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SFD Report Wai (India)



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SFD Report

Wai

India

This SFD Report was created from PAS data and through field based research by Center for Water and Sanitation (C-WAS), CEPT University, Ahmedabad.

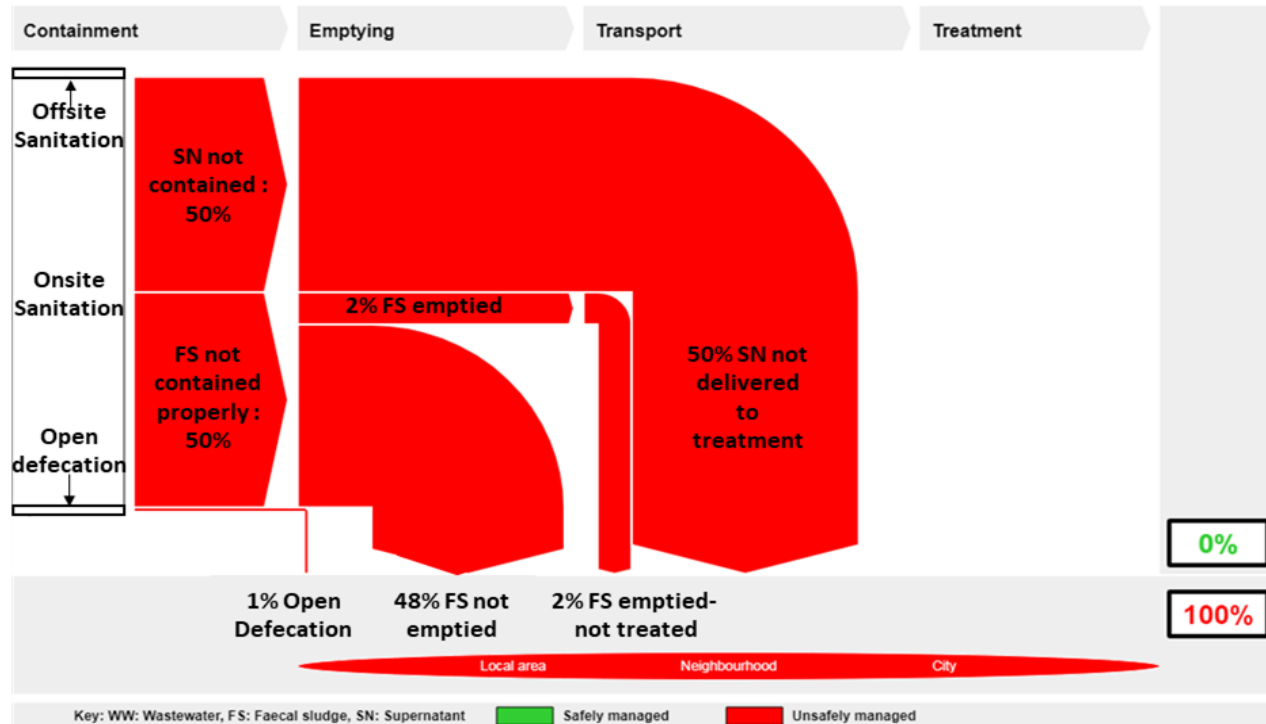
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1. The Diagrams

SFD diagram- Year 2015

Wai, Maharashtra, India
SFD Level: 3 – Comprehensive SFD

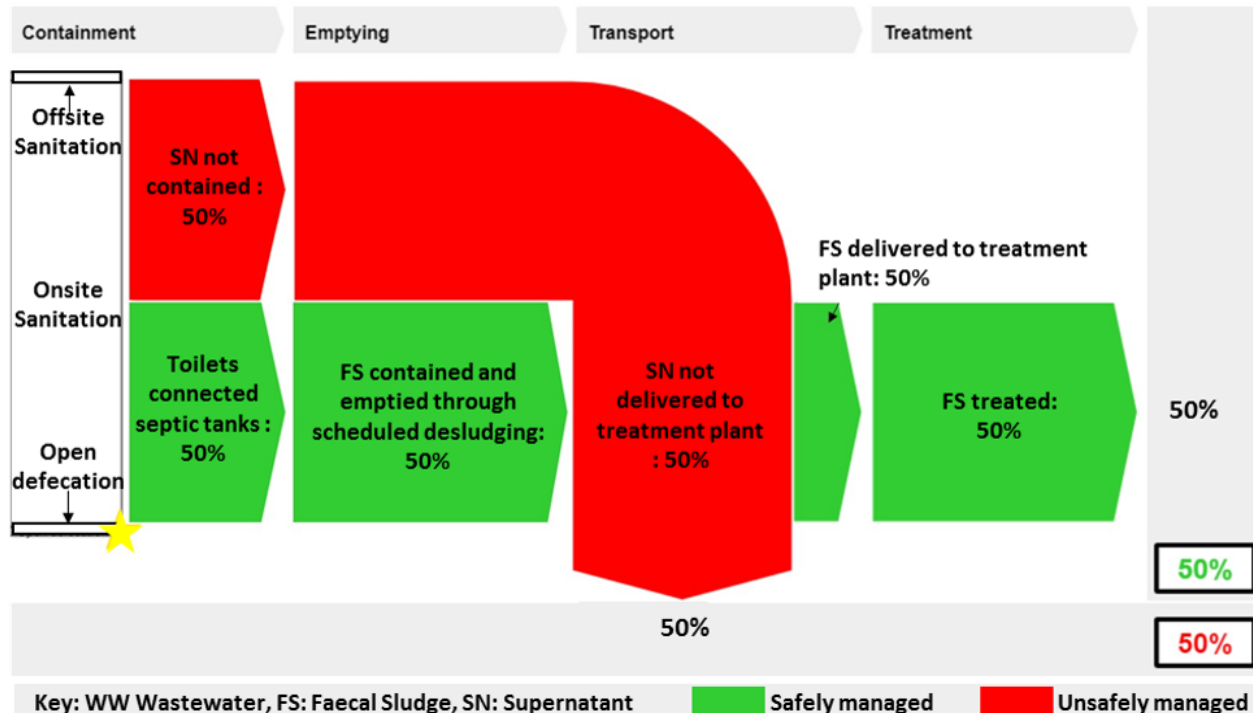
Date prepared: 31 Mar 2020
Prepared by : C-WAS



