



SFD Lite Report

Bageshwar

Uttarakhand, India

This SFD Lite Report was prepared by
Sanitation Capacity Building Platform (SCBP),
National Institute of Urban Affairs (NIUA).

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1 The SFD Graphic

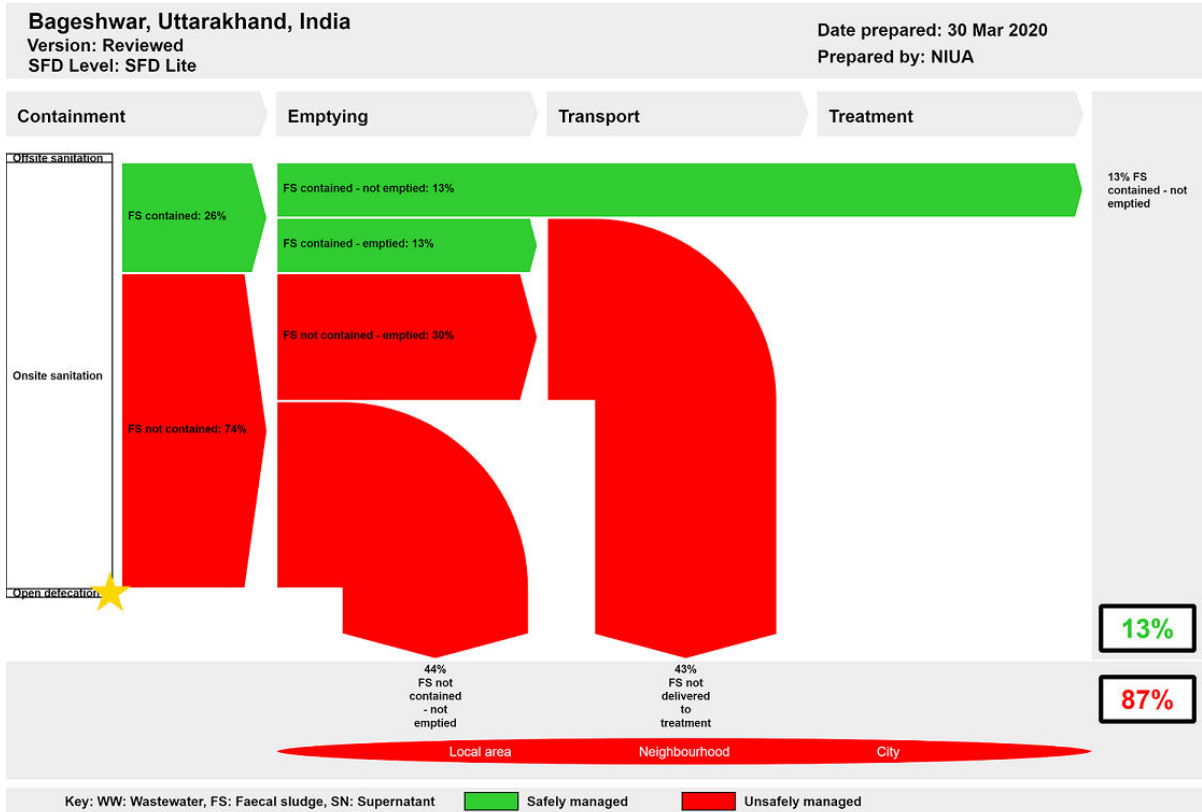


Figure 1: SFD Graphic for Bageshwar.

2 SFD Lite information

Produced by:

- Sanitation Capacity Building Platform (SCBP), National Institute of Urban Affairs (NIUA), New Delhi, India
- This report was prepared as part of the support to Uttarakhand State for Scale up of Faecal Sludge and Septage Management solutions.
- We would like to thank Mr. Raj Dev Jayasi, EO (Executive Officer), Bageshwar Nagar Palika Parishad (BNPP), Mr. Bhelwal, A.E (Assistant Engineer), Peyjal Nigam, Mr. Dinesh Chandra, J.E (Junior Engineer), Mr. Rajat, S.I (Sanitation Inspector).
- Special thanks to Mr. Ravi Pandey, SE (Superintendent Engineer), Urban Development Directorate (UDD) for their overall guidance and facilitation on the study.

