SFD Lite Report

Ravidas Nagar, Bijnor India

This SFD Lite Report was prepared by

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1 The SFD Graphic

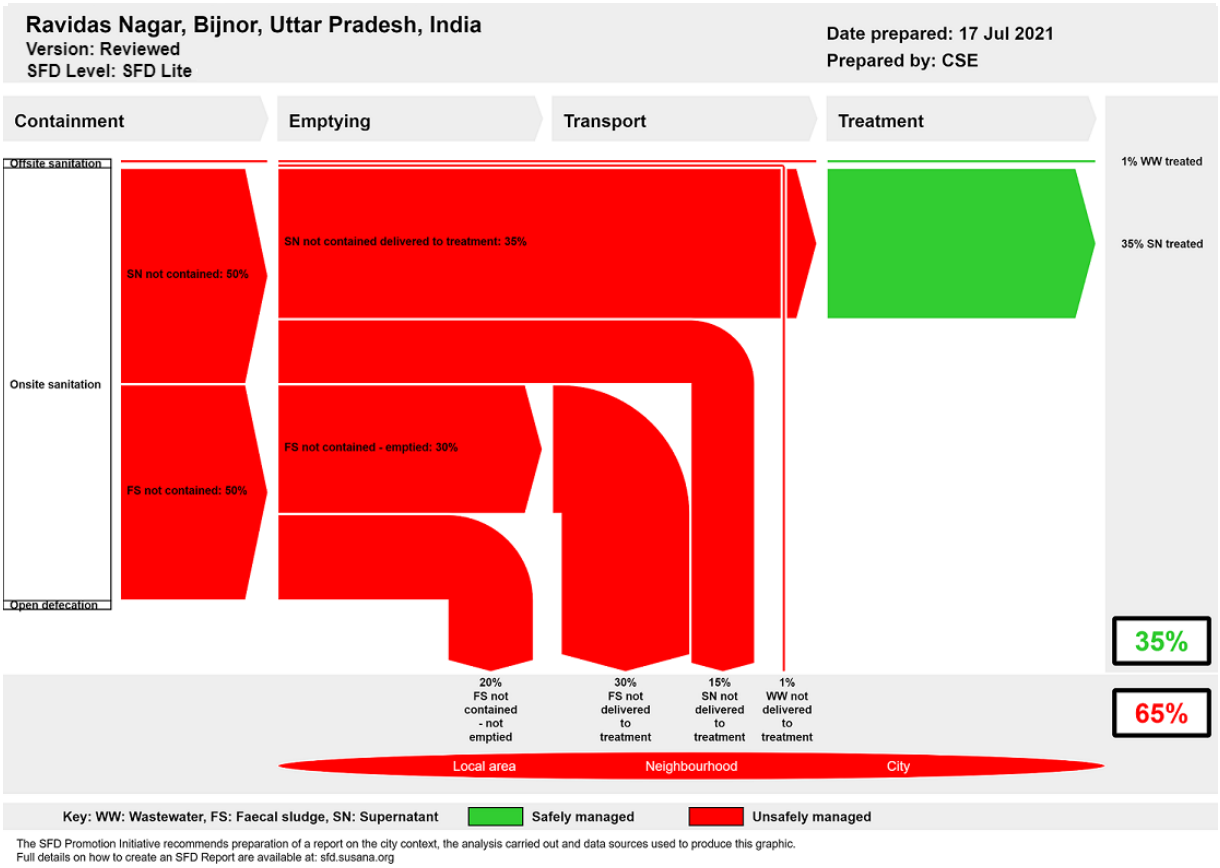

Figure 1: SFD Graphic for Ravidas Nagar, Bijnor.

