a Council, a Coordination Committee, and an Advisory Committee for Disaster Management (DM). These have the responsibility to formulate, review and implement policies and strategies in regard to DM. Additionally, The NGO Coordination Committee (NGOCC), headed by the Director General of the Department for DM, is mandated to review, and coordinate the activities of concerned NGOs in the country (WASH Sector, 2018).

Within the WASH response of the humanitarian organizations, responsibilities are distributed on three levels: 1. Chair; 2. Mid-level and 3. Zonal/ camp focus points. The DPHE is leading the sector response, co-chaired by Action Against Hunger (ACF) and UNICEF who are providing oversight, continued support, and monitoring. Mid-level coordination is carried out by IOM, UNHCR and UNICEF and is organized in different zones on the overall camp area (WASH Sector, 2018).

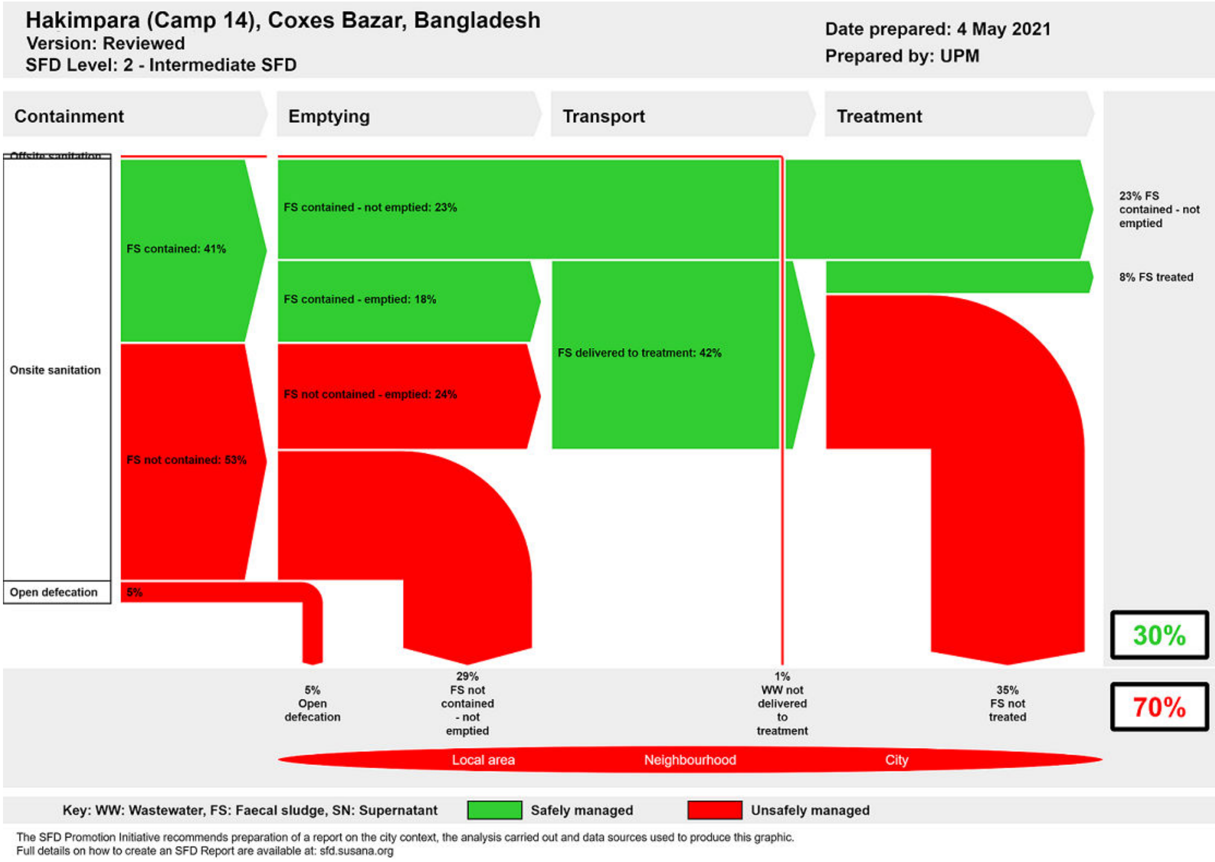
Humanitarian Response implementing organizations are organized in sectors such as WASH, Food, Shelter or Education. In Camp 14, BRAC is the main NGO implementing WASH and FSM services. UNICEF is in charge of mid-level coordination. A FSM Technical Working Group (TWiG), hosted by the Global WASH Cluster (GWC), is focusing on improving technical solutions for FSM as well as knowledge management & sharing, based on its 7-point strategy plan for 2020/21 (FSM Global TWiG Action Plan for 2020 (and beyond)/ Draft) (GWC, 2020).

[2] Applies as the 'Paurashava, City Corporations, Upazila Parishad and Union Parishad Act', according to the population size of the level of government. There are rural areas, secondary cities (Paurashavas) with a population of 15,000 to 60,000 inhabitants and City Corporation which there are currently nine of and one mega city, Dhaka (GoB, 2009).

Table 1: Overview of Stakeholders.

Key Stakeholders	Institutions / Organizations /
Public Institutions	Department of Public Health Engineering (DPHE) Ministry of Disaster Management and Relief (MoDMR), National Disaster Management Council (NDMC), Inter-Ministerial Disaster Management Co-ordination Committee (IMDMCC), National Disaster Management Advisory Committee (NDMAC), NGO Coordination Committee (NGOCC), Ministry of Local Government, Rural Development and Cooperatives (MLGRDC), Local Government Engineering Department (LGED)
Non-governmental Organizations	UNICEF, ACF, UNHCR, IOM, BRAC, SI, JSK and other WASH INGOs & NGOs
Coordination Mechanisms	REACH Initiative (OCHA), Inter Sector Coordination Group (ISCG), Global WASH Cluster (GWC), WASH Sector Cox's Bazar, Technical Working Group (TWiG) on FSM
Donors	USAID, EU, BMGF, Local Consultative Group (LCG)

7. Context-adapted SFD Graphic



8. Description of context-adapted SFD graphic

The context-adapted SFD graphic results at only 30% of FS being safely managed. While the data input is the same, the main difference in the results derives from the assumption that all treatment systems in Camp 14, lime treatment aside, do not sufficiently inactivate pathogens. Hence, the effluents discharged into the drains after treatment may still cause public health risk in the camp. In contrast, the 8% of FS being treated with lime and 23% that is been infiltrated or contained in OSS in area without significant risk for groundwater pollution, are considered as safely managed.

This assumption is based on the results of effluents quality of different systems using similar technologies implemented by UPM (2019b), and not on the actual performance of the systems in Camp 14. This approach was chosen due to absence of performance data and of a functional laboratory to test effluents at the time of data collection.

9. Process of SFD development

This SFD graphic is a first attempt to apply the SFD methodology to the Rohingya refugee camps in Cox's Bazar. UNICEF, as the Cluster Lead Agency (CLA), has selected Camp 14, as the most suitable camp due to the amount of data already available. BRAC, as the key implementing WASH partner, has kindly agreed to an interview and to provide further data.

In summary, this SFD graphic should be considered as an invitation to all stakeholders, especially UNICEF and BRAC, to collaborate and further improve this SFD graphic.

10. Credibility of data

Most of the data used for the SFD graphic as well as the report are based on documents that are publicly available on the OCHA hosted platform https://www.humanitarianresponse.info/ and published by the WASH Cluster, as well as annual monitoring publications by UNICEF, such as the CXB WASH CLA, and the REACH initiative. Additionally, two key informant interviews were held with BRAC and UNICEF. Informal observations from the UPM team experiences in Cox's Bazar were also included. These observations were mainly used to cross-check public data.

Due to time limitation, it was not possible to visit Camp 14 during the specific data collection mission for the purpose of this SFD report, but other camp sites have been visited several times, during the previous onsite assignment period between 2018 and 2020. For the same reasons, it was not possible to implement dedicated focus group discussions during the period. However, the data and information available from the CXB humanitarian response, in particular from the WASH cluster, is extensive. Most of the reports are published and accessible, including the WASH infrastructure spreadsheet and other data and reports listed in the references.

11. List of data sources

Abbreviated list of data sources:

- Global WASH Cluster (2020). Homepage. Available at: https://washcluster.net/
- Government of the People's Republic of Bangladesh (2019a). Emergency Multi-Sector Rohingya Crisis Response Project (EMCRP). Environmental and Social Management Framework.
- Government of the People's Republic of Bangladesh (2019b). Emergency Multi-Sector Rohingya Crisis Response Project (EMCRP) and Additional Financing: Resettlement Policy Framework.
- Inter Sector Coordination Group (ISCG) (2020): Map: Cox's Bazar. Rohingya population density by camp in Ukhia. As of 30 April 2020.
- REACH (2019e). Camp 14. Sanitation Infrastructure Coding: Latrine Facilities. Bangladesh – Rohingya Refugee Crisis – Cox's Bazar District. (November 2019).
- United Nations High Commissioner for Refugees (UNHCR) (2020). Refugee Population by Location. Rohingya Refugee Response Bangladesh as of 30 April 2020.
- WASH Sector Cox's Bazar (2020). WASH infrastructure Master Spreadsheet. Updated 12 January 2020.
- WASH Sector Cox's Bazar (2018b). *Sector Strategy for Rohingyas Influx March to December 20.*

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Editing:

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Abbreviations

ABR	Anaerobic Baffle Reactors
BOD	Biochemical Oxygen Demand
CAST	Cluster Advocacy and Support Team
CBD	Cox's Bazar District
CCPM	Cluster Coordination Performance Monitoring
CLA	Cluster Lead Agency
CXB	Cox's Bazar
DDM	Department of Disaster Management
DEWATS	Decentralized Wastewater Treatments System
DoE	Department of Environment
DPHE	Department of Public Health Engineering
DRR	Disaster Risk Reduction
DSK	Dushthya Shashthya Kendra
FGD	Focus Group Discussions
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSTP	Faecal Sludge Treatment Plant
GoB	Government of Bangladesh
GUK	Gana Unnayan Kendra
GWC	Global WASH Cluster
HH	Household
IMDMCC	Inter-Ministerial Disaster Management Co-ordination Committee
IOM	International Organization for Migration
IRF-FSM	Integrated Regulatory Framework for Faecal Sludge Management
ISCG	Inter Sector Coordination Group
JSK	Janoseba Kendra
LCG	Local Consultative Group
LCG-DER	Local Consultative Group for Disaster and Emergency Response
LGED	Local Government Engineering Department
MLGRDC	Ministry of Local Government, Rural Development and Cooperatives

MoDMR	Ministry of Disaster Management and Relief
MOFDM	Ministry of Food and Disaster Management
MSF	Médecins Sans Frontières (Doctors Without Borders)
NDMAC	National Disaster Management Advisory Committee
NDMC	National Disaster Management Council
NDMF	National Disaster Management Institutional Framework
NPDM	National Plan for Disaster Management
NPDRR	National Platform for Disaster Risk Reduction
NGO	Non-Governmental Organization
NGOCC	NGO Coordination Committee
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OD	Open Defecation
PwD	Person with Disabilities
SAG	Strategic Advisory Group
SI	Solidarités International
SOD	Standing Order on Disaster
TNA	Trainings Need Assessment
TS	Total Solids
TWiG	Technical Working Group
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
UPM	UPM Umwelt-Projekt-Management GmbH
WASA	Water Supply & Sewerage Authorities
WASH	Water Sanitation Hygiene
WHO	World Health Organization
WLC	Whole Life Cost
WWMF	Wastewater Monitoring Framework

1. City Context

Since the 25th of August 2017 estimated 727,000 people of the Rohingya community were forcefully displaced from the Rakhine State in Myanmar, seeking refuge across the border in the Cox's Bazar (CXB) District of Bangladesh. Considering earlier influxes, there is now a total number of about 861,545 displaced Rohingya located in Cox's Bazar. 52% are female, 48% are male and about 52% of the total population are children under age of 18 (UNHCR, December 2020). According to the Government of Bangladesh (GoB), 85% of the Displaced Rohingya Population (DPR) lives in collective sites, meaning refugee camps, 13% in collective sites in host communities, and 2% in dispersed sites in host communities (GoB, 2019a). The refugee camps are located in two mostly rural sub-districts (upazila) of the CXB District, the Teknaf upazila and the Ukhiya upazila. According to UNHCR (April 2020), the Kutupalong refugee camp and its extension camps (Camp 1E to Camp 20 Ext) alone register about 725,000 individuals, therefore it is often referred to as the "mega camp" (Figure 1). Additionally, around 158,000 Rohingya are registered in other camp locations in the Ukhia upazila and the Teknaf upazila, with the main camp located in the south of Teknaf (UNHCR, 2020).