Collaborating partners:

- Bageshwar Nagar Palika Parishad (BNPP)

Date of production: 28/06/2022

3 General city information

Bageshwar Nagar Palika Parishad area is 8.5 sq.km. and has 11 wards with a population of 25,045¹ (as of year 2018). There are 4,808 Households (HHs) post municipal boundary expansion in the year 2018. With the delimitation of boundary, the total number of wards have increased from 7 to 11. Presently, the geographical area² of the city is 8.5 Km². The revised municipal boundary has been considered for the current study. The average household size is 5.21.

Bageshwar lies at 29.8404° N, 79.7694° E. Bageshwar district is bounded by Almora district in the South, Chamoli district in the north and northwest and Pithoragarh District in the east. Bageshwar city is placed at a distance of approximately 320 km from the state capital Dehradun (Figure 2).



Figure 2: Bageshwar, Almora District, Uttarakhand (Source: SCBP/NIUA/2021).

Bageshwar is situated in a valley of the Kumaon Hills of the Central Himalaya range. The district comprises of two broad physiographic divisions from north to south viz. Central Himalayan Zone and Lesser Himalayan Zone. The general slope is towards south with an average elevation of 1,004 m above mean sea level (msl). The drainage of the area is mainly controlled by Saryu, Gomti and Pindar Rivers and their tributaries. The average temperature in the city is 19.9 °C, May being the warmest month with an average temperature of 25.9 °C and with an average temperature of 11.8 °C, January is the coldest month. Bageshwar receives an average rainfall of around 1,634 mm per year, the driest month is November with 5 mm of precipitation and with an average of 446 mm, July receives the highest rainfall in the city³.

¹ Key Informant Interview, Bageshwar Nagar Palika Parishad

² Key Informant Interview, Bageshwar Nagar Palika Parishad

³ <https://en.climate-data.org/asia/india/Uttarakhand/Bageshwar-175571/>

Rock types in this area include sedimentaries, meta-sedimentaries and plutonic igneous rocks. The soils of Bageshwar can be broadly classified into two types, viz. Soils of Lesser Himalaya and Soils of Greater or Central Himalaya. Majority of the area is covered by the first type; the city Bageshwar also comes under this type. The soils of Lesser Himalaya are mountain and hill soils which are very thin and fertile. These soils are mixed with pebbles and gravel. The texture varies from sandy to sandy loam.

Bageshwar Nagar Palika Parishad (NPP) has an infiltration well and one mini tube-well. The city has one Water Treatment Plant (WTP) with a capacity of 1.2 MLD (Million litre per day), where water is directly supplied to households after treatment. 85% of households in the town have water supply connections by Uttarakhand Jal Sansthan⁴. Average water supply in the city is 120 litres per capita per day (lpcd)⁵. Additionally, there are households dependent on other sources like natural streams and nearby community tube wells for domestic water usage⁶.

Average ground water level across the city is more than 15 mbgl (metres below ground level)⁷. Considering rock type in unsaturated zones is coarse sand and gravels, vulnerability of the aquifers was found to be at significant risk.

4 Service outcomes

Bageshwar, Uttarakhand, India, 30 Mar 2020. SFD Level: SFD Lite
Population: 25045

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 |
| T1A2C5 Septic tank connected to soak pit | 6.0 | 50.0 | 0.0 | 0.0 |
| T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow | 20.0 | 50.0 | 0.0 | 0.0 |
| T1B10C10 Containment (fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - with no outlet or overflow | 40.0 | 50.0 | 0.0 | 0.0 |
| T2A3C5 Fully lined tank (sealed) connected to a soak pit, where there is a 'significant risk' of groundwater pollution | 14.0 | 0.0 | 0.0 | 0.0 |
| T2A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution | 20.0 | 50.0 | 0.0 | 0.0 |

Table 1: SFD Matrix for Bageshwar, Almora, Uttarakhand (Source: Sachin/NIUA/2022).

⁴ Service level benchmark, Bageshwar 2018-19

⁵ Service level benchmark, Bageshwar 2018-19

⁶ Primary Survey

⁷ Central Ground Water Board Report, Uttarakhand, 2015-16.