2 SFD Lite information

Produced by:

- Centre for Science and Environment, New Delhi.
- This report was compiled as part of the SFD Promotion Initiative (SFD-PI) phase 3 project funded by the Bill and Melinda Gates Foundation (BMGF). We would like to thank Mr Durgeshwar Tripathi, Executive officer, Mr Govind Chowdhary, Sanitary and Food Inspector(NPP), Mr Amit Gautam, Junior Engineer, Jal Kal, Mr Yashwant Kumar, Junior Engineer (Civil, NPP), Mr Jaidev Singh and Mr Raunak Chowdhary, VA Tech WABAG for providing all the required secondary data and cooperating for Key Informant Interviews (KIIs) & Focussed Group Discussions (FGDs).
- We would also like to thank Mr Sudhesh Kumar Ward Member Ravidas Nagar and Neeraj Kumar Sanitation Supervisor Ravidas Nagar, for their key inputs and precious time during the field visits.
- Special thanks to Sachin Sahani, CSE for helping in generating a map for Ravidas Nagar, Bijnor.

Collaborating partners:

- Bijnor Nagar Palika Parishad, Bijnor, Uttar Pradesh.

Date of production: 17/07/2021

3 General city information

Ravidas Nagar is a small Low-Income Group (LIG) settlement in Bijnor City (geographical coordinates 290 9' 0" North and 780 16' 0" East[1]) in the state of Uttar Pradesh, India. It is located within Ward No. 2 of Bijnor City (the city has a total of 25 wards). As per Census of India, 2011, Ravidas Nagar was part of Ward No. 1; however, in the year 2016, it was reconstituted as a new ward. It is surrounded by wards 10 (North-West), 7 (North-East) and 14 (South).

Table 1 City Profile (Source: BNPP/Compiled by CSE/2021).

S.No.	Population Parameters	
1	Estimated Population, (2021)	5,500
2	No. of Households (2020)	700
3	Area (ha.)	5.4

According to Census of India, 2011, the population of Ravidas Nagar ward (then Ward No. 1) was 3,934 persons. The population in 2021, as estimated by the Department of Sanitation, Bijnor Nagar Palika Parishad (BNPP) is approximately 5,500[2].

The Urban Local Body (ULB) governing the town is Bijnor Nagar Palika Parishad (BNPP) or Bijnor Municipal Council. The total area under the jurisdiction of BNPP is 3.6 sq. km. Ravidas Nagar is spread in across area of 5.4 ha. (approx.) that accommodates around 700 Households (HH)[3]. BNPP is responsible for providing sanitation services like cleaning and maintenance of open drains, solid waste management and construction of roads in Ward No. 2. The topography of Bijnor District is majorly flat with very gentle slope. It is elevated 225 metres above mean sea level. The average rainfall is 999.4 mm. The temperature rises to 46°C and drops to 6°C. The soil type is clayey and sandy with occasional gravel and boulder.

Table 2: Population Growth Rate for Ravidas Nagar Bijnor (Source: BNPP/Compiled by CSE/2021).

Census Year	Population	Growth Rate (%)	Ward	Source
2001	1,200	-	1	Census 2001
2011	3,934	60	1	Census 2011
2016	3,260[4]	-20	2	BNPP
2021	5,500	40	2	Estimated BNPP

Ravidas Nagar is a pocket of lower-income settlements in the city[5]. Demographically, 50% of the population in the ward is Muslim who mostly own small businesses like slaughter houses, fish and meat shops, and provision other stores. The rest of the 50% population in the ward

[1] BNPP, 2018, City Sanitation Plan. Draft Report, Bijnor.
[2] KII with Sanitation and Food Inspector.
[3] KII with Ward Member.
[4] Reduction in the area of the ward and number led to reduction in population. KII with Ward Member.
[5] KII Executive Officer, BNPP.

are Hindus who also belong to socially and economically backward sections of the society[6]. As much as 60% of the sanitation workers working in BNPP hail from Ravidas Nagar. The settlement is home to a famous religious shrine, the Raidas temple located in the middle of the ward, constructed to honour Saint Ravidas, a leather worker, who wrote Bhakti poetry challenging caste norms and Brahmanical orthodoxy[7].