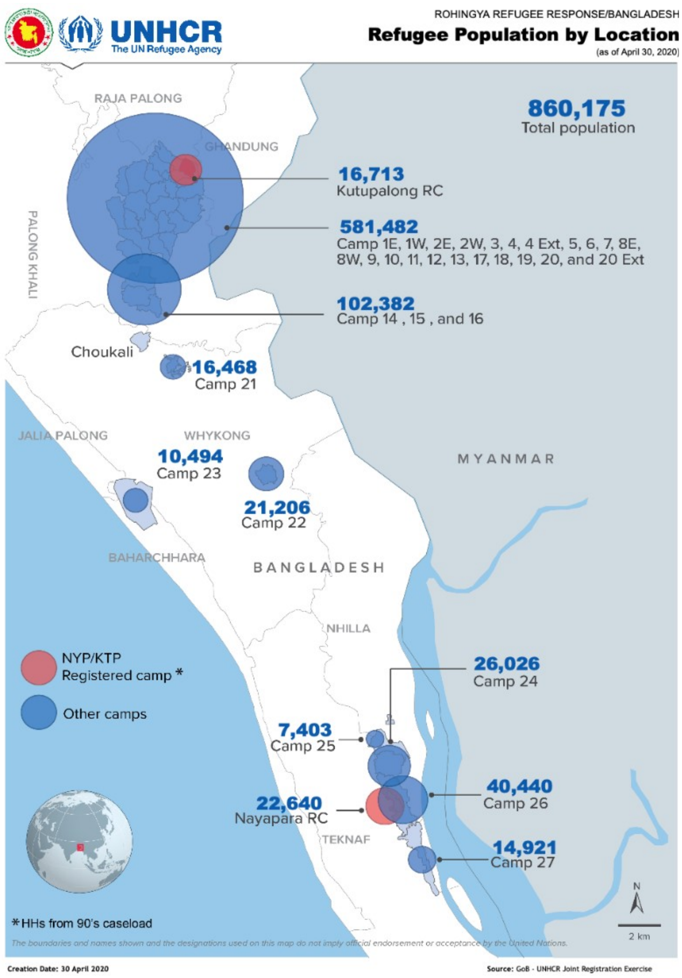

Figure 1: Presence in Camp 2020 (Source: UNHCR, April 2020).

The population density varies highly amongst the camps, with between 40,000 and 70,000 people per square kilometre. Figure 3 shows an overview of the space a single person has available on average in the camps in Ukhia, varying from 10 m^2 to almost 100 m^2. The UN Standard defines that a minimum surface area of 45 m^2 should be available for each person (Source: ISCG 2019, Figure 3).

In order to manage and administer the humanitarian response, all camps are divided into blocks. While incorporating data referring to all camps, this SFD report looks closer at Camp 14 which is called Hakimpara and is located south of the "mega camp" in the Ukhiya upazila. The Hakimpara camp site hosts 32,848 individuals (UNHCR, 2021) and is managed by UNICEF. The Water, Sanitation and Hygiene (WASH) services, including faecal sludge management (FSM), are operated mainly by BRAC, with additional services provided by Solidarités International (SI), MSF and the local NGOs Agrajattra, DSK and JSK.

For the main parts, the whole "mega" camp is located on sandy hills with steep slopes, which is also the case for Hakimpara. Before the RDP influx, the area was covered by forests. It was quickly deforested during the first phase response due to the need for space for shelters and firewood etc. of such a large population. However, reforestation efforts are in progress now (see for instance, IUCN July 2019, and UNHCR & IUCN Plantation Program 2018).

The climate in the area is tropical, with monsoons characterized by four seasons; pre-monsoon (March to May), monsoon (June to September), post-monsoon (October to November), and dry season (December to February)" (GoB, 2019a, p.29). The average annual rainfall for the area is 3,327mm, however, the GoB points out that, in the Teknaf upazila, rainfall amounts are higher than in the rest of the CXB District and that the monsoon season is starting later (around June instead of May) (Figure 2).

Moreover, the overall region, located on the eastern side of the Bay of Bengal, is prone to tropical cyclones, which generally appear between April and May and between October and November. The combination of those hazards exposes the already highly vulnerable population to further disasters such as landslides and disease outbreaks.

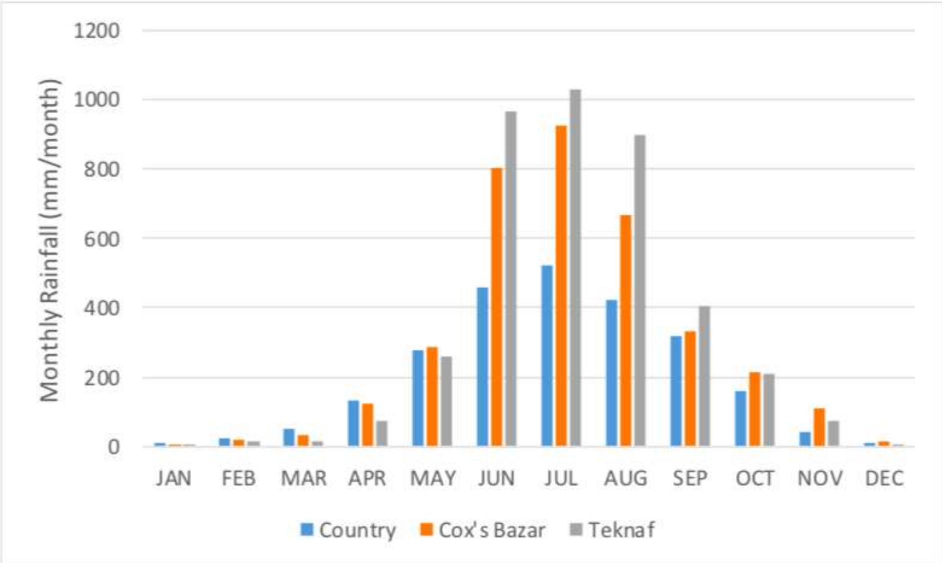

Figure 2: Rainfall patterns in Teknaf in comparison to Cox's Bazar district and the whole country of Bangladesh (Source: GoB, 2019).

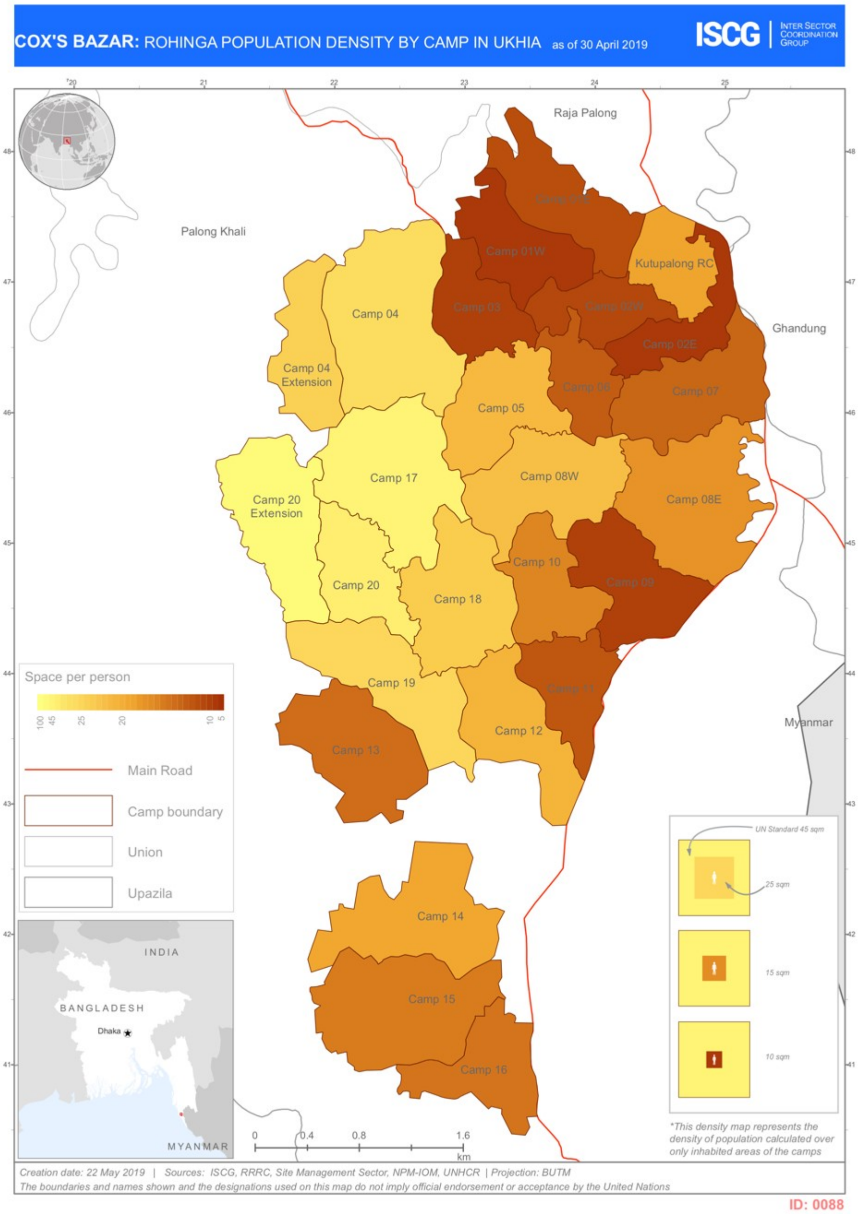

Figure 3: Population density in sub-camps in Cox's Bazar district (Source: ISCG, 2019).

2. Service Outcomes

2.1. Overview

Figure 4 shows the SFD selection grid for Camp 14. The data used for the SFD graphic are from the WASH-sector's infrastructural data set (January 2020). It includes the total number of 2,492 latrine cubicles and their distribution by containment type, combined with the reported number of self-made pit latrines. The open defecation rate and contamination risk for water sources information are from various REACH monitoring reports published in collaboration with the WASH Sector in CXB.

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				T1A1C9	Not Applicable
Septic tank					T2A2C5 T1A2C5					
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 Low risk of GW pollution
Lined pit with semi-permeable walls and open bottom	Not Applicable									T2A5C10 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								T1B11 C7 TO C9	Not Applicable

Figure 4: Selection grid.

2.2. SFD Matrix

Hakimpara (Camp 14), Coxes Bazar, Bangladesh, 4 May 2021. SFD Level: 2 - Intermediate SI
Population: 32848
Proportion of tanks: septic tanks: 100%, fully lined tanks: 100%, lined, open bottom tanks: 1

Containment				
System type	Population	FS emptying	FS transport	FS treatment
	Pop	F3	F4	F5
System label and description	Proportion of population using this type of system (p)	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
T1A1C9 Toilet discharges directly to 'don't know where'	1.0			
T1A2C5 Septic tank connected to soak pit	6.0	45.0	100.0	100.0
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	35.0	45.0	100.0	100.0
T1B11 C7 TO C9 Open defecation	5.0			
T2A2C5 Septic tank connected to soak pit, where there is a 'significant risk' of groundwater pollution	8.0	45.0	100.0	100.0
T2A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	45.0	45.0	100.0	100.0

Figure 5: SFD Matrix.

The following assumptions are considered in the SFD Matrix (Figure 5):

- 80% of the residences rely on the category "semi-lined pits with permeable walls and open bottom".
  - 87% of the latrines are covered by FSM services and 58% of the latrines can potentially contaminate tube wells due to their spatial proximity.
  - 45% of excreta is being emptied. This figure is accounting the portion of infiltrated excreta. The percentage is based on an estimated excreta production of 4.5L/p/d[3] (including flush water) divided by the designed treatment capacity, assuming that the treatment is operating at 100% of the installed capacity[4].
- 14% of the refugees are relying on toilets with septic tanks. Based on the unified design guidelines, it is assumed that the overflow is connected to drain fields or soak

[3] The assumption made resulting in estimated excreta production of 4.5L/p/d.
4 Considering the accumulation rates 0.3L/p/d and the estimated average excreta production of 4.5L/p/d, the ratio of excreta emptied from the OSS would be 7%.

pits. Because the "drain field" option is not available for the SFD matrix, a very similar category - "soak pit" was selected.

- 5% are estimated as open defecation. This results from a 4% open defecation rate based on demographic data (REACH, 2019a) and 1% rate accounted for unsafe disposal of children faeces (see also section 2.2.2).
- 1% of the residences are counted as users of self-made latrines which are not provided by any of the WASH implementing NGOs. In the SFD matrix, these are categorized as "No onsite container, toilet discharged to don't know where".[5]
- It is noteworthy that 6% of the unsafely managed FS is caused by unsafe practices of the residents themselves, mainly due to open defecation, unsafe disposal of excreta and the use of self-made latrines.

2.2.1. Onsite sanitation technologies and top structures

Distribution and types of toilet facilities

According to the WASH-sector's infrastructural data set, there is a total of 2,490 toilet cubicles (698 single latrines and 1,792 cubicles arranged in 463 WASH facility blocks with 2 to 6 toilet cubicles) constructed in the entire area of Camp 14 (WASH-Sector CXB, 2021). On average there are 13 users per latrine, which is in line with the Sphere minimum standards of maximum 20 users per latrine (Sphere Association, 2018) . 22 of the 34 camp areas, including Camp 14, are fulfilling this standard. However, in seven camps (Camps 01E, 06, 07, 10, 11, 26 and 27), the average is slightly higher with 21 to 23 users per latrine. For additional 5 camp areas (Camps 01W, 02E, 02W, 03 and 09), the number of users exceeds the recommendations, with 26 to 30 persons per cubicle. Furthermore, there are only 14% (340) gender specific latrines for women (REACH, 2019d).

In Camp 14, there are 29 emergency latrines (with 42 cubicles), 51 specified as shared latrines[6] (with 53 cubicles), 197 semi-durable (with 209 cubicles), and 884 durable latrines (with 2,186 cubicles). Of these total 1,161 toilet blocks, 698 blocks are with single cubicles and 463 are multi-cubicle blocks with 3-6 cubicles. Four blocks are including both types of separated cubical for toilet and bath. Out of 2,490 cubical, 73% are gender unspecified,13% male-only and 14% female-only toilets (WASH-Sector CXB, 2021).

As mentioned in the previous paragraph, besides single toilet cubicles, there are WASH facility blocks. These are defined as structures with more than one cubicle, which do not necessarily have to have the same infrastructure. For instance, a WASH block can include two latrines but can also describe a combination of a latrine and a bathing cubicle. In Camp 14, only four of these blocks exist, and the collection of FS occurs separately from the one of greywater.