A field-based study was conducted in the city covering 11 wards and interviewing around 50 HHs spreading across areas adjacent to Gomti River. Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) were conducted with the key stakeholders responsible for providing services on water and sanitation, in accordance to SFD Manual.

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

4.1 Off-site Sanitation Systems

As per the information provided by the municipality, all 4,808 households are dependent on onsite containment systems as there are no sewerage system in the city.

4.2 Onsite Sanitation Systems

The city is completely dependent on Onsite Sanitation Systems (OSS) with 100% of the population. During the field-based study, it was observed by the researcher as well as through interviews with households and masons, that the predominant type of sanitation systems in households across Bageshwar are containments - fully lined tanks, partially lined tanks and pits, and unlined pits - which are damaged or flooded with no outlet, lined pits with semi-permeable walls and open bottom, septic tanks connected to soak pit and fully lined tanks (sealed). The grey water generated from households dependent on OSS is discharged into Gomti River (Figure 3).

Containment:

Through key informant interviews (KIIs) and focus group discussions (FGDs) with municipal officials, 50 households, masons and emptier, it was found that households are dependent on different types of onsite sanitation systems. It is estimated that 6% of the population is dependent on septic tanks which are connected to soak pit, followed by 14% of the population dependent on fully lined tanks (sealed) with no outlet or overflow. About 20% of the population is dependent on lined tanks with impermeable walls and open bottom with no outlet or overflow. About 40% of the total onsite sanitation had containments (fully lined tanks, partially lined tanks and pits, and unlined pits) which were damaged or flooded with no outlet or overflow. Remaining, 20% of the population is dependent on lined tanks with impermeable walls and open bottom with no outlet/overflow posing significant risk to ground water pollution.

Containment systems, which are rudimentary designed septic tanks and emptied for more than 4 years, are considered as fully lined tanks and selected as T2A3C5. However, few septic tanks were observed correctly designed as septic tank system with emptying frequency of less than 4 years but are connected to soak pit and thus selected system T1A2C5. Most of the households in the city are dependent on lined tanks with impermeable walls and open bottom having no outlet (Figure.4) and had an emptying frequency of more than 10 years, thus selected system T1A4C10, partially these containments were also present along the stretch of Gomti River hence selected system T2A4C10. A pour flush community toilet picture is depicted in Figure 5.

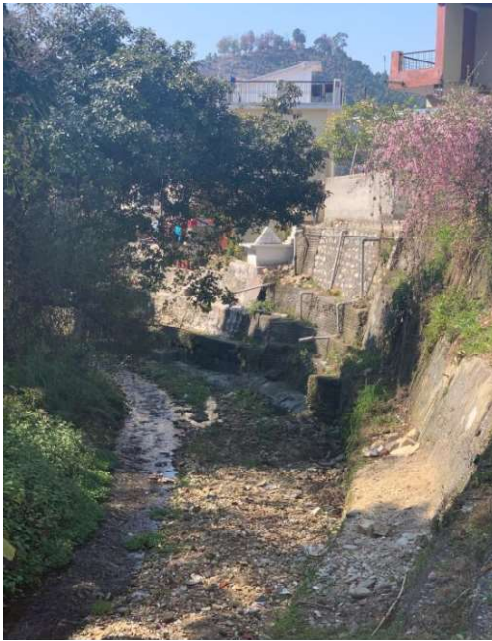


Figure 3: Grey water discharge into Gomti River
(Source: Laila/NIUA/2020).



Figure 4: Lined tanks with impermeable walls and open bottom having no outlet
(Source: Laila/NIUA/2020).



Figure 5: A pour flush community toilet
(Source: Laila/NIUA/2020).

Ground Water Risk Assessment

As per the risk assessment done on the groundwater pollution risk estimation tool provided by the Graphic Generator, the rock type in the unsaturated zone was selected 'coarse sand and gravels' with the groundwater depth more than 10m⁷. The tool estimated - 'High Risk' of groundwater contamination - and hence considered for the same in the selection of the systems. We can say that overall risk to ground water contamination is estimated to be 'High' in Bageshwar. But in case of containment type - lined pit with semipermeable walls and open

bottom (T2A4C10), 50% of the households are considered at low risk (i.e., 20%) and remaining percentage of households are considered at significant risk as they are located at riverside where groundwater level is less than 5 mbgl.