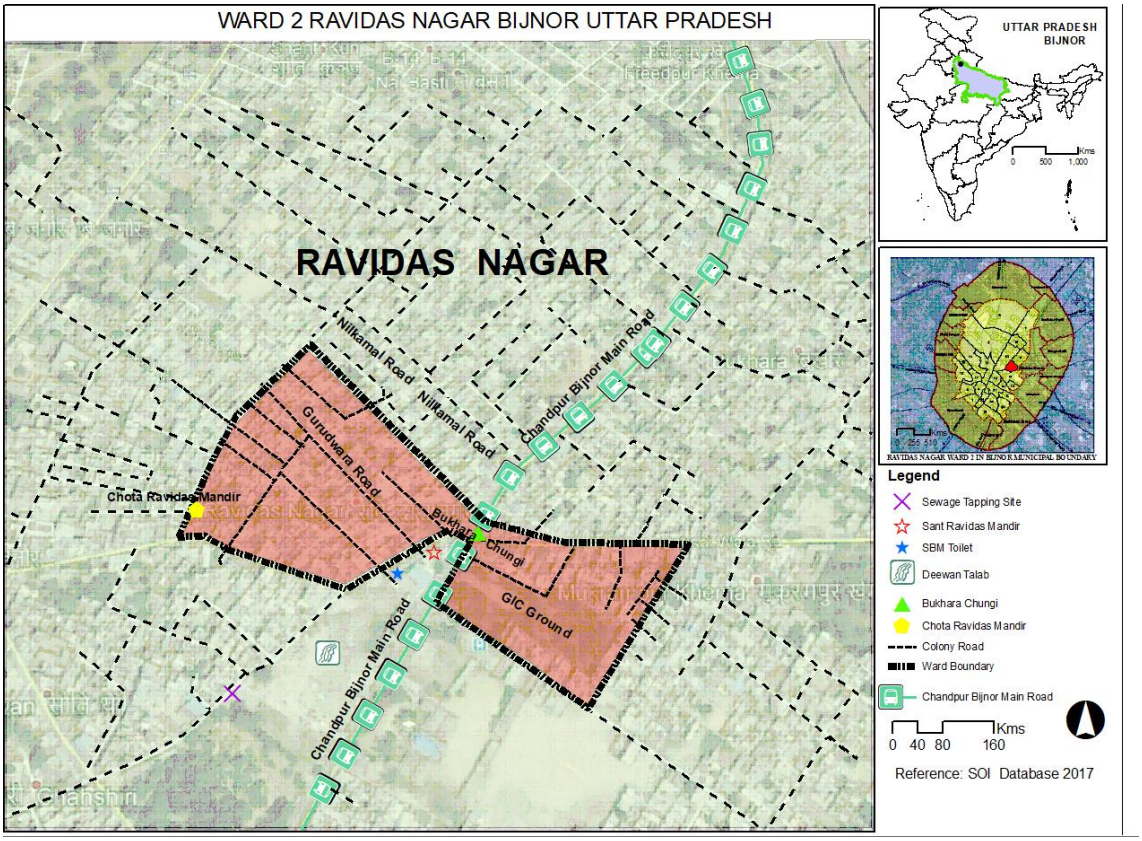

Figure 2: Map highlighting Ravidas Nagar (Ward 2) area in Bijnor City (Source: Harsh & Sachin/CSE/ 2021).

BNPP was certificated as Open Defecation Free City (ODF) in September 2018 by the Ministry of Housing and Urban Affairs (MoHUA) under Swachh Bharat Mission (SBM). Ravidas Nagar (ward 2) was declared ODF in July 2018. According to the declaration, there was no household found in the ward that had no access to a safe toilet[8]. Hence the ward is celebrating its ODF status. The city comes in *tarai* region (a lowland region in northern India and southern Nepal that lies south of the outer foothills of the Himalayas) and the River Ganges flows 8 km from the main city. Groundwater level in the city is pretty high and lies between 3 metres below groundwater level (mbgl) to 10 mbgl[9].

[6] KII Ward Member.
[7] KII with Executive Officer, BNPP.
[8] SBM Guidelines 2014.
[9] Groundwater Brouchure, District Bijnor, U.P (201).