In addition to the latrines constructed by members of the WASH Cluster (see further details under section 3.2), there is an ongoing, yet decreasing, practice of using self-made single or shared latrines. While this practice is an understandable response from the point of view of

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[5] Reach reports that 7% of all households use a self-made latrine. This number was converted with the available demographical information for individuals in Camp 14.
[6] It is not specified what type of materials are used for the structure, except for the slab (reinforced-concrete-slab).

households exposed to a rapid onset disaster and with an urgent need for sanitary facilities, continuity of this practice creates a significant risk for public health. Inadequate construction bears the risk of faecal contamination while using or emptying the latrines. In 2018, 17% of households reported that at least one family member was using a self-made single or shared household latrine (REACH, 2018). In 2019, this rate dropped to 7% (REACH, 2019a).

Findings of the Sanitation Needs Assessment organized in September 2019 are linking overcrowded latrines, poor maintenance, and somewhat lack of clear responsibility structures to the deterioration of the facilities. In some cases, it was reported that overcrowded latrines can even create tension between the communities (REACH, 2019b). The topic of (gender based) accessibility to toilet facilities is further elaborated on in section 3.4.

The overall rate of satisfaction in accessing latrines in Camp 14 however is reported to be high (91%), as 33% of households report to be very satisfied and 59% satisfied. In contrast, 4% reported to be unsatisfied and another 4% very unsatisfied with the access to latrines (REACH, 2019a).

Top structures

Given the emergency context, several types of latrines built during the first response phase or stabilization phase of the response can be found in the camps. A set of standard designs for the sanitation options, including latrine types, superstructure design and material as well as waste disposal systems for all camps was finalized in February 2018 by the WASH TWiG. Besides differences in design depending on the size and number of cubicles, the main agreed common features for all toilet types are: Iron sheets for walls and doors, MS angle or wooden frame used for door, walls and roof, concrete slab, plastic, or metal sheet used for roofing. This standard also assesses the durability of materials used for the top structures.

Containment types and capacities

In Camp 14, the main common containment type is a pit structure with lined walls made of reinforced concrete rings and with an open bottom. There are 2,138 of these pit latrines in Camp 14 (WASH-Sector CXB, 2021). In the overall camp, a number of different designs and volumes of pits have been implemented by the different WASH organizations, mainly depending on the phase of the ongoing humanitarian response. Toilet designs vary from emergency to (semi-)durable latrines. Emergency pits have a smaller capacity and are usually made of five concrete rings of 3ft (0.91m) diameter and 1ft (0.31m) height, resulting in 1m^3 volume. The durable forms can have between five to ten rings with an inner diameter of 4ft (1.23m). Their capacities vary from 1.5 to 3.2m^3 (UNICEF, Stakeholder 1). The different types of pit currently in use and their proportions are not documented, however, according to the interview with BRAC, 213 cubicles (9%) in Camp 14 have twin pits (Stakeholder 2).

To ensure the appropriate design and volumes for pits, the WASH sector in CXB published Unified Design Standards for pit latrines in February 2018 and an updated version in October 2019 (WASH Sector, 2018). In total, there are nine different sanitary designs. The main types are 1. a cubicle connected to one pit (Model used by Oxfam), 2. a cubicle with a direct pit and a soak pit (also 'Oxfam model'), 3. a single cubicle with twin pits (Caritas type, Figure 7), 4. A block of four cubicles connected to twin pits (DPHE type) and 5. a block of four cubicles connected to a sceptic tank with an additional drain field (Figure 9).

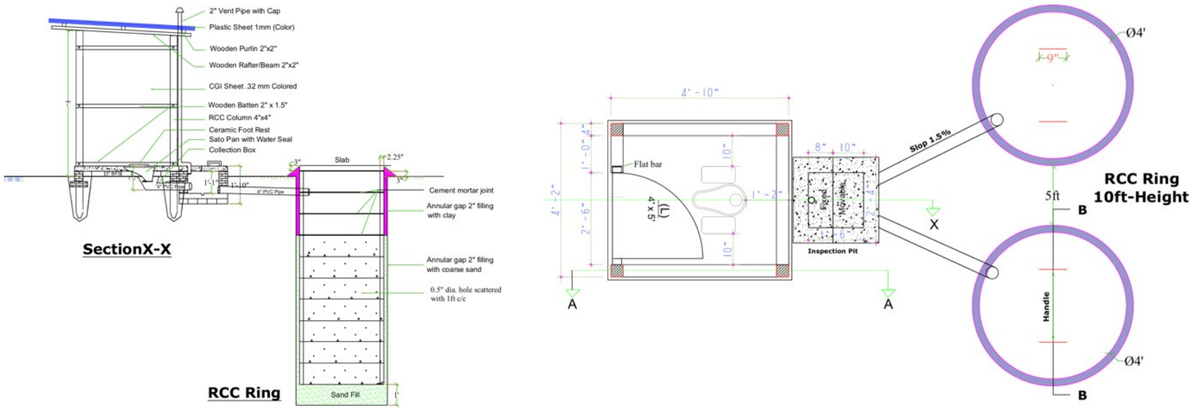

Figure 6: Examples of technical drawings of single cubicle with twin pits according to the Unified Design Standards for latrines in Cox's Bazar (Source: WASH Sector, 2019).

According to the unified design, a pit should be constructed with reinforced concrete rings with an inner diameter of 4 ft (or 1.23m) and a height of 1ft (0.31m). A pit consists of ten rings and reaches a depth of 10 ft (3.05 m). Perforated rings are used for the seven rings at the bottom in order to increase permeability and are filled with a compacted sand layer of 1 ft (0.31m) at the bottom and a sand layer of 2 ft (51cm) on the sides. The upper three rings are not perforated and filled with a layer of clay of 2 ft. The effective volume of such a single pit[7] is around 3.2m^3.

Figure 7: Concrete rings used for pit construction (Source: UPM 2020).

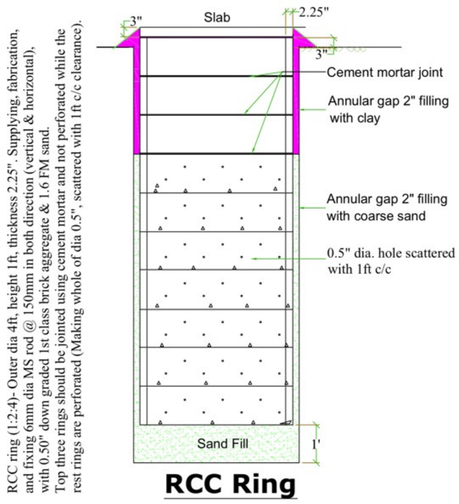

Figure 8: Technical drawing of pit construction including indicators for fillings (Source: WASH Sector 2018).

Overall, Camp 14 has 352 cubicles (14%) connected to septic tanks, with a median of five cubicles per septic tank (WASH-Sector CXB, 2021). As defined by the WASH sector design, the overflow of the two-chamber septic tank is connected to a drain field or soak pit (see Figure 9). A septic tank connected to four cubicles has an effective volume of 16.2 m^3.

[7] As the inlet pipe is placed between the 9th and 10th ring and as the FS cannot go above the 9th ring (to avoid clogging of the toilet), the effective volume of the tube is calculated based on height of 9 rings.

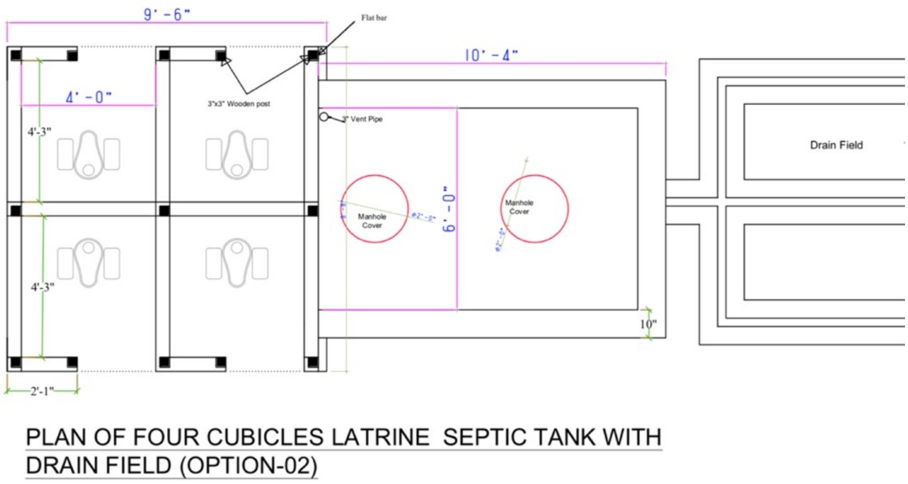

Figure 9: Technical drawings of a cubicle of four latrines connected to a septic tank and soak field, as according to the Unified Design Standards for latrines in Cox's Bazar (Source: WASH Sector, 2018).

2.2.2. Open Defecation

In the overall camp area, Open Defecation (OD) is not so much practised by adults. However, in the age group 0 – 4 years this is a common practice for 39% of boys and 36% of girls. In the age group 5 –11 years, 1% of both genders practice OD, which results in overall open defecation rate of 27% in 2019. Notably, the rate had declined by 4% since 2018 (REACH, 2019a). For Camp 14, based on the demographic data, which show that 17% of the total population are children under five years old, and 1% are in age group of 5 – 11 years (UNHCR, 2020b), OD rate estimation is 5%.

Overall, across the camps, additional defecation practices for children under five years old includes using a potty (10 – 11 %), a plastic bag (2%) or cloth (4 – 5%). 58% of households report to only use safe disposal methods (i.e., using the latrine), 20% report to apply a mix of unsafe and safe methods and 22% report to only use unsafe disposal method (such as disposal in an open area or with other garbage) (REACH, WASH Sector, 2019, p36). However, an awareness of the health risk caused by faeces is reported. Awareness raising sessions carried by WASH NGOs have resulted in an increased practice of safe disposal in latrines as well as an increasing demand for other sanitary options such the potties (REACH, 2019d).

2.2.3. Emptying and transport

Emptying services across the camps are carried out by different WASH implementing agencies with help of community volunteers. The emptying practices are numerous and vary across different NGOs. They can be grouped in three main categories:

- **Manual**: includes use of buckets which are easy to use, light, and affordable. This practice does not avoid the human contact with faecal sludge; it is unhygienic and slow compared with other methods (IFRC, 2018) (Solidarités International, 2018).
- **Manually operated mechanical collection** includes use of diaphragm pumps operated by hand. Diaphragm pump is a lightweight and portable pump, operating without fuel and reducing the human contact with faecal sludge. It provides better

hygienic conditions, but it is relatively slow (Sludge Pump Table, 2017) (Solidarités International, 2018).

- **Mechanical**: includes use of submergible wastewater pumps, as done by BRAC (Figure 10), diaphragm sludge pumps, centrifugal water pumps (Figure 11 Left) or vacuum trucks (Figure 11 Right). The mechanical method is more hygienic and faster compared to manual operation and it can pump FS over longer distances. However, fuel is required (Sludge Pump Table, 2017) (Solidarités International, 2018).

Figure 10: Sludge pump used by BRAC for pumping faecal sludge to transfer stations in Camp 14. (Source: BRAC 2020).

Figure 11: Left: Mechanical Emptying (Source: UPM, 2019) – Right: Vacuum Truck. (Source: UPM, 2019).

BRAC is the responsible WASH agency in Camp 14, however JSK, and Solidarités International (SI) are also providing WASH services in the particular camp. According to the FSM service mapping, the emptying is carried out by 32 community volunteers, including for the emptying and transportation of faecal sludge. BRAC is working with five groups for the provision of FSM services. One group for each FSTP with 3 to 4 persons per group (FSM Service Maping Camp 14, 2020). As reported during the interview, each group is equipped with submergible wastewater pumps and approximately 80% of the FS is emptied, while settled solids remain at the bottom of the pits (Stakeholder 2). It is not known how emptying is organized by JSK. It is reported that the service provision is carried with two volunteers that are responsible for servicing 10 latrines. The geo-tube system operated by SI in Camp

14 was not visited, however similar FSTP's were visited in Camp 21, where it was observed that emptying and transport were carried out manually. While this practice needs to be confirmed with SI for Camp 14, it would explain the relatively large number of 14 volunteers involved in the FSM services of their Geo-tube FSTP (FSM Service Maping Camp 14, 2020).

Figure 12: Manual Transport of Faecal Sludge to Geo-tube (Source: UPM, 2019).

Based on a previous study on manual emptying practice conducted by UPM, the median Total Solids (TS) content can be estimated at 1.4%; and is therefore relatively low.[8]

If emptied mechanically, the FS is pumped up to 300m, either directly to a FSTP or to one (out of 16) transfer stations in Camp 14. From there, it is further pumped over a distance of up to 1,000 m, to one of the FSTPs (out of the 5 connected to the transfer stations) currently in operation. These include four Anaerobic Baffle Reactors (ABR) in the blocks A, B, E, & C and one Lime Stabilization site in block D. The transfer station network operated by BRAC is divided in 5 geographical clusters (FSM Service Maping Camp 14, 2020).

For the FSM services provided by JSK, means of transport used to carry FS to the up-flow filter are unknown. For comparable Geo-tubes FSTP sites operated by SI in Camp 21, it is reported that transportation is carried out manually with barrels (UPM, 2019b). Yet overall, there is a tendency to move towards reducing human contact with the excreta, implementing more transfer stations and pressurized sewer networks for more effective transport of FS (Observation).