SFD diagram- Year 2018

Wai, Maharashtra, India
SFD Level: 3 – Comprehensive SFD

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Note: The ratio of FS and SN is taken as 50:50, as the exact ratio between them is not known. This is based on the assumption given in SFD preparation guidelines- "Where onsite containers are connected to a sewer network or to open drains, using a value of "50%" means that half the contents are modelled as faecal sludge; a proportion of this may be emptied periodically (you will enter this value in the SFD matrix). The remaining fraction will comprise faecal sludge which remains in the container and, in the case of open-bottomed tanks, infiltrate. The other half of the contents is modelled as supernatant discharging into the sewer network or to open drains" (slide #5 and #13, SFD Understanding the SFD Graphic Generator guidelines, Susana, 2018)

2. Diagram information

Desk or field based:

This SFD is prepared using field based studies and PAS online database

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3. General city information

Wai is small town in Satara district of Maharashtra, with a population of 36,025 (Census, 2011). It is located at 17° 55' 30" N latitude and 73°53'30.8"E. Total area of the city is 3.63 Km².

The city is situated at 718 m above mean sea level, resulting in high altitude. The temperatures here vary from a minimum of 14.3°C to a maximum of 34.6°C and the city has a tropical climate. The average annual rainfall here is 1022 mm. (CLIMATE-DATA.ORG, 2019)

Krishna River flowing through the city divides the city in two parts. The river flows from the west to east of the city. Dhom dam is 10 Kms upstream on this river.

Figure 1- Temples on the banks of Krishna River



The city is also known as *Dakshin Kashi* and is well known in Maharashtra for its Ghats and over 250 temples. The picturesque city is located 95 Km from Pune, is of the major shooting destinations for the Indian film industry.

4. Service delivery context

A comprehensive legal framework to regulate wastewater disposal at local level is absent in India. At the Union level, the Water (Prevention and Control of Pollution) Act, 1974 and the Environment (Protection) Act, 1986 include provisions for wastewater disposal. State Pollution Control Boards are responsible for their implementation (*The Environment (Protection) Act, 1986*) (*The Water (Prevention and Control of Pollution) Act 1974, 1974*). These laws also prescribe a penalty in the case for non-compliance. However, monitoring and implementation has been extremely poor.

The National Urban Sanitation Policy (NUSP) of Government of India (GoI), 2008 was the first comprehensive policy statement on urban sanitation in India. While the NUSP

recognized the entire sanitation cycle, need for addressing faecal sludge management, seems to not have seeped down to state and local governments (*NUSP, 2008*).

The advisory note on septage management in urban India, issued by Ministry of Urban Development (MoUD) in year 2013, recommends supplementing City Sanitation Plans (CSP) with Septage Management Sub-Plan (SMP) (*Advisory, 2013*). The Government of India’s Swachh Bharat Mission and AMRUT programme have focused on eradicating open defecation, providing proper sanitation infrastructure in the cities and has brought sanitation on the forefront of the development agenda. The Government of India, Ministry of Housing and Urban Affairs, issued a National Faecal Sludge and Septage Management (FSSM) Policy in year 2017. The key objectives of the urban FSSM Policy are to set the context, priorities, and direction for, and to facilitate, nationwide implementation of FSSM services in all Urban Local Bodies (ULBs) such that safe and sustainable sanitation becomes a reality for all in each and every household, street and city (*MoUD, 2017*). This has now been included in Swachh Survekshan. Based on the city’s status and progress in the sanitation and hygiene, ODF, ODF+ and ODF++ status are awarded. Parameters for achieving these status cover all aspects of the sanitation service chain i.e. user interface, containment, transportation, treatment and reuse of treated faecal sludge and wastewater. As a result of effective implementation of interventions in this sector, periodic evaluation and monitoring of these parameters, 488 cities around the country have already been declared ODF++ (*Ministry of Housing and Urban Affairs, 2020*).

The regulatory framework for onsite sanitation comes from the Municipal Act and Bye-laws. There are also legal instruments, related to environment pollution that provide for safe collection and discharge of

wastewater. The ULB is responsible for enforcing these regulations. Wai Municipal Council (WMC) is responsible for provision of sanitation service delivery in the city.

Sanitation in Wai: As per census 2011, 68% of the households had toilets on premises, 30% households depended on community toilets and 2% households defecated in the open. Most of the individual toilets were connected to septic tanks. These septic tanks usually had 2-3 chambers and were oversized in many cases. As per standards (*CPHEEO, 2013*), septic tanks should be cleaned every 2-3 years, but in Wai desludging of septic tanks was done on demand basis by the city council. Infrequent or delayed cleaning of septic tanks resulted in hardening of septage at the bottom of the tank which became difficult to desludge and reduced the treatment efficiency of the tank.

While implementing the city sanitation plan in Wai, many key decisions were taken. Wai city allocated land to TIDE technocrats to set up a Faecal Sludge Treatment Plant (FSTP). Scheduled desludging service of all the septic tanks in the city was taken up from 31st May, 2018. This was done on a fixed cycle of 3 years and a predetermined schedule (33% annually) by dividing city into three zones. A private service provider, SUMEET is contracted by WMC to provide scheduled desludging service.

5. Service outcomes

A brief overview of the different sanitation systems in Wai across the sanitation service chain for the year 2018 is given below:

Containment: The vast majority of the households in Wai city have toilet facilities within the premises (82%), while the remaining 18% of the population relies on community toilets. None of the individual toilets were found to be using single or double pit latrine systems. There are 36 community toilet blocks with a total of 277 seats and 6 urinals across the city. There are 3 public

toilets in various parts of the city. These public toilets are situated at the bus stand and temple sites. All of these community and public toilets are connected to the septic tanks (PAS, 2019)

Figure 2- Supernatant and greywater flowing through open drains



The supernatant from these septic tanks flows into the public drains. There are no soak pits in Wai as the soil type is not very permeable (for infiltration) and also the ground water table is very high.

Desludging and transportation: The desludging of septic tanks connected to individual toilets in Wai is done by Sumeet Facilities Private limited. Desludging of septic tanks connected to community toilets and public toilets is done by the Wai Municipal Council (WMC) using its own vacuum truck.