4 Service outcomes

Ravidas Nagar, Bijnor, Uttar Pradesh, India, 17 Jul 2021. SFD Level: SFD Lite Population: 5500 Proportion of tanks: septic tanks: 50%, fully lined tanks: 50%, lined, open bottom tanks: 100%								
Containment								
System type	Population	WW transport	WW treatment	FS emptying	FS transport	FS treatment	SN transport	SN treatment
	Pop	**W4c**	**W5c**	**F3**	**F4**	**F5**	**S4e**	**S5e**
System label and description	Proportion of population using this type of system (p)	Proportion of wastewater in open sewer or storm drain system, which is delivered to treatment plants	Proportion of wastewater delivered to treatment plants, which is treated	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated	Proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants	Proportion of supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated
T1A1C6 Toilet discharges directly to open drain or storm sewer	1.0	70.0	100.0					
T1A2C6 Septic tank connected to open drain or storm sewer	39.0			60.0	0.0	0.0	70.0	100.0
T1A3C6 Fully lined tank (sealed) connected to an open drain or storm sewer	60.0			60.0	0.0	0.0	70.0	100.0

Table 3: SFD Matrix for Ravidas Nagar, Bijnor (Source: Harsh/CSE/2021).

The outcome of the SFD graphic shows that 35% of the excreta flow is classified as 'Safely Managed' and the remaining 65% is classified as unsafely managed (Figure 1). The unsafely managed excreta originates from wastewater not delivered to treatment (1%), Faecal Sludge (FS) - not contained, emptied but not delivered to the treatment (30%), FS not contained - not emptied (20%) and 15% of supernatant not delivered to treatment.

Overview on technologies and methods used for different sanitation systems through the sanitation service chain is as follows:

4.1 Offsite Systems

Bijnor city has a sewerage network that connects open drains in the city to the Sewage Treatment Plant (STP). While the sewer network has been laid out in Ravidas Nagar, none of the households are connected to the network yet[10].

The Wastewater (WW) and Supernatant (SN) from the households go to open drains which are later intercepted to the sewer lines[11]. However, during the field observation and sample household survey, it was found that few households (T1A1C6, 1%) have connected their toilets directly to open drains[12].

Figure 3: Blockage in open drains (Source: Harsh/CSE/2021).

[10] KII with Site Engineer VA Tech Wabag.
[11] KII JE Water works.
[12] Field observation

The open drains in the area were found to be blocked at several points due to which seepage of WW on the roads and open plots was observed. The interception point for the Ravidas Nagar area is adjacent to the fish market at the corner of *Diwani Talab* (Figure 4).

Figure 4: Interception point at *Diwani talab mandi* for open drains (Source: Harsh/CSE/2021).

Due to blockage in drains and improper maintenance of drains, complete interception of the wastewater in Ravidas Nagar is not happening[13]. Hence, it was assumed that only 70% of the WW generated in the ward 2 is intercepted and delivered to treatment (variable W4c).

4.2 Onsite Sanitation Systems (OSS)

Figure 5: Under construction FLT (Source: Harsh/CSE/2021).

Containments: Based on the household sample survey, KIIs, FGDs and field observations, it is estimated that 99% of the population of Ravidas Nagar is dependent on OSS. The two prevalent OSS in the Ravidas Nagar area are Fully Lined Tanks (FLT) connected to open drain (T1A3C6, 60%) and Septic Tanks (ST) connected to open drain (T1A2C6, 39%). FLTs are either rectangular or square with volumes ranging from 3-7 m^3. STs as observed are 2-3 chambered tanks with 4-9 m^3 in volume[14]. Most of the septic tanks observed in sample household surveys do not adhere to the standards prescribed by the Bureau of India Standards (BIS). The size of the tanks is generally decided by factors like space availability and the economic status of the household (Figure 5).

According to the District Project Manager (DPM), Swachh Bharat Mission (SBM), financial aid for 420 Individual Household Latrines (IHHL) were given in Ravidas Nagar ward 2 as of February 2020[15]. The recipient households either had no toilet facility or were using insanitary toilets. During the field observations and sample household survey, it was noticed that all these households had built FLTs connected to open drains as their containment system.

Figure 6: Community Toilet in Ravidas Nagar (Source: Harsh/CSE/2021).

Community Toilet: There is one Community Toilet (CT) located in Ravidas Nagar (Figure 6). However, there are no Public Toilets (PTs) in the vicinity. Moreover, no households in

[13] KII with Site Engineer VA Tech Wabag.
[14] FGD with Masons.
[15] KII with DPM SBM.