Based on the data from the household survey conducted by REACH in April and May 2019 for Camp 14, 41% of households reported that they experienced overflow of latrines in the past three months (REACH Initiative, 2019).

[8] Based on eight composed daily samples taken by UPM over eight weeks (one composed daily sample per week) of FS delivered to one of the FSTP in the Camp 4 extension in 2020.

2.2.4. Treatment and Disposal

According to the FSM service mapping, the overall designed and installed treatment capacity for all FSTPs in Camp 14 is 451m³/week[9] or 64.4m³/day. When applying the accumulation rate of 0.5l/p/d[10] and multiplying with the current number of 32,848 refugees on site, the estimated FS production is 16m³/day or 112 m³/week.

The following table is based on the FSM service mapping for Camp 14 which was later updated by BRAC during the review. The accumulated number of latrines covered by FSM services is 2,167 latrines (Source: Stakeholder 2) (Table 1). This number suggests that 87% of latrines are covered by FSM services in Camp 14.

Table 1: Camp 14 FSM Services (Source: FSM Service Mapping Camp 14, 2020).

Organization	FSTP Type[11]	Total Number of Volunteers per FSM	Design Capacity (m³/week)	FSM Coverage (Number of Latrines)[12]	Number of Transfer Stations
BRAC	ABR	3	45	517	2
BRAC	ABR	3	22	327	3
BRAC	ABR	4	140	406	4
BRAC	ABR	3	54	408	4
BRAC	Lime	3	70	413	3
JSK	Up-flow filter	2	30[13]	17	0
SI	Geo-Tube	14	120	79	0
Total		32	451	2,167	16

During the first phase of the emergency response, lime treatment, used as decentralized chemical treatment, was and is still now a widely used method for pathogen removal by the WASH agencies. According to a FSTPs inventory, lime treatment is estimated to represent 40% of the installed treatment capacities across the camps (WASH-Sector CXB, 2021) **. Lime treatment** achieves pathogen reduction by mixing FS with hydrated or prediluted lime in order to rise the pH >12 (ARUP, UNHCR, OXFAM, 2019). There are some differences on how the lime treatment is applied depending on the NGOs' practices. Some use lagoons for mixing, other barrels or concrete tanks. Subsequently, the FS is dewatered in settlement tanks, or dewatering beds. The liquid part passes either through a filter media before it is discharged into the environment or directly infiltrates into soak pit or pond. The solids are either incinerated, buried, or stored. While capital costs are low, operational costs are relatively high due to the consumption of lime which may increase if high dosing is needed. An estimation of the Whole Life Cost (WLC) over 10 years shows that lime treatment is

[9] The installed capacity of one FSTP, out of the seven, was not reported and therefore not included into the total installed capacity calculation.
[10] Rate used in the FSM gap analysis by the WASH sector Cox's Bazar (2019).
[11] ABR is referring of an system, consisting of an ABR and horizontal filter.
[12] Updated by BRAC during the review.
[13] Reported by BRAC with 5m³/d.

considered as having one the highest cost with a range of 105,602 – 420,000 USD and space requirements between 18 to 41m² for the treatment of 1m³ of FS (ARUP, UNHCR, OXFAM, 2019) . Moreover, and besides the general environmental risk, handling lime chemical can become a health risk for the workers while operating the mixture. A representation of effluent qualities can be found in Table 2. Values are taken effluent quality measurements done by UPM in 2019 at two lime treatment sites in the camps.

Figure 13: Example of Lime Treatment in a barrel. Right: Lime Treatment in Lagoon (Source: UPM, 2019).

Anaerobic Baffled Reactors (ABRs) treatment systems combine mechanical and biological treatment methods. They can be described as improved septic tanks equipped with a series of baffles to increase contact surface and time of FS with microorganisms, resulting in an improved treatment (Gensch, 2018) . ABR treatment is estimated to be around 12% of the total installed treatment capacity in all the camps in Cox's Bazar (WASH-Sector CXB, 2021). However, standing alone an ABR is not a complete treatment and therefore usual setup in the camps includes further post-treatment steps such as unplanted gravel filters or planted horizontal constructed wetlands with a small polishing pond (UPM 2019b) (ARUP, UNHCR, OXFAM, 2019). In Camp 14, the ABR system set-up includes two settler tanks, four baffled reactors, one horizontal constructed wetland and a small polishing pond. Subsequently the effluent is discharged to the drain (Stakeholder 2). Solid parts are reported to be transported to the lime treatment site for further treatment (ibid). The ABR system was identified as very cost effective and space saving by an ARUP study, comparing treatment systems in all the camps in CXB. With land requirements of only 5m² to treat 1m³ of FS and due to low investment and maintenance costs, the WLC of 21,159 USD is significantly lower than the WLC of lime treatment (ARUP, UNHCR, OXFAM, 2019).


Figure 14: Example of Horizontal Constructed Wetland. Right: Horizontal Gravel Filter (Source: UPM 2019).

Comparing the performance of a similar ABR system set-up to the one used in Camp 14, including the post treatment of effluent, it is assumed that the system does not perform sufficient removal of pathogens for safe discharge of the effluent into the open drain (see effluent qualities in Table 2, based on UPM samples taken in 2019). However, BRAC reported that dewatering of FS will be implemented as a pre-treatment step and only effluent will be further treated in the ABRs. By significantly reducing the strength of FS and if ensuring a continued inflow[14] respecting the required velocities inside the ABR, this method has potential to significantly improve the overall performance of the system. However, it is not certain if the constructed wetlands and polishing pond would perform as expected due to their small dimensions.

Another type of FSTP used in Camp 14 is the so-called **Geo-Tube**; it approximately accounted for 1-2% of the total reported treatment capacity in all the camps in Cox's Bazar (WASH-Sector CXB, 2021) . A Geo-Tube separates solid from the liquid part through a geotextile, yet it is observed that this geotextile is often replaced by the widely available mosquito mesh. The Geo-Tube is imbedded in a lined bed with the filter at the bottom (see Figure 15 as an example).

Figure 15: Example of Geo-Tube FSTP (Source: UPM, 2019).

[14] Instead of current batch leading of ABRs, which is suboptimal for their operation.

The solids are retained within the mesh, while the liquid part either evaporates or mostly drains off by gravity passing through a lined filter at the bottom of the bed. The filter consists of three layers of filter media (sand, gravels, and bricks) followed by either an infiltration bed (brick field), a soak pit or simple discharge into the environment (ARUP, UNHCR, OXFAM, 2019) (UPM, 2019b). The remaining solids are typically buried. In the overall FSTP comparison done by Arup, this type of treatment is somewhat in the lower middle range for space requirements with 14m^2/m^3. Whole Life Cost over 10 years is USD 70,677 (ARUP, UNHCR, OXFAM, 2019).

However, the effluent qualities presented in Table 2, suggest that the effluent should be infiltrated in an area with low groundwater pollution risk. Also, discharge in e.g., drains or the surface water should be avoided. For Camp 14, it is not known if the effluent is being discharged or infiltrated.

Table 2: Effluent Quality (Source: UPM, 2019b).

Parameter	ABR[15]	Lime 1	Lime 2	Geo-Tube	Up-flow Filter
pH	8.8	14	14	8.1	8.4
TS (%)	0.2	1.3	0.5	0.4	0.2
VS (%)	43	21	14	42	27.9
COD (mg/L)	400	13,600	1,075	3,850	1,275
BOD_5 (mg/L)	138	3,765	311	1,270	416
NH4-N (mg/L)	352	42	200	1,063	30
TN (mg/L)	623	1,890	1,917	2,692	730
TP (mg/L)	40	49	3	12	17
Faecal Coliform (cfu/100mL)	2.E+05	Nil	Nil	5.E+06	3.00E+04
Helminths (Number/L)	Nil	2,000[16]	Nil	1,000[6]	1,000[6]

Another widely used treatment is the **anaerobic up-flow filter system**, currently operated by JSK. Anaerobic Filter is a fixed bed biological reactor with one, or a series of chambers, filled with a filter material. As the influent passes through the filter, the particles are trapped on the surface of the filter media and the organic matter is degraded under anaerobic condition by the active biofilm which is attached to the surface of the filter media. The "up-flow" is referring to the flow direction, from the bottom to the top, inside the filter chamber where the solids settled and thickened at the lower part. Overall, the anaerobic filter is estimated to be around 10% of the total installed treatment capacity across all camps (WASH-Sector CXB, 2021).

Other piloting biological treatments can be also found such as biogas toilets, anaerobic lagoon, BioFil-latrines, constructed wetlands and Activated Sludge Treatment (UPM, 2019b).

[15] Samples are taken from the polishing pond by UPM (2019b).
[16] Only count without viability.

Figure 16: Anaerobic up-flow filter system (Source: UPM, 2019).

2.2.5. Summary of sanitation systems and variable assumptions

- ✓ The proportion of FS in septic tanks, fully lined tanks and lined tanks with open bottom/all types of pits is considered 100%, as per the guidance given in the Frequently Asked Questions (FAQs) in the Sustainable Sanitation Alliance (SuSanA) website.
- ✓ 1% of the population has toilets connected to 'don't know where' (system T1A1C9), considered as an off-site system by the SFD-PI methodology.
- ✓ 45% of all excreta from onsite sanitation systems (both tanks and pits) is being emptied, as stated and explained in section 2.2. This is an overall estimation and thus, variable F3 for all onsite sanitation systems has been set to 45%.
- ✓ It has been assumed that all FS emptied is delivered to treatment and thus, variable F4 for all sanitation systems has been set to 100%.
- ✓ The assessment of the treatment efficiency was not part of the scope of this SFD report but it was assumed that all treatment technologies work in a proper way, so a treatment efficiency of 100% was assumed for all FS that reaches treatment. So, variable F5 for all sanitation systems was set to 100%.
- ✓ For the context-adapted SFD graphic, there were data available on the effluent values from similar treatment units in use in other places at Cox's Bazar. Thus, a value of 18% was selected for the treatment efficiency as an approximation. Thus, variable F5 for all sanitation systems was set to 18%.
- ✓ Open defecation practices have been estimated at 5% (system T1B11 C7 TO C9).

2.2.6. Groundwater Pollution Risk Assessment

Even though drinking water quality testing has, so far, not shown levels of pollution (REACH, Water Needs Monitoring, 2019), the groundwater pollution risk in the overall area is considered significant and increasing due to the high-water stress. According to REACH

2020, 58% of latrines across all camps are located in an area of groundwater pollution risk. The results of the *SFD Groundwater pollution risk estimation* tool also results in a high-risk estimation. Factors considered here are:

- Vulnerability of the aquifer:
  - Geology: hilly; soil type: fine sand; depth of groundwater table: 5-10m (GoB, 2019b).
- Horizontal separation distance between sanitation systems and groundwater wells (estimation by BRAC, Stakeholder 2):
  - Sanitation facilities that are located <10m from groundwater wells: <25%.
  - Sanitation facilities that are located uphill of groundwater wells: >25%.
- Percentage of drinking water produced from groundwater sources: >25%.
- Water production technology used to extract groundwater: Bore holes (77% of households report tube wells as their main source of water, REACH 2019).

The Government of Bangladesh, as well as responding organizations, are alerting about the increasing challenges in the supply of safe drinking water across different camps. About 23% of the reported 16,185 installed tube wells have become non-functional due to (seasonal) dry-up or need for maintenance (REACH Water Factsheet, 2019c). Since the influx in 2017, there was an increase over 20-fold of the amount of water points constructed in an area which is already highly water-stressed. Water levels around the camp areas are reported to have fallen between 5 and 9m (GoB, 2019b, pp.5-6.) Additionally, over 70% of the water stored in households is reported to be contaminated (ibid). Yet, as the water quality testing has so far not shown contamination of the water sources, it is implied that contamination occurs somewhere along the water distribution chain (REACH, 2019b).

2.3. SFD Graphic

Figure 17 shows the SFD graphic where 65% of the excreta is safely managed whereas 35% is unsafely managed.