Figure 3- Desludging operations in Wai



Wai is one of the first cities in India to implement a scheduled septic tank desludging service. Under this plan all the septic tanks in the city would be desludged once in 3 years.

The entire city was divided in 3 zones and one zone is taken up for desludging each year.

Initially, around 100 septic tanks were being desludged annually in Wai. After introduction of scheduled desludging, around ~1000 septic tanks are been desludged annually.

While implementing the FSSM plan, WMC has also decided that FSSM is a public service and would therefore be financed out of local taxes. Wai introduced sanitation tax on all properties in Wai to partially offset costs of scheduled desludging. This sanitation tax is much less than what households paid for emergency/demand based desludging earlier. This ensures that all residents – including the low income communities that do not pay property tax, are served.

Treatment and disposal: A 70 KLD capacity FSTP set up by Tide Technocrats Private limited started functioning on 30th May 2018. FSTP has significantly prevented environmental pollution caused due to inappropriate disposal of septage in open areas.

Figure 4- Wai FSTP



The treatment process at FSTP uses pyrolysis technology to treat sludge that destroys all pathogens, and provides a usable end product in the form of bio-char. Bio-char provides excellent soil enrichment when used with compost. The treated liquid from the treatment plant is used for landscaping within the premise and cleaning suction trucks and vehicles.

6. Overview of stakeholders

The Wai Municipal Council (WMC) is led by Chief Officer and supported by 19 councillors. WMC is responsible for planning, designing, and construction activities for public services.

Public health and sanitation services are delivered by WMC through the health department of the Council which is headed by the sanitary inspector. Septage management is also the responsibility of the same department. Scheduled desludging and Operation and maintenance of FSTP is outsourced to private contractors.

Table: Key stakeholders

Key Stakeholders	Institutions / Organizations /
Public Institutions	<ul style="list-style-type: none"> Wai Municipal Council (WMC), Maharashtra Pollution Control Board (MPCB)
Private Sector	<ul style="list-style-type: none"> Sumeet Facilities Private limited(Septic tank desludging services) Tide Technocrats Private limited(O & M of STP)

7. Credibility of data

Two key sources of data are used: primary data collection from WMC and PAS Project, 2019. The data is verified and updated through key informant interviews (KIIs) with WMC officials.

8. List of data sources

For this SFD report, primary data is collected through discussions with officials of Wai Municipal Council. The secondary data source is the Service Level Benchmark (SLB) database for Wai city collected under PAS Project, CEPT university (www.pas.org.in) (PAS Project, 2017). The performance assessment framework developed under PAS project is operationalized through the online SLB-PAS module, a web based system for collection and analysis of water supply and sanitation

services data. It includes aspects of equity and on-site sanitation to capture the ground reality in Indian cities.

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Abbreviations

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
CEPT	Centre for Environmental Planning and Technology
CPHEEO	Central Public Health & Environmental Engineering Organization
CSPs	City Sanitation Plan
DMA	Directorate of Municipal Administration
EPA	Environment Protection Act
FS	Faecal Sludge
FSM	Faecal Sludge management
FSSM	Faecal Sludge and Septage management
FSTP	Faecal Sludge Treatment Plant
GoM	Government of Maharashtra
GR	Government Resolution
JnNURM	Jawaharlal Nehru National Urban Renewal Mission
KIIs	Key Informant Interviews
KM	Kilometer
MJP	Maharashtra Jeevan Pradhikaran
MLD	Million Litres per Day
MoHUA	Ministry of Housing and Urban Affairs
MoUD	Ministry of Urban Development
MPCB	Maharashtra Pollution Control Board
MWSSB	Maharashtra Water Supply and Sewerage Board
NUSP	National Urban Sanitation Policy
O&M	Operation and Maintenance
ODF	Open Defecation Free
OSS	Onsite Sanitation Systems
PAS	Performance Assessment System
PLAM	Performance Linked Annuity Model
SBM	Swachh Bharat Mission
SFD	Shit Flow Diagram
SMP	Septage Management Sub-Plan
SNA	Sujal Nirmal Abhiyan
UDD	Urban Development Department
ULBs	Urban Local Bodies
WMC	Wai Municipal Council
WSS	Water Supply and Sewerage
WSSD	Water Supply and Sanitation Department

1 City context

1.1 Location

Wai is a city located in Satara District of Maharashtra, India. The total area of the city is 3.63 Km² (PAS, 2019). It is located at 17° 55' 30" N latitude and 73°53'30.8"E longitude and is surrounded by the mountainous region of the *Sahyadris* with an average elevation of 718 meters. The city is located 35 Km away from Satara, 95 Km from Pune and 250 Km from Mumbai. It is a picturesque city and is one of the sites used by the Indian film industry for TV and film production.

Figure 1 Picturesque ghats of Wai



Situated on the Mahad-Pandharpur State Highway, Wai is a major city on the way to the hill stations of Mahabaleshwar and Panchgani. It also has an epithetic name “*Dakshin Kashi*”. It is known in Maharashtra for its *ghats* on the banks of the Krishna River and more than 250 temples, especially the *Dholya Ganapati* temple on *Ganapati Ghat*.

1.2 Climate

The city is situated at 718 M above mean sea level, resulting in high altitude and a tropical climate. The temperatures here vary from a minimum of 14.3°C to a maximum of 34.6°C. The average annual temperature is 24.1 °C while the average annual rainfall is 1022 mm. (CLIMATE-DATA.ORG, 2019)

The city experiences heavy rainfall but the undulating topography makes the water runoff easier. The frequent flooding of river Krishna and release of water from upstream Dhom dam increases severity of the problem faced by the city during monsoon season.

1.3 Demographics

The population of the city as per Census 2011 was 36,000 persons. The decadal growth rate is 12.5%. It is estimated that Wai has a population of 43,000 and with a total of 12,000 households in the year 2019. The density of the city is 13,000 persons per sq.km. The city has two major slum localities i.e. *Gurebazaar* slums and *Kashikapadi* slums. The number of slum households in the city are 550 and the total population living in these slums is 2,765 people. (PAS, 2019).