Ravidas Nagar are registered to use CT for defecating purposes and it is used used majorly for urination. The size of the ST connected to the open drain of CT is 8 x 4 x 4 m which is desludged every 2-3 years[16].

Emptying: BNPP provides emptying services in the area by employing a 5,000-litre capacity desludging vehicle[18]. The service is carried by a crew of two persons (driver and a helper). There are 6 private desludging operators with 8 vacuum tankers plying in the city which charges a fee of 15 to 30 USD per emptying trip depending upon the size of the containment. It was observed on the field during the sample household survey that Ravidas Nagar has congested and narrow lanes. Hence, it makes it difficult for a 5,000-litre capacity desludging machine to commute through them (Figure 7). It was informed that around 70% of households are inaccessible by BNPP and private desludging machines[19].

Figure 7: Emptying near Gurudwara Rd Ravidas Nagar (Source: Harsh/CSE/2021).

As discussed with households, in highly congested lanes it was revealed that in the failure of accessibility through mechanized means they call private manual emptiers for carrying the emptying of containments. Around 60 to 70 persons in Ward 2 (Ravidas Nagar) and Ward 1 (cumulatively) of Bijnor give services of manual emptying in congested areas. In many cases, these emptiers are the sanitation workers of the BNPP who manually empty the containments for extra income.

Figure 8: Government desludging tractor-mounted machine for decanting in broader lanes (Source: Harsh/CSE/2021).

In general, for emptying a tank size of 4 m^3 (3 m deep), a group of 4 manual emptiers is required for emptying, transporting and disposing of the FS[20]. Most of the people get their tanks emptied, but not in a scheduled manner. The frequency of emptying varies from 8 to 12 years.

Hence, it is assumed that households that are taking too long to get their tanks emptied are rather using their systems without emptying and the population using their systems with emptying (variable F3) is estimated to be 60% for all types of tanks.

[16] KII with Sanitation Supervisor Ward 2- Ravidas Nagar.
[18] KII with Sanitation and Food Inspector.
[19] KII Sanitation Supervisor Ward 2- Ravidas Nagar.
[20] FGD with Sanitation Workers.

Transport: BNPP has one tractor-mounted desludging machine which is used for providing desludging services in all wards of Bijnor City (Figure 8). BNPP charges an emptying fee of 20 USD. The vacuum tankers are equipped with a motorised pump, storage tank of 2,500 to 5,000 L capacity and a 200 ft. (60.92 m) long hose pipe to access containment systems in narrow roads and congested areas[23]. According to KII with government desludging operator, they avoid emptying operations in ward no. 2 Ravidas Nagar. It is done mainly due to difficulty in accessibility to households' containments. Generally, HHs which are parallel to the main road (Neel Kamal Road, Gurudwara Road, etc.) get desludged through mechanical means. HHs in congested lanes (70% HHs) are emptied by using drums of 500 litre capacity (for collecting FS) which are transported using hand carts by manual emptiers. Manual emptiers empty around 5 to 6 tanks per month for which they charge around 35-45 USD per tank for a tank size of 4 m^3 of volume.[24] SN and WW from open drains are tapped and diverted to STP through sewer lines. Since there were blockages in open drains, the possibility of intercepting all the wastewater to sewer lines was sceptical. Therefore it is assumed that only 70% of SN (variable S4e) and WW (wariable W4c) is tapped that completely reaches to the treatment plant[25].

Figure 9: STP (capacity 24 MLD) in Bijnor City. (Source: Harsh/CSE/2021).

Treatment and Disposal: A 24 MLD Sewage Treatment Plant (STP) which was commissioned in 2019, is used for treating wastewater from Bijnor City (Figure 9)[26]. Water from Ravidas Nagar is tapped and diverted into sewer lines which end at the STP's inlet[27]. At present, the STP receives a peak inflow of 17 MLD.[28] There are seasonal variations that are observed in the inflow water like in monsoon where the inflow of wastewater reaches to 20 MLD. The lab report from the STP revealed that the discharge standards, prescribed by the Central Pollution Control Board (CPCB), are met by the plant, hence the wastewater and supernatant treated at the STP is considered 100% (variables W5c and S5e). Hence, columns W5c and S5e are taken as 100%. BNPP

Figure 10: FS discharged on road side low lying land. (Source: Harsh/CSE/2021).