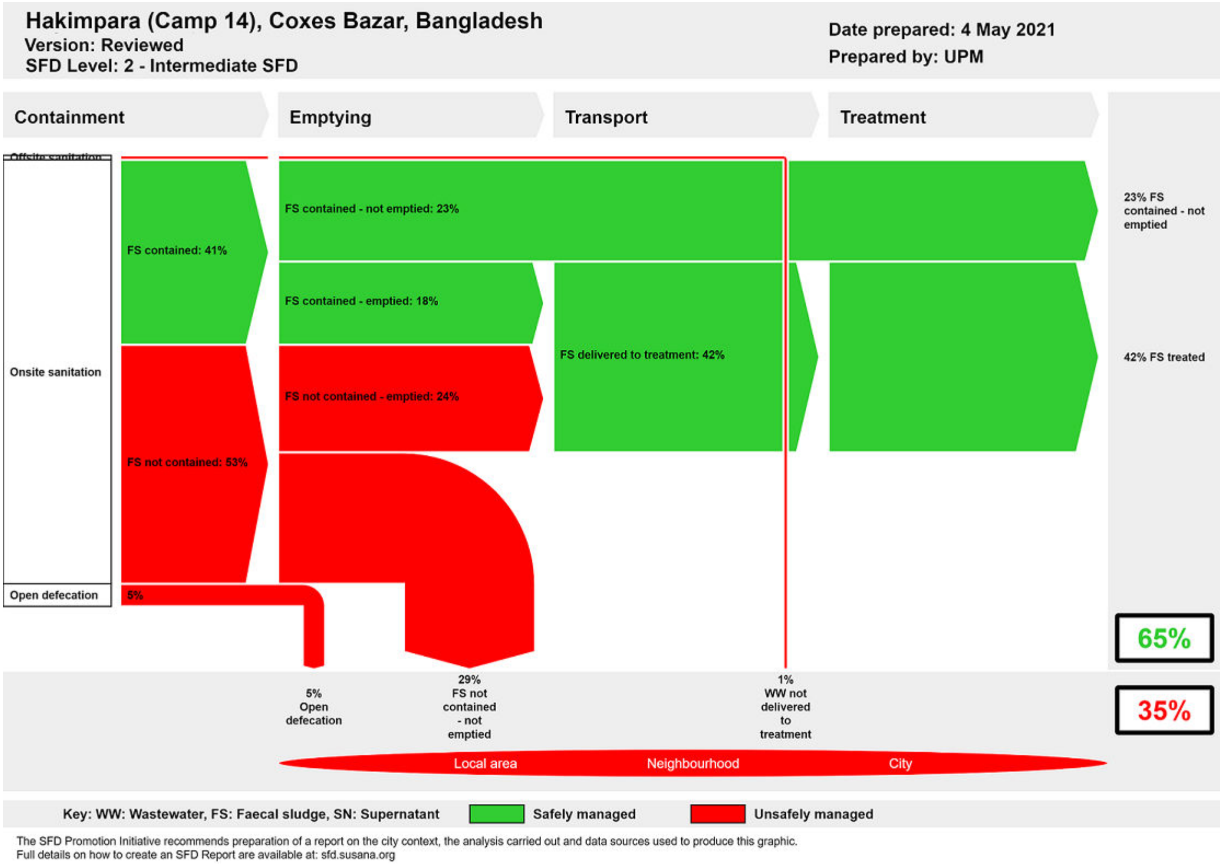

Figure 17: SFD Graphic, Hakimpara Camp 14.

The unsafely managed excreta originate from wastewater not delivered to treatment (1%), Faecal Sludge (FS) not contained - emptied but not delivered to treatment (29%) and open defecation (5%).The safely managed excreta originate from FS contained - not emptied (23%) from systems located in areas of low risk of groundwater pollution and FS emptied, delivered to treatment and treated (42%).

2.4. Discussion of certainty/uncertainty levels of associated data used for the SFD Matrix

The data used for the SFD Matrix were mainly collected from the WASH Infrastructure Mapping as well as from the 2020 REACH monitoring report and previous REACH outputs from 2019. These data were selected as there are the most official data available. This choice gives the possibility as well to compare the data of the different camps and allows to produce additional SFDs for Cox's Bazar using similar data sources.

Interviews were conducted with UNICEF and BRAC as the main operating NGO for WASH Services in Camp 14. The interviews gave better insights into the service delivery context in Camp 14, as there was no time to organize an actual visit of Camp 14. UPM team members have visited other camps in Cox's Bazar and are generally aware of WASH and FSM procedures within this humanitarian response. It is important to notice that this report and the SFD graphic are to be read as an initial draft. Comments and inputs from UNICEF, BRAC and any other relevant stakeholders are strongly encouraged.

The main uncertainty of this SFD graphic is the actual quality of the effluents of the ABR system set-up used in Camp 14. During the interview, BRAC mentioned that, as many other WASH NGOs, they had no opportunities to actually monitor these due to the absence of a suitable laboratory. As the actual performance of the FSTP highly impacts the outcome of the SFD graphic, it is the main weakness of the result presented here.

In order to come out with a realistic scenario for this SFD graphic, a UPM study on the performances of comparable treatment systems in other camps in Cox's Bazar (UPM, 2019b) was used. Analyses of effluent samples showed a low treatment performance (Table 2), it was therefore assumed that the ABR FSTPs currently operated by BRAC, as well the up-flow filters and the geo-tubes, were facing similar challenges. The results of this approach are displayed and discussed with the context-adapted SFD graphic.

2.5. Context-adapted SFD Graphic

The context-adapted SFD graphic results as a contrast with 30% of excreta being safely managed instead of 70%. While the data input is the same, the large difference in these results derives from the assumption that the current ABR treatment set-up, geo-tubes and up-flow filters in Camp 14 do not sufficiently inactivate pathogens to be classified as “to not cause a public health risk”. Therefore, since it cannot be proved that the treatment units of Camp 14 are performing similarly as comparable treatment set-ups in other camp sites, that is the reason why it was decided to include this context-adapted SFD graphic into the report.

With the treatment system currently in use, effluents from the ABR are transported through a constructed wetland, followed by a small polishing pond, and then discharged into drains. While this generally would be a suitable practice, samples, and reports from comparable treatment set-ups in other camp sites strongly lead to the assumption that pathogens are not sufficiently inactivated before being discharged into the drains (Table 1).

Additionally, in 2018, wastewater from various drains from Camp 3 and the Camp 4 Extension was sampled and analysed showing a concerning concentration in range of 1E+04 up to 9E+06 cfu/100mL for E. coli, and in average 1,000 No/L for Helminths, highlighting potential problems as presented in the Appendix 5 (UPM, 2019a).

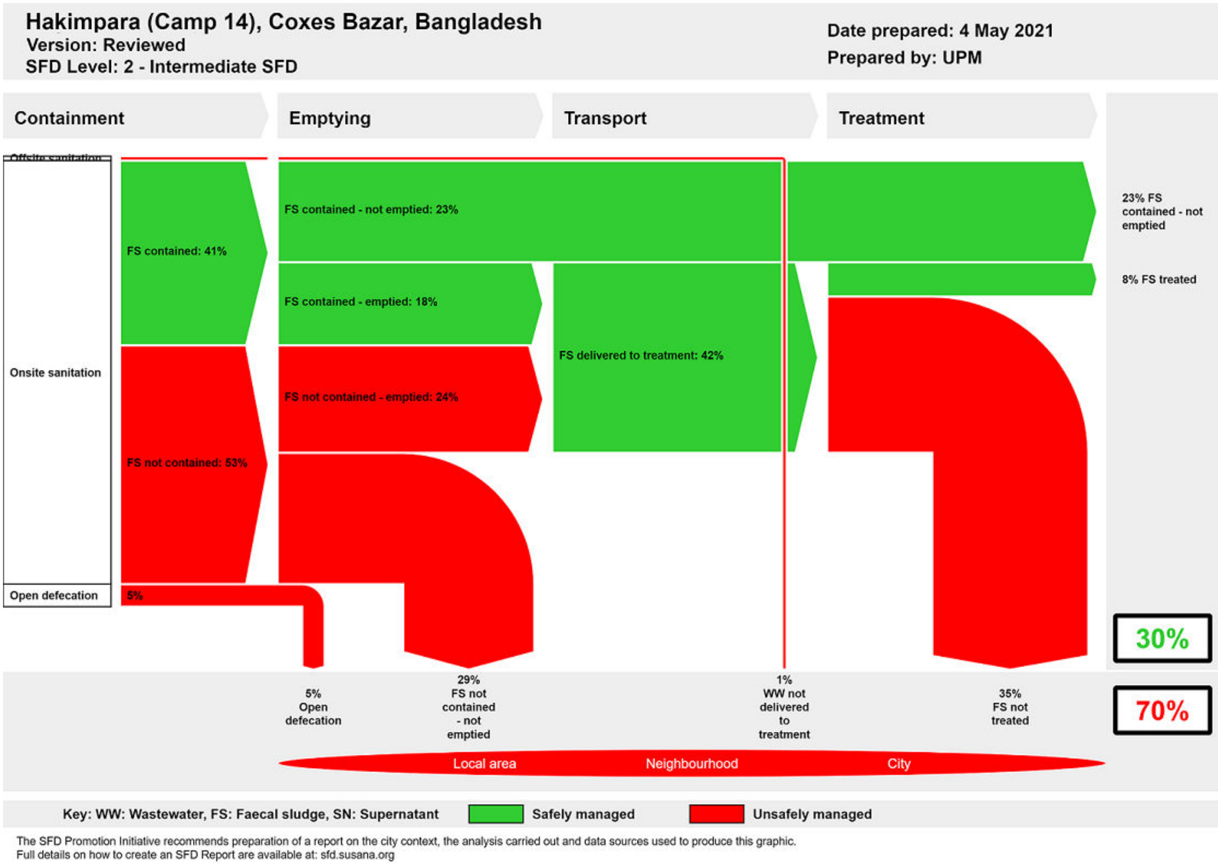

Figure 18: Context-adapted SFD Graphic, Camp 14.

The only treatment shown to remove effectively the pathogens is the lime treatment. The context-adapted SFD graphic assumes that the 17% of FS treated in these systems can be therefore classified as safely managed. Adding another 1% of FS which remains as settled solids in a FSTP system[17], leads to the assumption that 18% of FS reaching a FSTP (variable F5 set to 18%) is classified as safely managed (Figure 19).

[17] Calculated with: Influent TS. 1.4%, Effluent TS. 0.2%

Hakimpara (Camp 14) , Coxes Bazar, Bangladesh, 4 May 2021. SFD Level: 2 - Intermediate S
Population: 32848
Proportion of tanks: septic tanks: 100%, fully lined tanks: 100%, lined, open bottom tanks: 1

Containment				
System type	Population	Emptying	Transport	Treatment
	Pop	F3	F4	F5
System label and description	Proportion of population using this type of system	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated
T1A1C9 Toilet discharges directly to 'don't know where'	1.0			
T1A2C5 Septic tank connected to soak pit	6.0	45.0	100.0	18.0
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	35.0	45.0	100.0	18.0
T1B11 C7 TO C9 Open defecation	5.0			
T2A2C5 Septic tank connected to soak pit, where there is a 'significant risk' of groundwater pollution	8.0	45.0	100.0	18.0
T2A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	45.0	45.0	100.0	18.0

Figure 19: SFD matrix for the context-adapted SFD graphic.

3. Service delivery context

3.1. Policy, legislation, and regulation

3.1.1. Policy

The year 2021 will mark the 50th anniversary of the independence of Bangladesh, hence its National Development Vision has been set for 2021 and was accompanied by the Perspective Plan 2010-2021, setting targets on how to achieve this vision. The need for water and sanitation services is clearly mentioned, and even set as a major focus area (GoB 2012, p.96), but remains vaguely formulated: Improved sanitation access and management could be envisioned through 'for example, access to piped water, maintained sewerage systems, environmentally sound hospital and industrial waste disposal' (ibid, p.80).

In the last two decades, Bangladesh has indeed made great efforts and improvements towards providing water and sanitation services. Significant progress has been made in reducing open defecation from 34% in 1990 to 1% of the national population in 2018. Nonetheless, improved sanitation remains a major challenge reaching only 61% coverage and an annual growth rate of 1.1% (GoB, 2017b).

Since 2017, the Integrated Regulatory Framework for Faecal Sludge Management (IRF-FSM) puts an emphasis on the heavily reliance of the country on onsite sanitation and the need for management of faecal sludge. According to the 2009 Local Government Act, local governments are in charge of overseeing the development of water and sanitation services (GoB, 2017a).

Furthermore, for Bangladesh, as a country prone to natural disasters, such as cyclones, flooding, or earthquakes and at risk of human-induced hazards (GoB, 2017b), an effective and well implemented framework for disaster management (DM) and risk reduction is essential. Under the Ministry of Disaster Management and Relief (MoDMR), the National Disaster Management Institutional Framework (NDMF) in place comprises the Disaster Management Act (2012), the Disaster Management Policy (2015) and already two National Plan(s) for Disaster Management (NPDM) (2010-2015 and 2016-2020). The first NDPM was the first policy document of this kind in Bangladesh. It reflected a paradigm shift from only passively responding to disasters towards a more active approach by developing comprehensive risk reduction strategies as well as capacity building. Based on these efforts, the Disaster Management Act (2012) was also put in place (GoB, 2017c). A review of the first NPDM highlighted the need to strengthen the capacities of district and upazila administrations towards DM. The second plan (2016-2020) additionally stresses the importance of linking DRR with sustainable development, while recognizing the emerging risks resulting from rapid urbanization and climate change for Bangladesh (GoB2017c, i-iii). The main document for operationalizing these plans is the Standing Order on Disaster (SOD) of 1997 (revised in 2010) which was legalized by the Disaster Management Act, 2012. It describes the roles and responsibilities of each ministry or agency during the different periods of a disaster response from risk reduction/ preparedness to rehabilitation. When it comes to WASH, the Department of Public Health Engineering (DPHE) and the Water

Supply & Sewerage Authorities (WASAs)[18] are the main actors. Besides regular duties in none- crisis times, DPHE is responsible for ensuring access to safe drinking water, provision of technical supply and repair during emergency as well as coordination and development of risk reduction strategies with NGOs and private sector actors. DPHE is therefore also mandated to co-chair the WASH Cluster in Bangladesh (see further under section 3.2).

3.1.2. Institutional roles

In Bangladesh, the mandate for Water and Sanitation is regulated by the 2009 Local Government Act (amended in 2010). It defines municipal roles and areas of jurisdiction and the responsibilities of local governments, including those related to water and sanitation. As the rest of the country is heavily relying on onsite sanitation, the above-mentioned Institutional & Regulatory Framework for FSM (IRF-FSM) applies to all four levels of municipal regulation, slightly adjusted to the context of rural areas and smaller to larger cities[19].