1.4 Data sources

For this SFD report two major data sources have been used. Primary data sources include collecting data from the city through site visits and key informant interviews with WMC officials. The CEPT team is supporting the Wai city for planning, implementation and monitoring of faecal sludge management plan since year 2012 with aim to make Wai a model city with improved sanitation services. The secondary data source used is the Performance Assessment System (PAS) Project (www.pas.org.in). This data was verified and triangulated through primary data collection from Wai Municipal Council (WMC).

The Performance Assessment System (PAS) Project is about measuring, monitoring and improving delivery of water and sanitation in cities of India. The PAS Project works with state and local governments in six states of India. Service delivery level data on water and sanitation for Wai is available on the PAS website. This is used to create SFD matrix.

This SFD report explains two SFD graphics i.e. Baseline SFD diagram for year 2015 and SFD diagram based on scenario for year 2017-18. These two timelines have been selected in order to explain the situation of sanitation in Wai before and after implementation of major sanitation interventions including introduction of scheduled desludging services and Faecal Sludge Treatment Plant.

Map 1 Location of Wai in Maharashtra



2 Service delivery context description/analysis

2.1 Policy, legislation and regulation

Sustainable sanitation is about providing adequate services in all aspects of the sanitation value chain. It is not just limited to providing toilets but also providing better services in

collection/containment, conveyance, treatment and reuse of Faecal sludge and grey water. Under Article 21 of the constitution of India, sanitation has been declared as a fundamental right to life. Constitution of India declares sanitation as a state subject which implies that a state can make laws through the statutory powers conferred to them in this sector.

2.1.1 National Level

Provisions concerning to wastewater disposal are stated in the Water (Prevention and Control of Pollution) Act, 1974 and the Environment (Protection) Act, 1986. The implementation of this act is monitored by the State Pollution Control Boards. The Environment (Protection) Act is designed to provide a legislative framework and prescribe remedies for non-compliance of any laws established under previous Acts (*The Environment (Protection) Act, 1986*). However, as a result of poor monitoring and implementation, the Act has not been utilised to its fullest potential

The Jawaharlal Nehru National Urban Renewal Mission (JnNURM) was launched in year 2005 with focus on infrastructure development projects in urban areas. Particularly in the sanitation sector, it primarily focused on large-scale investments like centralized sewer systems while septage management and onsite sanitation, in general, were not covered.

The entire sanitation cycle and the need for addressing faecal sludge management in urban India were highlighted by the National Urban Sanitation Policy (NUSP) of Government of India (GoI), 2008. The policy focused on providing safe sanitation to all in urban area, awareness generation, behaviour change, making cities open defecation free and integrated citywide sanitation. Though, there were not many proposals for septage management submitted by urban local governments for funding under the JNNURM programme during 2008-12. This clearly proves the fact that despite of being a comprehensive policy, the message did not percolate to state and local governments. (*NUSP, 2008*).

Considering the need to focus on septage management, Ministry of Urban Development (MoUD) issued an advisory note on septage management in urban India in year 2013. This recommends including Septage Management Sub-Plan (SMP) as a part of City Sanitation Plans (CSP) that are being prepared and implemented by the cities. (*Advisory, 2013*).

The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act has become instrumental in eradicating manual scavenging from India. Enacted in the year 2013, this act prohibits employment of manual scavengers and installations of insanitary latrines.

The Atal Mission for Rejuvenation and Urban Transformation (AMRUT), was launched with a primary focus of providing basic services in 2015. It considers septage management as one of its mission components and allocates financial support for the same. (*AMRUT, 2015*)

Ministry of Housing and Urban Affairs (MoHUA) and a host of research and civil society organisations jointly drafted and signed a National Declaration on Faecal sludge and Septage Management (FSSM) on 9th September 2016. Building up on this a National Faecal Sludge and Septage Management Policy was issued by Ministry of Housing and Urban Affairs, Government of India in year 2016. The key objective of this policy was to facilitate nationwide implementation of FSSM services in all ULBs. (*MoUD, 2017*)

In addition to above policies, National government programme on Swachh Bharat Mission focused on eradicating open defecation and providing proper sanitation infrastructure in the cities of India. Swachh Bharat Mission (SBM) was launched in the year 2014 with a vision to ensure hygiene, waste

management and sanitation across the nation. As per the guidelines of Swachh Bharat Mission (urban) (SBMU), all the urban local bodies have to provide a toilet to all the households having no latrine within premises, and an effective solid waste management system (SBM, 2014). Based on the city's status and progress in the sanitation and hygiene sector ODF, ODF+ and ODF++ protocols were developed. Parameters for achieving the status of ODF, ODF+ and ODF++ covers all aspects of the sanitation service chain i.e. user interface, containment, transportation, treatment and reuse of treated faecal sludge and wastewater. As a result of effective implementation of interventions in this sector and periodic evaluation and monitoring of these parameters through Swachh Survekshan, currently 488 cities around the country have already been declared ODF++ (Ministry of Housing and Urban Affairs, 2020). These cities are moving forward towards achieving Water+ protocol which not only focuses on septage management but also grey water management and reuse of treated wastewater.

2.1.2 State Level

Maharashtra adopted the principles of NUSP in its Sujal Nirmal Abhiyan (SNA) as a guiding statement for the water supply and sanitation sector. SNA prescribes measures for mainly addressing community and public toilets, but falls short of addressing other aspects of the sanitation service chain.

Government of Maharashtra has launched the 'Swachh Maharashtra Mission' at the state level in response to implementation of the Swachh Bharat Mission at the central level. The Swachh Maharashtra Mission in urban areas is being implemented by Urban Development Department (UDD) through a dedicated Swachh Maharashtra Mission Directorate. At the city level, the Mission is being implemented by Urban Local Bodies (ULB).

Urban Maharashtra was declared ODF by the President of India on 2nd October 2017. The state government of Maharashtra has issued a resolution for setting up independent FSTPs in 311 cities. This GR provides mandatory directives to cities for setting up an independent FSTP. Apart from this, state government has also instructed 36 cities in Maharashtra that have a Sewage Treatment plant (STP) to treat their septage at their own STPs. The State also issued a GR to co-treat septage from other 32 cities that fall in 20 km buffer of a nearby STP. The state is further ensuring that all cities achieve the status of ODF+/ODF++. With all these ongoing efforts in sanitation, Maharashtra became third cleanest state under Swachh Sarvekshan 2019.