[23] FGD with Private Desludging Operators.
[24] FGD with Sanitation workers.
[25] KII with Site Engineer VA Tech Wabag.
[26] KII with Site Engineer VA Tech Wabag.
[27] KII with JE Water works.
[28] Log book of Sewage Treatment Plant.

has no designated site for the disposal of FS[29]. Therefore, in the absence of such provision, the private emptiers discharge the faecal sludge in low lying areas near roads and farms[30] (Figure 10). The manual emptiers usually carry out emptying services during midnight and dispose of the FS in storm water drains or in empty plots in the vicinity. Since there is no dedicated treatment provision for FS in Bijnor, the emptied FS from Ravidas Nagar remains untreated before going into the environment (variable F5 set to 0%).

5 Data and assumptions

The baseline survey conducted by CSE in June 2021 contains detailed data on different stages of the sanitation value chain. The SFD graphic relied on these data, collected during sample household surveys, along with key informant interviews and focus group discussions. Finally, data from all these sources were triangulated to produce the SFD graphic. The last census was carried out about 10 years ago. So, the actual population, household and sanitation data is not updated yet but assumed based on KII and FGDs to generate the SFD graphic. Most of the households with septic tanks and fully lined tanks do not know the actual type, size and design desludging periods. Due to all these data gaps, some assumptions have been made to produce the SFD graphic. Following assumptions were made for developing the SFD graphic for lower-income settlement, Ravidas Nagar, Bijnor.

- Volume of wastewater generated is estimated as 80% of the volume of water supplied.
- As per the guidance given in the Frequently Asked Questions (FAQs) in the Sustainable Sanitation Alliance (SuSanA) website, it is assumed that 50% of the contents of septic tanks and fully lined tanks is FS.
- The proportion of wastewater and supernatant conveyed to treatment is assumed to be 70% (variable W4c). Since it is done by tapping and interception of open drains, it was assumed that some of the wastewater is lost due to blockages and seepages from open drains.
- The proportion of OSS emptied is considered as 60% assuming 10 years as the threshold, based on the size of the tank and the number of people dependent on that system. So, households getting their systems emptied in less than 10 years are considered to be using their system with emptying and those who are taking more than 10 years are considered as good as not emptying their systems.

[29] KII with Sanitation and Food Inspector, BNPP.
[30] Field observation.