In all cases, the responsibilities of local governments towards overseeing the development of water and sanitation services are enforced through the Ministry of Local Government, Rural Development and Cooperatives (MLGRDC). The MLGRDC is encouraged to set up a unit dedicated to FSM and to collaborate with the Local Government Engineering Department (LGED), Department of Public Health Engineering (DPHE) in the matters, as well as relevant institutions.

As according to the National Disaster Management Framework mentioned above, roles and tasks of responsible institutions at distributed at both national and sub-national levels. In 2012 the Ministry of Disaster Management and Relief was reorganized from the Disaster Management and Relief Department under the Ministry of Food and Disaster Management (GoB, MoDMR online). Now the MoDMR is in charge of coordinating efforts across all agencies. Additionally, the National Disaster Management Council (NDMC), and the Inter-Ministerial Disaster Management Co-ordination Committee (IMDMCC) as well as the National Disaster Management Advisory Committee (NDMAC) have the responsibility to formulate, review and implement policies and strategies in this regard. The National Platform for Disaster Risk Reduction (NPDRR) functions as the secretariat of its member institutions the MoDMR and the Department of Disaster Management (DDM), and coordinates and provides facilitation to relevant stakeholders involved in DM. The NGO Coordination Committee (NGOCC) headed by the Director General of the DDM is mandated to review and coordinate the activities of concerned NGOs in the country (WASH Sector CXB 2018b, Strategy Document).

The GoB generally runs a Local Consultative Group (LCG) as the intersection between humanitarian and development actors. Under the umbrella of this Local Consultative Group, there are 18 thematic working groups of which one is the Disaster and Emergency Response (LCG-DER). This LCG-DER is mandated to ensure "effective coordination of the national and

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[18] Cox's Bazar is currently completely relying on onsite sanitation and has no WASA in place for most parts of Bangladesh except the urban centres of Dhaka, Khulna, Chittagong and Rajshahi.

[19] Applies as the 'Paurashava, City Corporations, Upazila Parishad and Union Parishad Act', according to the population size of the level of government. There are rural areas, secondary cities or so called Paurashavas with a population of 15,000 to 60,000 inhabitants and City Corporation (currently nine) and one mega city, Dhaka (GoB, 2009).

international stakeholders" […] "and is chaired by the by the Secretary, Ministry of Disaster Management and Relief; and Co-Chaired by the UN Resident Coordinator" (GoB 2017b, p.7).

On the sub-national level, the four administrative levels (District, Union, Upazila and Paurashava), have each their own Disaster Management Committee in order to ensure effective planning and coordination of risk reduction and emergency response management on local level (ibid) (Figure 20).

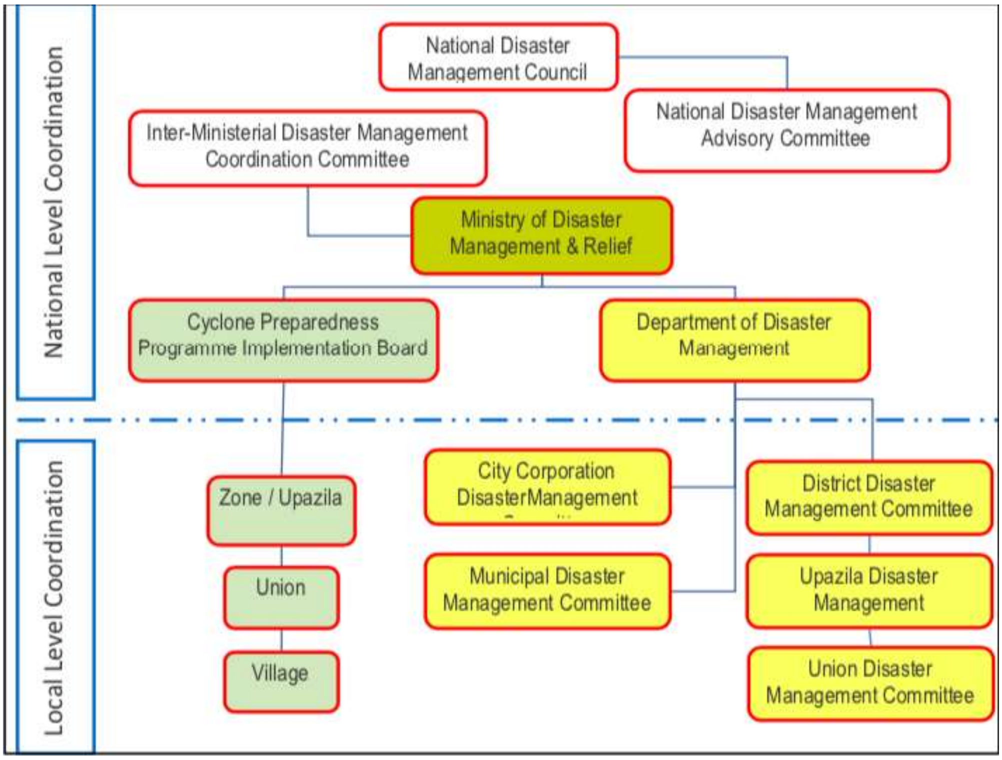

Figure 20: Institutional framework for disaster response in Bangladesh. (Source: GoB 2017b).

Organization of the Humanitarian response actors in the field of WASH

On the humanitarian response side, WASH is mainly organized through the Global WASH cluster and its local representation in Cox's Bazar (Figure 21). Since a reforming process that started in 2005, responding organizations in the humanitarian field are organized in clusters[20], in order to improve effectiveness of the response, accountability and a strengthened partnership between NGOs, UN-agencies and other partners involved. At that time, UNICEF got identified as the Cluster Lead Agency (CLA) of the Global WASH Cluster (GWC), meaning that UNICEF ultimately is accountable for ensuring the GWC fulfils its role and responsibilities. In order to support and carry out these tasks, the GWC and UNICEF established a secretariat, the Cluster Advocacy and Support Team (CAST) (GWC, 2016).

Another important entity of the WASH Cluster is the Strategic Advisory Group (SAG) which is usually chaired by the GWC Coordinator. The SAG is in charge of representing the overall interest of the GWC members and developing the Cluster's vision and strategic framework and plans. Along these tasks, the "Water Sanitation and Hygiene Cluster Strategic Plan 2016 – 2020" was released in December 2016. This plan engages GWP partners to set up

[20] Other clusters are for instance "Shelter", "Food Security", or "Education".

Technical Working Groups (TWiG) in order to implement the cluster strategies. Currently, there are four active TWiGs: 1. Operational Research; 2. Quality Assurance Systems; 3. Cash and Market; 4. Faecal Sludge Management (FSM) (GWC Online, 2020).

The FSM TWiG was created in Cox's Bazar as a consequence of technical and knowledge transfer challenges while responding to the massive influx of Rohingya refugees. The GWC group agreed to a 5-year plan which is reviewed on annual basis. For the period 2020/21, the 7-point plan focuses mainly on "knowledge management and knowledge sharing to allow stronger technical support" (GWC Online, 2020).

Coordination with responding actors of other relevant fields besides WASH is organized through the Inter Sector coordination Group (ISCG) (WASH Sector Cox's Bazar, Sector Strategy p.13). "Responding agencies are organized into 12 thematic Sectors and Sub-Sectors (e.g., Protection, Health, WASH) as well as Working Groups that focus on cross-cutting issues (e.g., Protection, Gender in Humanitarian Action, Communicating with Communities)" (ibid.).

In Hakimpara (Camp 14), BRAC is in charge of implementing the WASH response. BRAC, as an international NGO founded in Bangladesh, has been working in Cox's Bazar for over 36 years, including "providing services to Rohingya communities from previous influxes as well as supporting the host community in the surrounding areas" (BRAC, Strategic Plan 2019, p.3). Since the latest influx of Rohingya communities in August 2017, BRAC's interventions have been focusing on reactive emergency responses mainly in the field of WASH and shelter provision (ibid). Moreover, BRAC reports to actively engage into above mentioned coordination mechanisms such as the ISCG and camp level coordination mechanisms (ibid, p.10).

Besides BRAC, additional FSM services are provided by International NGO Solidarités International (SI) and the Bangladeshi NGO Janoseba Kendra JSK.

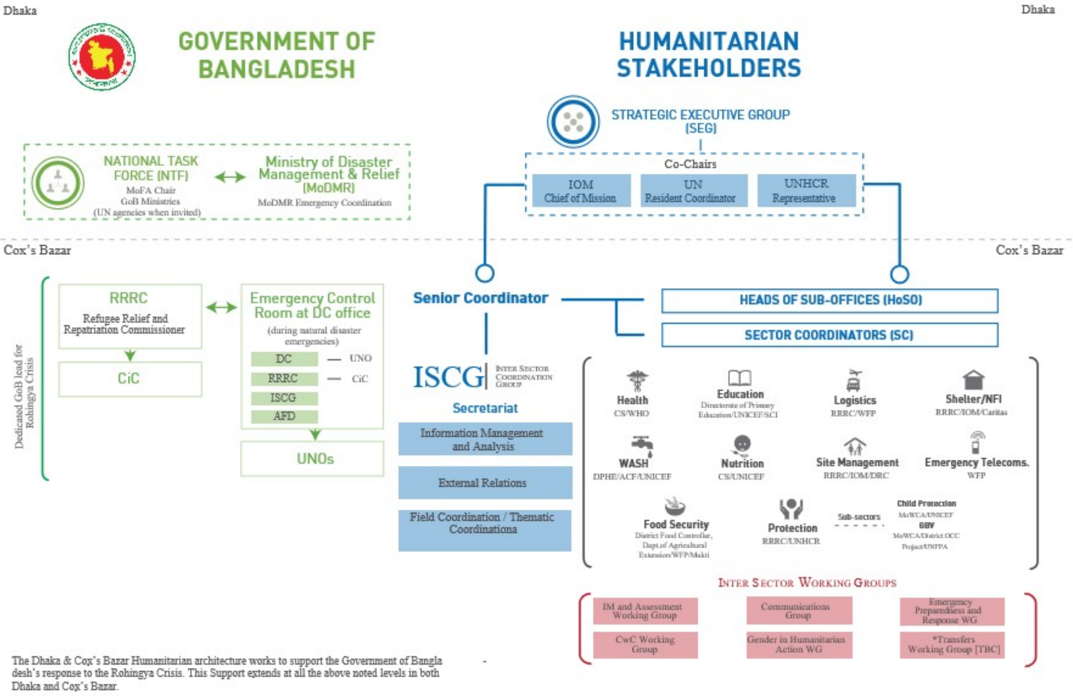

Figure 21: Inter Sector Coordination Structure for the humanitarian response in Cox's Bazar (Source ISCG, 2020b).

3.1.3. Service standards

Service standards for FSM in emergencies remain a major challenge, as there are no global standards for the different steps along the whole sanitation value chain yet. Partial standards focus on the set-up of the latrines, their decommissioning (WASH Sector, 2019) as well as requirement regarding their distance from water sources. Two main documents for FSM in Cox's Bazar have been published in 2017 as a collaboration between the GoB and the WASH Sector: 1. "Operational Guidelines WASH in Emergencies – Bangladesh. Second Edition" and 2. the "WASH Sector Standards for Cox's Bazar".

It is emphasized that these WASH emergency guidelines are in line with general sanitation regulations of the GoB, as well as the Sphere guidelines (GoB 2017d, p.101). Despite being published before the release of the revised Sphere Standards in November 2018 (The Sphere Handbook, Edition 2018), the response in Cox's Bazar is in coherence with the updates, although necessary local adjustments were made, given the high density and hilly terrain in the area. An overview comparing both standards can be found in Table 3 and Table 4.

Table 3: Comparison of FSM standards of the WASH Sector in Cox's Bazar (2018b) and Sphere Standards (2018).

WASH Sector Strategy for Rohingyas Influx (2018b) in comparison to Sphere Standards (2018)			
Main category	**Subcategory**	**WASH Sector Cox's Bazar**	**Sphere Standards, 2018 (p.114-116)**
Construction	Depth and materials	All latrines built on a hill will need to have a pit of at least 5 feet deep made of concrete rings of 30-inch diameter & 24-inch height. Similar & relevant context-specific feasible ideas are encouraged bearing in mind the principle of 5 feet-depth	Should be appropriate and acceptable to context
Location	Distance to water sources	Distance between water source (downhill/downstream from any ground/surface water source) & latrine should be at least 30 meters; if not possible, at least 10 meters (30 feet) distance, downhill Ideally, the bottom of the pit is ≥ 1.5 m above groundwater	If soil permeability tests cannot be conducted, the distance between containment facilities and water sources should be at least 30 meters, and the bottom of pits should be at least 1.5 meters above the groundwater table. Increase these distances for fissured rocks and limestone or decrease them for fine soils
Location	Flood levels	Avoid locating latrines in flood prone areas or raise them above the flood level; locate them in a safe, lit location if possible	Assess the local topography, ground conditions, groundwater, and surface water (including seasonal variations) to avoid contaminating water sources and inform technical choices
Location	User needs	Latrines should be as close to users as possible (< 50 m away from users' home); consult with users to choose a convenient and safe location	Distance between dwelling and shared latrines: Maximum 50 meters Ratio of shared latrines: Minimum 1 per 20 people

Table 4: Appropriate number of users per latrine in emergency responses over time. (Source: WASH Sector Standards Cox's Bazar 2017).