2.1.3 City Level

ULBs are responsible for the provision of basic services like water supply, sanitation and solid waste management in their respective cities. In sanitation, the services include all aspects of the delivery chain i.e. safe collection, conveyance, treatment and disposal/reuse.

Wai was declared Open Defecation Free in the first phase of Swachh Maharashtra Mission (Urban) in August, 2016 and ODF++ in September 2019.

2.2 Institutional roles

There are various institutions that govern management and delivery of basic urban services.

2.2.1 State level

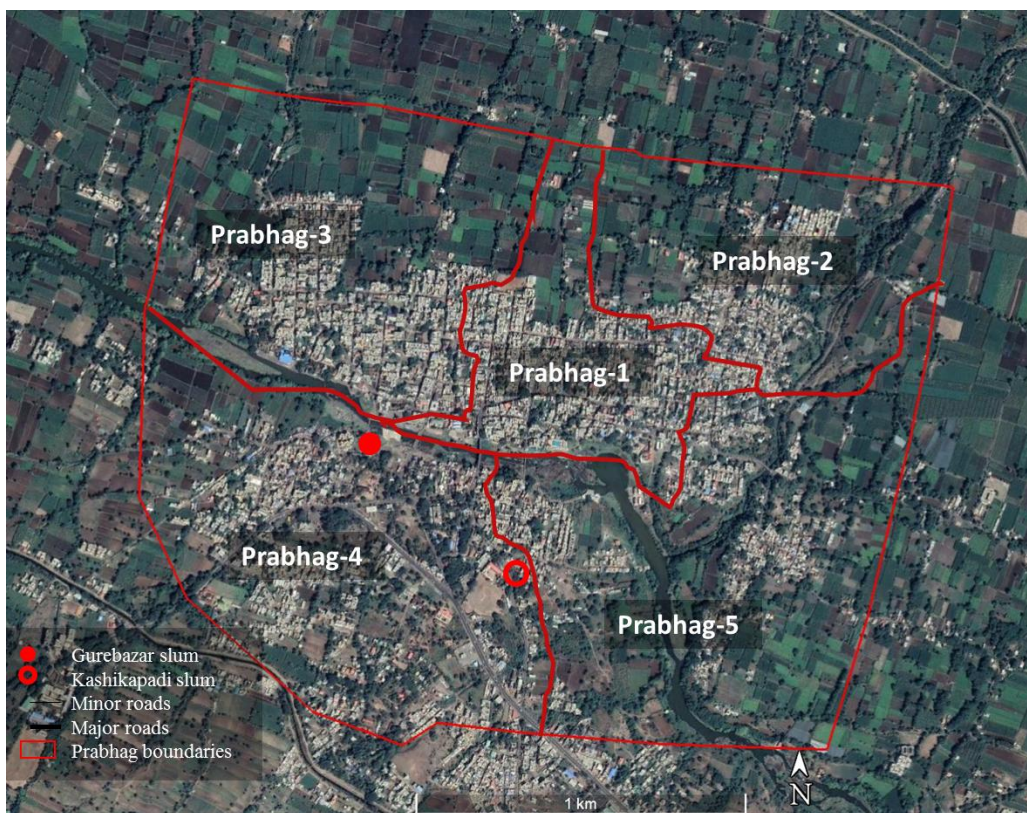
At the state level in Maharashtra, three departments/agencies play a vital role in policy making and septage management: The Urban Development Department (UDD), Water Supply and Sanitation Department (WSSD) and Maharashtra Jeevan Pradhikaran (MJP).

UDD along with its unit, the Directorate of Municipal Administration (DMA) look after the overall urban development policy, staffing, budgets, monitoring of ULB performance and sanitation/ septage management policies. WSSD formulates policies and guidelines for water supply and sanitation in rural and urban areas. Thus, some overlap with UDD is observed in this function. Maharashtra Water Supply and Sewerage Board (MWSSB) was established as per MWSSB Act, 1976 for proper regularization of water supply and sewerage services in the State. It was subsequently named as MJP in 1997. MJP is responsible for planning, designing and implementation of water supply and sewerage schemes in rural and some urban areas, including facilitation for necessary financial provisions.

The role of Maharashtra Pollution Control Board (MPCB), a state-level environmental regulator, is limited to monitoring of pollution of surface water bodies. Concerned ULBs are informed about the quality of water in lakes and rivers and asked to take appropriate actions. MPCB does not have any role in regulating faecal sludge management in cities.

2.2.2 City level

Map 2 Prabhag map of Wai



At city level, ULB is responsible for providing water, sanitation and solid waste services. ULBs are required to play a dual role of the service provider (providing drains, cleaning drains, constructing and maintaining public toilets and community toilets, etc.) and of a regulator (ensuring compliance to building bylaws, ensuring proper discharge of wastewater to drains etc.). In larger cities, there are separate departments that perform these dual roles – the Town Planning Department, Drainage Department and Public Health Department.

However, in performing these dual roles, ULBs are constrained by limited staff and technical capacity. Recruitment of sanitary workers (*Safai Karmacharis*) in the ULBs is guided by rules framed by the state government and ULBs do not have much flexibility.

The following table summarizes the roles and responsibilities of various institutions:

Table 1: Institutional roles and responsibilities

Institution	Roles and responsibilities
Urban Development Department (UDD)	Allocation of budget, regular monitoring and functioning of ULBs. Approval of municipal budgets, funding of CSPs and other proposals.
Water supply and sanitation Department (WSSD)	Preparation of state urban sanitation strategies, policy, guidelines, schemes.
Maharashtra Jeevan Pradhikaran (MJP)	Key financing vehicle. Plans and constructs urban Infrastructure. However, it is not involved in the management of onsite sanitation systems.
Maharashtra Pollution Control Board (MPCB)	Advises state on pollution related standards and policies. Monitoring of treatment plants. Key regulator for pollution related issues.
Wai Municipal Council (WMC)	Planning, designing, implementation, operation and maintenance (O&M) of urban infrastructure. Development control. Overall management of the civic services in the city. Responsible for septage emptying, transportation and disposal.

The following table shows the responsibilities for sanitation service delivery within WMC.