6 Context-adapted SFD Graphic

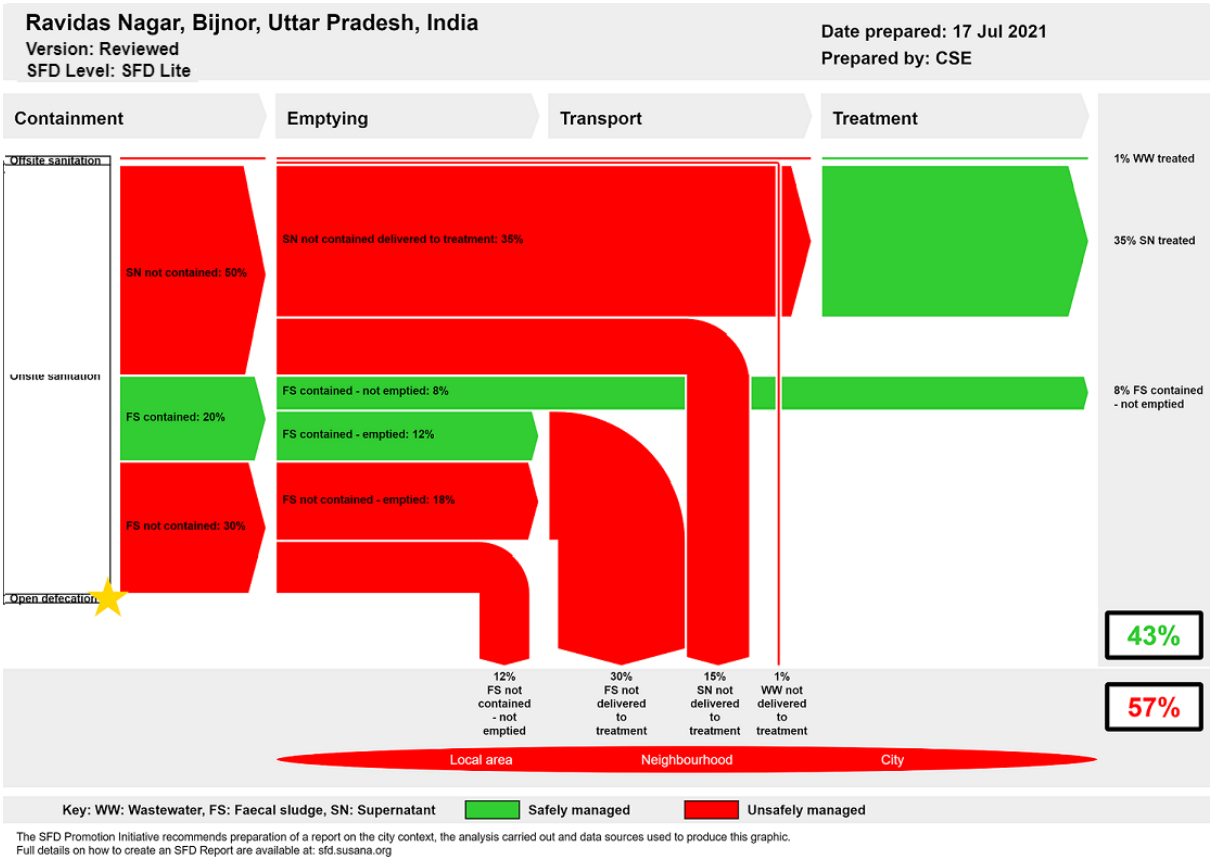

Figure 11: Context-adapted SFD Graphic for Ravidas Nagar, Bijnor (Source: Harsh/CSE/2021).

The only difference suggested in the context-adapted SFD is at the containment stage for correctly designed septic tanks, though connected to open drains. Based on the assumptions, 50% of the proportion of the content of the septic tank is solid FS, which is generated and collected inside the septic tanks. The remaining 50% of the content is supernatant, which attributes to be 20% of the population flows through open drains. The solid FS collected in the septic tank is considered to be contained and hence 20% of FS is contained (represented green in colour at containment stage). Followed by this, 12% of FS contained is emptied, and the remaining 8% is FS remaining in the tank which is contained and never emptied. The supernatant generated from the septic tank connected to the open drain is not contained and hence is considered to be unsafely managed (represented in red). Overall, excreta of 57% of the population is not safely managed according to the context-adapted SFD graphic.

7 List of data sources

Reports and literature

- District Census Handbook 2011 for Bijnor (Houses and household amenities and assets table HH-08: percentage of households by availability of the type of Latrine Facility http://censusindia.gov.in/DigitalLibrary/MFTableSeries.aspx
- District Census Handbook 2011 (Population Census Abstract Data Table (India & State/UTs-Town/Village/Ward Level). http://censusindia.gov.in/2011census/population_enumeration.html
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- SFD Lite Report, Bijnor (2020).
- City Sanitation Plan, 2019 Bijnor.

Key Informant Interviews (KII)

- DPM Swachh Bharat Mission, Bijnor.
- Junior Engineer (JE), Waterworks.
- Junior Engineer (JE) Civil, Bijnor Nagar Palika Parishad (BNPP).
- STP In-charge & Site Engineer, VA Tech Wabag Limited.
- Sanitation & Food Inspector, BNPP.
- Executive Officer, BNPP.
- Ward Member Ward 2-Ravidas Nagar.
- Sanitation Supervisor Ward 2- Ravidas Nagar.

Focus Group Discussions (FGD)

- Masons.
- Private desludging operators.
- Ward members.
- STP Sewer Staff, VA Tech Wabag Limited.
- Sanitation workers.

Field Visits

- Community toilet, Ravidas Nagar.
- Wastewater tapping locations of Ravidas Nagar.
- Sewage Treatment Plant (STP).
- Random household survey.
- Faecal sludge discharge sites.

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