	Immediate	**Medium**	**Long term**
Timing	0-3 months	3-6 months	6 months+
Persons/ Latrine	100	75	50

Besides the lack of comprehensive global FSM standards for emergencies due to various challenges in this regard (see for instance Huber, M.S. and Jennings, A., 2018), the WASH Sector in Cox's Bazar released in May 2019(b) the *Wastewater Monitoring Framework* v1 (WWMF) which provides information on how to proceed with testing of Faecal Sludge Treatment Plants (FSTPs). The publication includes the objectives for testing (namely quality assurance and control), standards for sampling methods, procedures, equipment cleaning and safety measurements in the field and in the laboratory. The focus of the framework is on the compliance testing and monitoring. "[…] the Framework does not aim to provide information on the performance of FSTPs which will be a separate support provided through the WASH Sector" (WWMF, v1 2019b, p1).

It is pointed out that the WWMF follows the Environmental Impact Standards set by the national Department of Environment (DoE) on public and environmental health (Figure 22). The WWMF should be applied when there is a public health or environmental health risk due to discharge of effluent into surface water. However, in a densely populated camp area, infiltration can cause a health risk as well. Therefore, the WWMF guidelines should also be applied if an FSTP infiltrates and meets one of the below criteria[21]:

- "Within two vertical metres of the highest seasonal water table from the deepest part of the infiltration gallery[22]
- Within fifteen horizontal meters of a tube well, water pipe, reservoir, canal, or water body[23]
- Within an area which is prone to flood"

(Source including footnotes: WWMF 2019b, p.1)

According to this monitoring framework, FSTPs should be tested at least every three months. Sites of 20m^3 capacity, or larger, should be tested every month. Technologies, such as biogas plants, which do not discharge effluent and are desludged to other FSTPs, are excluded from this proposed timeline. A laboratory should provide test results. In case a parameter fails to meet the required standard, the agency operating the camp, and/or the FSTP, is requested to provide a plan of action or request for support.

However, the actual availability of laboratories that can test effluents poses a major challenge in Cox's Bazar. Many organizations do not have in-house capacities and rely on shipping their results to labs in larger cities such as Chittagong, which is located about 5-hours north. BRAC was also sending their samples to Chittagong, but had to terminate this operation and therefore instead have the two parameters, BOD and COD, tested through the international health research institute ICDDR, B. The institute runs a representation in Cox's Bazar and sends samples through air to their laboratory in Dhaka (Stakeholder 2). Nonetheless, WASH agencies are waiting for the opening of the upcoming DPHE FS lab funded by SDC.

Effluent Parameters

As mentioned above, the Government of Bangladesh has national standards in place for sewage discharge, which apply to the effluent of FSTPs. The monitored parameters are based on the original values from the Ministry of Environment and Forest from 1997 and updated in 2019 by DoE. However, it is not clear if the updated discharge standards are already enforced (Figure 22). According to the authors' understanding, the updated version might require a correction, since Nitrate effluent value (250mg/L) cannot be higher than the Total Nitrogen (15mg/L) itself, as stated in the standards. Further considerations might be required regarding sewer discharging standards suitability for effluent from onsite faecal sludge treatment.

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[21] References are based upon https://www2.gov.scot/resource/buildingstandards/2017Domestic/chunks/ch04s10.html.

[22] Various guidelines including SPHERE and WHO provide recommendations of 1.5m-2m minimum distances with the most conservative approach taken.

[23] "*Parker, A, Carter, I (2009), National regulations on the safe distance between latrines and water points. Draft version. Dew Point.* The report references urban standards from the *Bangladesh National Building Code (1993)* stating 15m distance and the unreferenced rural standards from DPHE of 30ft. In addition, the WHO *Guideline on Sanitation and Health (2018)* uses 15m. Given the above and risk factors within the camp, a conservative approach was taken and 15m selected."

The Environment Conservation Rules, 1997
Government of the People's Republic of Bangladesh
Ministry of Environment and Forest

SCHEDULE – 9

Standards for Sewage Discharge
[See Rule 12]

Parameter	Unit	Standard Limit
BOD	miligram/l	40
Nitrate	,,	250
Phosphate	,,	35
Suspended Solids (SS)	,,	100
Temperature	Degree Centigrade	30
Coliform	number per 100 ml	1000

Notes :

(1) This limit shall be applicable to discharges into surface and inland waters bodies.
(2) Sewage shall be chlorinated before final discharge.

Schedule – 6

Schedule – 7
Standards for Sewage Discharge
(Rules - 23)

Sl No.	Parameters	Unit	Standard Limit
1	pH		6-9
2	BOD	mg/L	30
3	Total Nitrogen	"	15
4	Nitrate	"	250
5	Phosphate	"	35
6	Suspended Solid (SS)	"	100
7	Temperature	Degree Centigrade (^{O}C)	30
8	Coliform	CFU/100 mL	1000
9	Oil & Grease	mg/L	10
10	COD	mg/L	200

Terms and Conditions:
1. This limit shall be applicable to discharges into surface and inland waters bodies.
2. Sewage shall be chlorinated before final discharge.

Figure 22: Standards for Sewage Discharge Left: Environment Conservation Rules of 1997 and Right: Department of Environment, Guidelines 2019 (Source: Government of Bangladesh).

3.2. Planning

3.2.1. Service targets

According to the WASH Sector in Cox's Bazar, there are different minimum requirements for WASH and FSM services in the camps. When it comes to the number person per latrines, the preferred option is: "One latrine shared by 2 or 3 families. Appropriate number of people per cubicle: Segregated latrines (female, children and male) with a ratio of 1: 20". Beyond this, it is aimed to provide separate communal latrines for women and men, yet the long-term target is to provide household level WASH facilities when possible. Also, in order to increase the sustainability and maintenance, community participation for the construction of household latrines is promoted, especially for households that are headed by women or elderly (WASH Sector, 2017).

In Camp 14, there is one latrine available per 13 individuals (REACH, 2019f) hence the ratio determined by the Sphere standards is met. There are five community latrines blocks, and some are "gender marked", meaning is stated whether these are supposed to be used by women or men. However, BRAC states that more engagement is needed on the enforcement of these gender signs. Moreover, all WASH blocks, including hygiene facilities, are under gender protection (Stakeholder 2).

In the Humanitarian Crisis Management Program Strategy 2020 for Cox's Bazar (p.27), BRAC sets the overall target for all camps they are serving to:

- 133,456 people including men, women, girls, boys, children, and people with disabilities in camps have access to at least 20 litres of safe water per person per day for drinking and other domestic purposes
- 152,521 people including men, women, girls, boys, children, and people with disabilities in camps have access to functional and safe latrines

These numbers are however not specifically for Camp 14. In order to get a better understanding and overview of service targets, UNICEF, as CLA, is in the process of conducting a WASH Sector mapping of service targets and performances in the camps

(Stakeholder 1). For instance, the number of bathing facilities, latrines and their construction material and type, as well as their individual location through a geo-code are being tracked (WASH Infrastructure Dataset, January 2020). This data set is also one of the main sources of information for the development of this SFD graphic.

3.2.2. Investments

According to the Bangladesh Joint Response Plan for Rohingya Humanitarian Crisis, January-December 2020, at total sum of 115,477,601 USD has been requested for providing WASH services in the camp in Teknaf and Ukhia together, of which 6,683,195 USD have been funded (5.8% of the request). Additionally, another 13,643,249 USD has been requested for an appropriate response to the SRARS CoV-2 (COVID-19) pandemic in 2020 (OCHA Financial Tracking Service, 2020).

Table 5: Selection of sanitation and FSM targets and funding requests for the Rohingya response 2020 (Source: OCHA 2020, adaptation by Antje Heyer).

Organization	Funding Request in USD	Selected highlights in terms of sanitation and FSM targets
UNICEF	27,500,000	Points out the need to increase coverage of FSM sites to ensure all latrines are being emptied regularly, kept functional and the sewage safely treated and disposed of.
IOM	19,160,199	Focuses on their sanitation targets for refugee and host communities together on construction of new – as well as upgrading of existing latrines, bathing facilities DEWATS. Gender-inclusivity and improved access and usability for Persons with Disabilities (PwD). New and more durable latrines shall minimize desludging and health risk.
BRAC	7,028,615	An implementing organization for both cluster coordinators mentioned above, aims for 2020 "to ensure all refugees living in camps and affected Host Communities have adequate, appropriate and acceptable latrines to allow rapid, safe and secure access at all times
Target number	**BRAC specific sanitation targets**	
90,651	Number of targeted people disaggregated by sex, age and disability in camps who have access to functional and safe latrines:	
30	Percentage of households reporting visible waste in the vicinity of their accommodation	
70	Percentage of targeted people disaggregated by sex, age and disability who are accessing safe, functioning, and dignified communal bathing facilities	

Furthermore, the Resettlement Policy Framework by the GoB, from December 2019, clearly acknowledges the need to "improve access to resilient and eco-friendly sustainable sanitation" (GoB 2019b, p.8). Measures target safe water supply as well as safe and acceptable sanitation set-up along the entire sanitation service chain. The framework notably points out options for re-use of faecal matter: "These interventions will contribute to improve sanitary and hygiene conditions in the camps, [help to prevent] soil, and water contamination due to untreated faecal discharge to the environment, and [will contribute] to produce agricultural fertilizer and a clean renewable energy source for community use" (ibid, p.8). A summary of these interventions can be found in Table 6.

Table 6: Overview of planned WASH interventions by the GoB under the Resettlement Policy Framework (Source: GoB, 2019b).

Activities	Parent project	Additional Financing
Restoring tube wells	400	1,500
Installing mobile desalination plants	4	//
Mini piped water supply system (incl. tube wells, pump house, OHT, pipe network, water carriers and solar panel)	28	32
Water quality monitoring including water resource availability	428	
Rehabilitation/New Construction of improved individual latrines	3,000	10,000 (will benefit additional 83, 500 people)
Construction of HHs bio-fill toilet	500	2,000 (will benefit additional 20,500 people)
Construction of chamber community latrines/public toilet (with water source), septic tanks and solar support	70 latrines	20 (will benefit additional 3,400 people)
Construction of a composting and biogas plant	30	//
Construction of integrated waste and faecal sludge management (FSM) system	Lump sum	//
Drainage installation and Improvements		will benefit 5,500 people
Installation of rainwater harvesting system		200 (will benefit additional 1,100 people)

The Swiss Agency for Development and Cooperation SDC is planning and establishing an Faecal Sludge Laboratory (FSL) for the Bangladesh DPHE. After the commissioning, DPHE will take over the responsibility of the FSL and conduct its operation. The DPHE lab will function as a governmental reference lab. Meaning it will monitor the effluent quality of faecal sludge and wastewater treatment plants and will verify the compliance with national effluent standards. However, the DPHE lab is not meant to conduct sample analysis for process control or process engineering of treatment plants. Instead, this will be the responsibility of the plant operating organizations. Moreover, it is important to note that as a reference laboratory, the DPHE FSL is not planned to provide guidance on how to improve treatment performances.

Based on the Bangladeshi national effluent standards, the DPHE FSL will be able to analyse the following parameters: pH, BOD, COD, Total Nitrogen, Nitrate, Phosphate, Suspended Solids, Temperature, and Coliforms. The test frequency for each plant and the plants considered for the testing will be defined after the commissioning of the FSL. Due to the outbreak and response to COVID-19, construction on a laboratory for testing FS in Cox's Bazar was delayed (Stakeholder 5).

3.3. Equity

3.3.1. Current choice of services for the urban poor

While one cannot speak about urban poor in a refugee camp of about three years of age, there are still marginalized groups in such setting: women, girls, elderly, and people with impairments and/ or limited physical mobility especially face struggles.

According to REACH monitoring outputs, the sanitation facilities are perceived to have clear catchment areas linked to the boundaries of the camp blocks or so-called mahjis blocks. However, do to spatial or geological condition, accessibility of latrines still remains a challenge, with overcrowding of latrines as the main issue reported (26%). In 2019, 34% of the households reported that at least one-member faces challenges accessing latrines

(REACH, 2019a). In 2018, 37% of the households reported so (REACH, 2018). Hereby, more women (39%) than men (24%) are reported to face related challenges. In addition, overall, of 22% of households reported that at least one individual is feeling unsafe when visiting the facility, with no significant difference between age and gender. In Camp 14, the proportion of household feeling unsafe is 13%, lower than the average for all camps (REACH, 2019a).

An additional accessibility challenge is the long travel time from shelter to WASH facilities, even if the majority have a latrine within the Sphere-recommended 50-metre distance. Other factors such as the hilly topography, poor road conditions, long distances to collect water or insufficient lighting during the night decrease the level of accessibility, as identified by the WASH/REACH findings on sanitation (WASH-Sector CXB, REACH, 2019). In Camp 14, the median walking distance to access facilities is 5 minutes. Yet, the accessibility of pit latrines varies strongly from 5 minutes up to 30 minutes: 59% of households reach latrines within 5 min walking, 30% within 10 min, 6% within 15 min, and 5% within 20 to 30 min (REACH, 2019a).

3.3.2. Plans and measures to reduce inequity

In Camp 14, BRAC works closely with the community in regard to cleaning of latrines and the acceptance of chlorinating water by following the Risks, Attitudes, Norms, Abilities, and Self-regulation RANAS approach to systematic behaviour change. The approach works with four phases: first, identification of possible behavioural factors; second, measurement of the behavioural factors identified and determination of those steering the behaviour; third, selection of corresponding behaviour changes techniques and development of appropriate behaviour change strategies; and fourth, implementation and evaluation of the behaviour change strategies (Contzen, N., Mosler, H.-J. 2015). With these steps, applying the RANAS approach takes up several months, yet appears to be successful in Camp 14. According to BRAC, previously exclusively women cleaned the latrines, yet this would change through community engagement specifically targeting men. The goal of this engagement is that by next year, men will be cleaning latrines themselves (Stakeholder 2). BRAC works with two volunteer groups: one group responsible for cleaning WASH facilities and on responsible for managing the desludging of latrines.