Table 2: Institutional framework for the sanitation sector

Urban Service	Planning	Execution	O & M	Tariff fixation and collection
Water Supply	Water supply department, WMC	Water supply department, WMC	Water supply department, WMC	Tax department, WMC
Sewerage	Sanitation department, WMC	Sanitation department, WMC	Sanitation department, WMC	Tax department, WMC
Onsite sanitation	Sanitation department, WMC	Sanitation department WMC, Private contractors	Sanitation Department WMC, Private contractors	Tax department, WMC
Public and Community Toilets	Sanitation department, WMC	Sanitation department, WMC	Sanitation department, WMC	Tax department, WMC

3. Service Outcomes

The section given below highlights the outcomes of the measures taken by the WMC that had an impact on the sanitation service chain.

3.1 Overview

In 2013, City Sanitation Plan (CSP) was prepared for Wai by Center for Water and Sanitation, CEPT University, Ahmedabad and All India Institute of Local Self Government, Mumbai. In 2014, Wai Municipal Council started implementing key actions from their CSP for making Wai Open Defecation Free and city-wide septage management plan. With introduction of own toilet scheme, Wai Municipal Council granted a subsidy of Rs. 10,000 for construction of own toilets which was later reinforced by Swachh Maharashtra Abhiyan with an additional subsidy of Rs. 12,000 per household. WMC also initiated various IEC and awareness program, created awareness material and monitored the OD spots with the help of “Good Morning Pathak” which resulted in achieving the ODF status.

After achieving the ODF status, city aimed at achieving ODF+/ODF++, which focused on increasing the individual toilet coverage to 80% and safe collection and disposal of faecal matter. City council mobilised additional applications from the SHGs and explored access to credit for those households who cannot undertake the construction due to financial constrain.

The other condition to achieve ODF++ status was collection, conveyance and treatment of septage should be carried out in a safe manner. For this, WMC formed an Integrated Faecal Sludge Management Plan (IFSM) and decided to implement it. The plans ensure that onsite sanitation systems function well as desludging services are provided to all on a scheduled basis at an interval of 3 years and all the human waste collected is treated through simple, efficient septage treatment facilities. As a result of implementing these measures, Wai was declared ODF++ on 24th September 2019.

3.1.1 Containment

Figure 2 Community toilets in Wai



The vast majority of the households in Wai city have toilet facilities within the premises (82%), while the remaining 18% of the population rely on community toilets. None of the individual toilets are found to be using single or double pit latrine systems. There are 36 community toilet blocks with a total of 277 seats and 6 urinals across the city. There also are 3 public toilets in various parts of the city. These public toilets are situated at bus stands and pilgrim places. All of these individual, community and public toilets are connected to the septic tanks (PAS Project, 2017).

Before commencing the scheduled desludging plan, all the septic tanks in the city were surveyed to assess number and capacity of septic tanks. The supernatant generated from these septic tanks flows directly in to the public open drains. There are no soak pits connected to septic tanks in Wai as the soil type is not very permeable and also the ground water table is very high.

3.1.2 Emptying and transportation

Wai is one of the first cities in India to implement a scheduled septic tank desludging service. Under this service all the septic tanks in the city would be emptied once in 3 years. For this, the entire city was divided in desludging 3 zones and the city aims to empty the septic tanks of 1 zone per year. Initially, septic tanks were being cleaned annually in Wai and these services were being provided by the WMC operated truck against a charge.

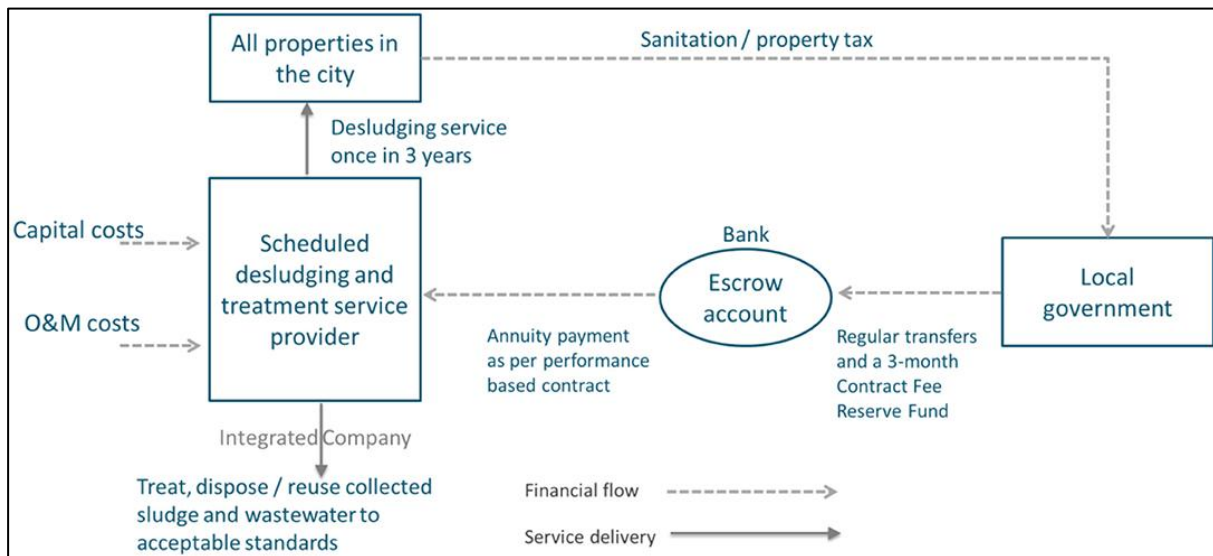
Figure 3 Scheduled desludging practices in Wai



Innovative means of financing the service and monitoring the process has also been introduced. WMC with help of C-WAS developed a performance-based contract for provision of Scheduled emptying service through private operator. Through a competitive tendering process, a private Company from Pune was selected to provide the emptying service.

“For financing the scheduled desludging services, the city has levied a sanitation tax. The sanitation tax is part of overall property tax which is paid annually by property owners to local governments for various services. This allows the tax to be more equitable as those with larger and better properties pay a higher property tax. This will also make the desludging service more affordable for the low income groups. Wai has allocated both sanitation tax and some transfer from property tax for financing the scheduled desludging service” (Meera, Dinesh, & Upasana, 2019). This is known as the PLAM-Performance Linked Annuity Model as shown in figure: 1 given below.