Furthermore, the above-mentioned Resettlement Policy Framework by the GoB points out that efforts to relocate households most at-risk from landslides and flooding are “underway” (p.5). However, there is insufficient suitable land available to accommodate even this highest-risk category of households. The framework also incorporates a sub-component on “Strengthening Community Resilience” in terms of social and economic needs, especially targeting women, children, elderly, and people with disabilities (GoB, 2019b).

Considering the high vulnerability of the camp population, many NGOs are addressing issues such as gender-based violence and clearly work toward reducing inequity in various forms. Additionally, many organisations such as BRAC or the IRCS also target the vulnerable host communities in Cox’s Bazar district in their programs (see for instance ISCG, 2018).

3.4. Outputs

3.4.1. Capacity to meet service needs, demands and targets

The REACH initiative reports that in the total camp area only 57% of toilet cubicles are functional and appropriately designed. This means that only more than half of the latrines are constructed according to the combination of all of four design parameters that are defined by the TWiG. The picture is different when looking at the design parameters individually, because for the vast majority of the latrines at least one or several of the design parameters are incorporated: MS angle or wooden frame used for door (92%), walls and roof (91%), concrete slab (93%), plastic or metal sheet used for roofing (95%) (REACH, 2019a).

Another REACH monitoring (2019d) on the functionality of these latrines reveals that only 78% of the latrines are functional. The key characteristics that need to be in place in order to classify a toilet as functional are: four walls (98%), a roof (99%), a functional door (90%), and a pan that is not full (84%). Hence, it appears to be a challenge for the WASH sector to not only construct but also maintain toilet facilities according to its own design standards.

While all these characteristics refer to the top structures and are not necessarily related to health risks, these data still reveal the challenges the Rohingya population, especially women and girls, faces when using (gender-mixed) latrines that have no functional door for instance.

3.4.2. Monitoring and reporting access to services

The monitoring efforts in the Global WASH Cluster are based on its "Minimum Requirements for National Humanitarian WASH Coordination Platforms (2017)" which define data that the cluster members should collect in order to ensure coordination and accountability to affected populations. Besides these minimum requirements (MRs), the GWC runs other monitoring initiatives such as "the Cluster Coordination Performance Monitoring (CCPM), WASH funding analysis, and the full cluster diagnostic tool" (GWC, 2017). The information collected are used by cluster coordinators and the cluster lead agency (UNICEF) to highlight trends in cluster functionality and also identify specific core functions that need support (ibid). Results of these monitoring efforts are published by REACH and UNICEF. In Cox's Bazar, monitoring is frequently carried out and publications distinguishing their results between dry season in September/ October and monsoon season in May. Publications can be found on the OCHA hosted website *https://www.humanitarianresponse.info*. The level of information available on this website differs from cluster to cluster.

The WASH Sector monitoring efforts include needs assessments for water, sanitation and hygiene involving focus group discussion (FGD) in camps in Ukhia and Teknaf. For 2019, there were 19 FGD split by gender and involving men and women equally, though additional discussions on hygiene were conducted with women in Teknaf (REACH, 2019d).

According to the REACH household surveys on WASH, 10% of the participants report to have been consulted for their input on design and construction of latrines as well as bathroom facilities. With one percent point lower (9%), these participants also report that their input was considered (REACH, 2019d).

General complaint and feedback mechanisms for the refugees remain a challenge. Participants of FGD report mahjis (block leaders) as their main point of contact for making complaints about sanitation. Mahjis generally are expected to either resolve the issue directly or to accompany complainants to the relevant actors for further follow-up. Apparently very few of the participants report going directly to NGO staff or volunteers for complaints. Moreover, "[…] when asked how current complaint mechanisms could be improved upon, the majority of participants either remained silent or stated they have no recommendations. The minority of participants that reported suggestions indicated that it would be better if they had a clear understanding of who were the most appropriate people to discuss sanitation issues with" (REACH, 2019d).

In their strategic response plan from 2019, BRAC states that "information needs to be more language-appropriate, accessible and inclusive" since 59% of refugees interviewed do not feel informed on issues such as safety measures during cyclones and outbreaks, their rights and camp's governance (BRAC 2019, p.7). Therefore, BRAC aims to update the current M&E system and improve towards a more comprehensive approach responsive to the needs and requirements of the Humanitarian Crisis Management Program (p.11).

3.5. Expansion

3.5.1. Stimulating demand for services

Since the Rohingya living in the camps setting are depending on humanitarian services, especially in terms of WASH, little activities to stimulate demand for further services have been found. Efforts mainly focus on awareness raising in terms of hygiene or cleaning of latrines as mentioned by BRAC (Stakeholder 2).

Yet, it is noteworthy that these awareness raising sessions have resulted to an increased awareness for the health risk through contact with faeces. A growing practice of disposal of child faeces in latrines is also reported, as well as the demand for other child-friendly sanitary options such the potties (REACH, 2019c).

3.5.2. Strengthening service provider roles

Based on feedback received from the Training Needs Assessment (TNA) circulated among members of the FSM TWiG in CXB, eight topics within FSM theme requiring further training and assistance were identified in 2018. UPM Umwelt-Project-Management GmbH (UPM) was commissioned by the Bill & Melinda Gates Foundation to provide this specific technical assistance. UPM conducted a series of trainings in order to provide an overview of different design aspects for different types of treatment options and to raise awareness about the importance and complexity of these treatment systems.

During these trainings, it has been observed by UPM that not all participants have an extensive understanding and the knowledge required to design appropriate FS treatment. The trainings also covered a general overview of different treatments methods, with a focus on the challenging factors of high population density in the camp setting, as well as maintenance and monitoring.

Due to Covid-19 outbreak, not all of planned training sessions could be conducted and had to be cancelled. An overview on conducted and planned trainings is presented in the Annex 7.

Other institutions, such as IHE Delft, conducted extensive training on FSM in the emergencies, to strengthen and support service providers (IHE Delft, 2019).

4. Stakeholder Engagement

The main share of the data used for this report was collected during a 4-week stay of UPM team experts in Cox's Bazar in January-February 2020. However, UPM international and local team members have been working in Cox's Bazar on regular basis from September 2018 to February 2020 and had the opportunity to visit several camps in the area during its technical assistance assignment, in particular Camp 12 and others.

The engagement process of this SFD report during one of the training sessions implemented by UPM in Cox's Bazar. During this training, the concept of SFD reports was presented as well as the type of information required to develop such report for the refugee camps in Cox's Bazar. The WASH manager of UNICEF suggested Camp 14 as a suitable site to test the SFD methodology. UNICEF also established contact with BRAC, the main organization operating WASH and FSM in Camp 14. In February 2020, a meeting with three staff members of BRAC was organized, including the WASH project manager. One staff member was already familiar with the SFD methodology and had even developed a first SFD graphic for Camp 14. That graphic was developed in the context of a 14-day training on FSM organized by the IHE Delft that same month. BRAC openly shared the data needed to develop this SFD report. The UPM experts were invited by BRAC to visit Camp 14. Unfortunately, due to time restrictions and other duties outside the Cox's Bazar, the experts could not visit the camp . Shortly after this, the global pandemic of COVID-19 started. Hence, efforts in the WASH sector focused on the response towards this outbreak.

UPM shared the first SFD graphic and report with BRAC in June 2020. BRAC sent a review of the draft yet further progress of the report got on hold due to staff changes and the ongoing focus on the COVID-19 response.

In early 2021, UPM picked up the work on this report again. The statistics in use were checked and if necessary updated, mainly with publications by UNICEF and UNHCR on *https://www.humanitarianresponse.info*. Also, contact with BRAC was established once again, in order to include updates of their work and make a final check of the report.

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7. Appendix

7.1. Appendix 1: Stakeholder identification

Stakeholder identification

	Stakeholder Group (see Section 3.1 Stakeholder Engagement Document)	Name of organisation	Name of contact person	Contact No.	Email Address	Position	Source of contact	Influence (high/medium/low)	Interest (high/medium/low)	Additional comments
Stakeholder 1	Expert Organization	UNICEF	Mohammad Ashfaqur Rahman	Office: +8809604107392; ext.7392 | Mobile: +880 1753 964135	morahman@unicef.org	WASH Officer		medium	high	
Stakeholder 2	Expert Organization	BRAC	Kawsar Iqbal Palash		kawsar.soc@gmail.com.	Project Manager (WASH-UNICEF)	UNICEF	medium	high	Ended his mission with BRAC
Stakeholder 3	Expert Organization	BRAC	Md. Tahidul Islam	Office:+8801847455778	tahidul.i@brac.net	Project Engineer - WASH	UNICEF	medium	high	
Stakeholder 4	Expert Organization	BRAC	Mohammed Juma	Office:+8801847455998	Ishaq.aj@brac.net	Team Lead WASH	BRAC	medium	medium	
Stakeholder 5	Expert Organization	SDC	Ralp Bland		ralph.bland@eda.admin.ch	Head of SDC Project Office	UPM	medium	medium	Ended his mission with SDC
Stakeholder 6	Expert Organization	SDC	Manuel Krähenbühl		manuel.kraehenbuehl@eda.admin.ch	Sanitation and Solid Waste Management Expert	Ralph Bland	medium	medium	Ended his mission with SDC
Stakeholder 7	Expert Organization	SDC	Mirco Keller	Office: +880 1713 011 108	mirco.keller@eda.admin.ch	Deputy Head of SDC Project Office	Manuel Krähenbühl	medium	medium	

7.2. Appendix 2: Tracking of Engagement

Tracking of Engagement

Comment: List stakeholder that was directly engaged in the study. For desk-based assessment through Email or Phone. For field-based assessmet through the corresponding data collection method	Date of Engagement	Purpose of Engagement	Maximum 100 word summary of outcomes
Stakeholder 1	30.01.2020 04.02.2020	Introduction to SFD in UPM workshop Data collection / exchange	Mr. Rahman visited the UPM workshop regarding FSM where the SFD method was introduced. He became interested and in a follow up meeting, suggested to develop a SFD for Camp 14. He also established contact with the main WASH operating NGO BRAC.
Stakeholder 2	13.02.2020 - 03.2020	Meeting / Interview	Mr. Iqbal was highly interested in developing a SFD for Camp 14 and encouraged his colleagues to follow-up on questions and sending data. He left the BRAC mission before the first draft SFD was submitted to BRAC.
Stakeholder 3	13.02.2020 -	Meeting / Revision of SFD Draft	Mr.Islam already had participated in a SFD method training by IHE Delft and hence was familiar the method and even had produced a draft SFD graphic earlier. He was highly interested and engaged in the interview and followed up with sending data. He gave comments on the first SFD draft.
Stakeholder 4	13.02.2020 - 07.07.2021	Meeting / Revision of SFD Draft	Mr. Juma encouraged the development of a SFD through his team. He also invited UPM to return to visit Camp 14. He gave comments on the first SFD draft, yet not on the later version send to him.
Stakeholder 5	Jan 2020 - Feb 2021	UPM Workshops; personal meetings / Email exchange	Mr. Bland participated in the UPM Workshop on FSM in January 2020. Since then he stayed in touch about the work of SDC in CXB, specifically about the progress of the DPHE Laboratory. Later on, email exchange was established.
Stakeholder 6	08.03.2021	Email exchange	The contact was established through Mr. Bland. Email exchange on SDC engagement in Cox's Bazar, specifically about the progress of the DPHE laboratory was established.
Stakeholder 7	Jun-21	Email exchange	Email exchange on SDC engagement in Cox's Bazar, specifically about the progress of the DPHE laboratory.

7.3. Appendix 3: Water Characteristics Open Drain, Camp 3 & Camp 4X

Table 7: Water Characteristics Open Drain, Camp 3 & Camp 4X (UPM, 2019).

Parameter	Drain channels (Mean)
pH	7.5
TS (%)	0.5
VS (%)	18
COD (mg/L)	448
BOD_5 (mg/L)	187
TKN (mg/L)	37
TP (mg/L)	0.3
Faecal Coliform (cfu/100mL)	3.E+06
Helminths (Number/L)	1,000

7.4. Appendix 4: Strengthening service provider capacities

Table 8: Topics and Trainings on FSM in Cox's Bazar.

Topic	Schedule	Status
Anaerobic Baffled Reactor (ABR) and Anaerobe Filters (AF)	09.09 -11.09	
Effluent Post Treatment of Anaerobic Systems (Sand filter,Trickling filter, French drain, Constructed wetlands).	28.10 - 31.10	
Compliance and performance monitoring of Faecal Sludge Treatment Plants (FSTP)	28.10 - 31.10	
Faecal Sludge Management Value Chain (Semi-) Centralized final treatment of Faecal Sludge in Combination with Organic Waste	11.02 - 13.02, 20.02 - 13.02	
Green Eco-Technologies for a better camp environment (a) Co-composting, co-fermentation & planted gravel filter, (b) Living wall and keyhole gardening, (c) optimizing and maintaining biogas sanitation systems	11.11 - 14.11	
Behaviour Change for Effective Basic Solid Waste (SW) Segregation How to implement a successful SW segregation practice in the camp with focus should be most on behaviour change?		**Cancelled due to COVD-19**
From liquid sludge to transportable Biosolids: FSTP desludging, settling, dewatering, thickening, drying of sludge	04.12 - 05.12	
Decentralized Wastewater Treatment System (DEWATS)	27.01 - 29.01	
Thermal treatment of plastics to fuel		**Cancelled due to COVD-19**
Conveyance and sewer design for FS collection		**Cancelled due to COVD-19**

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