Figure 4: PLAM-Performance Linked Annuity Model



Source: Citywide Inclusive Sanitation Through Scheduled Desludging Services: Emerging Experience from India

After the implementation of this model, more than 1060 septic tanks have been emptied and 91 lakh litres of faecal sludge has been treated till 13th March 2020.

3.1.3 Treatment and disposal

Figure 5 Operations at Wai FSTP



A 70 KLD capacity FSTP was set up by Tide Technocrats Private limited that started functioning on 30th May 2018. The technology approach is the Thermal Treatment approach. The private service provider, Tide Technocrats are responsible for O&M of the plant for 2 years from the date of commencement. The collected septage is now treated in this treatment plant, which has significantly reduced environmental pollution caused due to inappropriate disposal of septage openly.

The treatment technology, pyrolyzes septage with a limited oxygen supply that destroys all pathogens present in excreta, and provides a usable end product in the form of bio-char. Bio-char provides excellent soil enrichment when used with compost. The treated liquid from the treatment plant is used for landscaping within the premise and cleaning suction trucks and vehicles. Interventions on reuse are currently underway.

Supernatant generated from the septic tanks as well as the greywater generated in the city, flows through the existing open drains and gets disposed of in the river Krishna without any treatment. This is leading to severe degradation of river water quality. In order to adequately capture and treat this wastewater, a Detailed Project Report (DPR) on underground sewerage/sullage scheme has been proposed. The DPR is proposed to have 40.6 km of underground sewer network and two treatment plants of 2.5 and 3.0 MLD capacity. The project will help in achieving SDG targets 6.2 and 6.3 that emphasize on importance of collection, conveyance and treatment of wastewater. This will significantly decrease the incidences of waterborne diseases to the people living in the city as well as people living on the downstream side of the river.

4 SFD Graphic

The SFD selection grid and matrix that have been used to generate SFD graphic are given in the annexures. The two timelines i.e. for year 2015 and 2018 have been selected in order to explain the sanitation scenario in Wai before, and after the implementation of scheduled desludging of septic tanks, Faecal Sludge Treatment Plant and other measures mentioned in the City Sanitation Plan.

In Wai, septic tanks are connected to open road side drains. Hence, The ratio of FS and SN is taken as 50:50 based on the following assumption given in SFD preparation guidelines- "Where onsite containers are connected to a sewer network or to open drains, using a value of "50%" means that half the contents are modelled as faecal sludge; a proportion of this may be emptied periodically (you will enter this value in the SFD matrix). The remaining fraction will comprise faecal sludge which remains in the container and, in the case of open-bottomed tanks, infiltrate. The other half of the contents is modelled as supernatant discharging into the sewer network or to open drains" (*SuSanA, 2018*).

In the year 2015, of 50% FS, only 2% of septic tanks were getting desludged in a year and this desludged septage was dumped in an open ground, due to absence of treatment facility. The supernatant flowing in open drains is discharged untreated into river Krishna.

However, after the implementation of FSSM plan in the Wai city, the sanitation situation improved considerably. In the year 2018, with onset of scheduled desludging operations and treatment facility, SFD has shown considerable improvement in safely managed sanitation. All septic tanks are envisaged to get emptied in duration of 3 years, as mentioned by national guidelines. (As per CPHEEO guidelines, septic tanks should be desludged once in 2-3 years). Also, septage desludged from septic tanks is getting treated at the FSTP. The supernatant from the septic tanks and grey water from households continues to flow in open road drains and discharge in Krishna river without treatment. Therefore, SFD diagram of year 2018 shows 50% safely managed sanitation and 50% unsafe sanitation system. The city is planning to implement a treatment facility for grey water and supernatant in the next phase to achieve 100% safely managed sanitation.

Figure 6: SFD graphic for year 2015

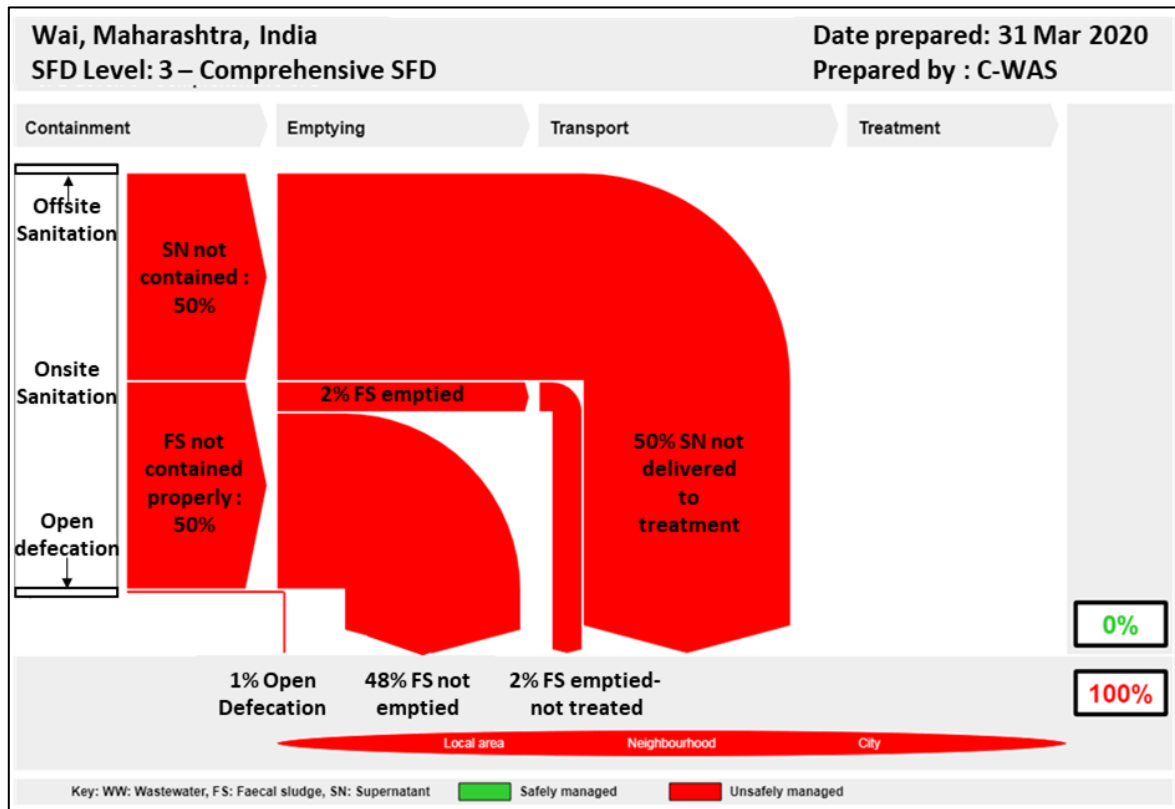
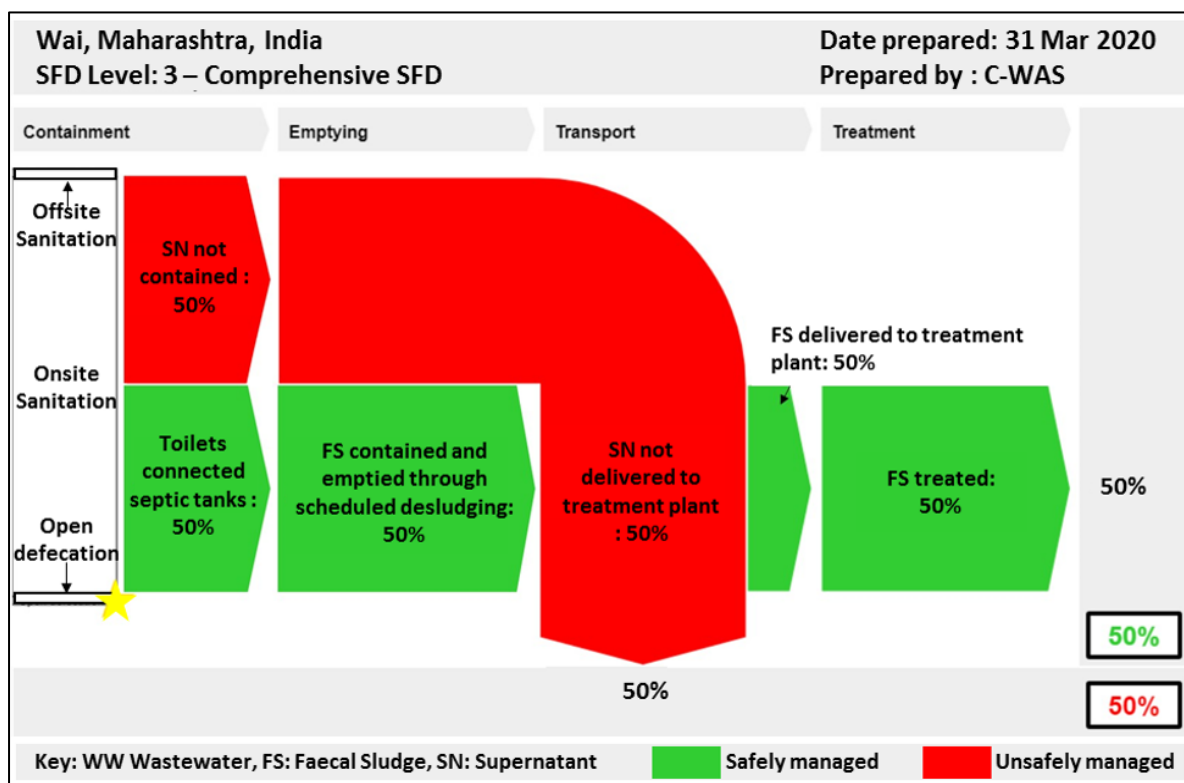


Figure 7: SFD graphic for year 2018



Note: The ratio of FS and SN is taken as 50:50, as the exact ratio between them is not known. This is based on the following assumption given in SFD preparation guidelines- "Where onsite containers are connected to a sewer network or to open drains, using a value of "50%" means that half the contents are modelled as faecal sludge; a proportion of this may be emptied periodically (you will enter this value in the SFD matrix). The remaining fraction will comprise faecal sludge which remains in the container and, in the case of open-bottomed tanks, infiltrate. The other half of the contents is modelled as supernatant discharging into the sewer network or to open drains" (*slide #5 and #13, SFD Understanding the SFD Graphic Generator guidelines, Susana, 2018*)

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7 Appendix

Appendix 1: Stakeholder identification

No.	Stakeholder group	In Wai context
1	City council / Municipal authority / Utility	Wai Municipal Council
2	Ministry in charge of urban sanitation and sewerage	Urban Development Department, GoM
3	Ministry in charge of urban solid waste	Urban Development Department, GoM
4	Ministries in charge of urban planning finance and economic development.	Urban Development Department, GoM
5	Service provider for construction of onsite sanitation technologies	Local masons
6	Service provider for emptying and transport of faecal sludge	Sumeet Services Private Limited(Septic tank emptying services)
7	Service provider for operation and maintenance of treatment infrastructure	Tide Technocrats Private limited(O & M of STP)
8	Market participants practising end-use of faecal sludge end products	N/A

Annexure 2: SFD selection grid (Year 2015)

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					Not Applicable
Septic tank					Significant risk of GW pollution Low risk of GW pollution	T1A2C8				Not Applicable
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									Significant risk of GW pollution Low risk of GW pollution
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										Significant risk of GW pollution Low risk of GW pollution
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

Annexure 3: SFD selection grid (Year 2018)

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						Not Applicable
Septic tank					Significant risk of GW pollution Low risk of GW pollution	T1A2C6					
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									Significant risk of GW pollution Low risk of GW pollution	
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										Significant risk of GW pollution Low risk of GW pollution	
Toilet failed, damaged, collapsed or flooded											
Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded											
No toilet. Open defecation	Not Applicable										Not Applicable



About CWAS

The Center for Water and Sanitation (CWAS) is a part of CEPT Research and Development Foundation (CRDF) at CEPT University. CWAS undertakes action-research, implementation support, capacity building and advocacy in the field of urban water and sanitation. Acting as a thought catalyst and facilitator, CWAS works closely with all levels of governments - national, state and local to support them in delivering water and sanitation services in an efficient, effective and equitable manner.

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