Emptying & Transport of Faecal Sludge:

Onsite Sanitation: There are no cesspool vehicles available either owned by government or private players in the town. Buckets are used for desludging; the emptied sludge is then discharged into a fresh excavated pit in the backyard of the households. The emptying charges is approximately Rs. 4,000 (US\$ 50⁸).

While interviewing and discussions with the households, 50% of households responded that they have never emptied their tanks. The other 50% of the households reported emptying only when toilet is blocked or overflow occurs from access-hole. Thereby, 50% (variable F3) is assumed for the proportion of faecal sludge emptied for system ‘fully lined tanks connected to open drains.

For septic tanks 50% (variable F3) of emptying is assumed for proportion of faecal sludge emptied. For lined tanks with impermeable walls and open bottom having no outlet, as these tanks were of irregular size and were emptied after a long duration of 10 years, therefore 50% (variable F3) was considered; same was considered for containment (fully lined tanks, partially lined tanks and pits, and unlined pits) which were damaged or flooded having no outlet. For fully lined tank (sealed) connected to a soak pit, where there is a 'significant risk' of groundwater pollution (T2A3C5), variable F3 was set to 0%.

Treatment Disposal/ Reuse:

Bageshwar NPP does not have any Sewage Treatment Plant and/or Faecal Sludge Treatment Plant. The emptied sludge is discharged into pits in the backyards of the households, which is then covered with soil until it dries up.

Open Defecation (OD)

As BNPP is ODF (Open Defecation free) certified and no instance of OD was noticed during the visit, therefore the ODF star mark is represented in yellow over the SFD graphic.

4.3 SFD graphic

The output of the SFD graphic represents that only 13% of the human excreta flow is attributed to be safely managed and the remaining 87% is unsafely managed (Figure 1). The unsafely managed excreta of 87% is contributed by onsite sanitation. Under onsite component i.e., 100%, - FS contained is attributed by 26% of the population which constitutes septic tank connected to soak pit (T1A2C5), 6% and 20% from lined tanks with impermeable walls and open bottom, no outlet or overflow (T1A4C10). FS not contained is attributed by 74% of the population - FS contributed from containments – fully lined tanks, partially lined tanks and pits, and unlined pits- failed, damaged, collapsed or flooded - with no

⁸ 1 US\$= 78.94 INR

outlet or overflow (T1B10C10) constitutes to 40%, fully lined tanks (sealed) connected to a soak pit, where there is a 'significant risk' of groundwater pollution (T2A3C5) constitutes 14% and lined tanks with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution (T2A4C10) is attributed by 20% of the population. Henceforth, it is assumed that 50% of FS is emptied in case of FS contained, thus 13% (3% from septic tank system +10% lined tank system) is emptied and the remaining 13% FS is contained but not emptied and it represents the portion of FS which remains in tanks and infiltrate into the ground but not contaminating the groundwater table hence represented safe (green arrow). FS not contained – emptied is 30%. It constitutes 50% of FS emptied i.e., 20% from damaged or collapsed systems and 10% from lined tank systems. Faecal Sludge (FS) emptied but not delivered to treatment, hence discharged in the neighbourhood is attributed by 43% (30% + 13%) of the population. Thereby, the remaining 44% of the population's FS is not contained not emptied. No Supernatant (SN) is generated from the systems (septic tanks to soak pit + fully lined tank sealed with no outlet or overflow + lined tanks with impermeable walls and open bottom; and all types of pit) as 100% proportion of the content in the tank is FS and 0% is SN.

5 Data and assumptions

Service Level Benchmark, Bageshwar 2015-16 was considered as the baseline and the data for all the stages of sanitation chain were updated based on the data collected from field through KILs, FGDs, observations and secondary data collected from relevant stakeholders. Following assumptions were made for developing the SFD graphic for Bageshwar.

1. Volume of wastewater generated is estimated as 80% of volume of water supplied.
2. Maximum emptying frequency for septic tanks – four years, fully lined tanks – one year and 10 years for lined pits with semi permeable walls and open bottom are considered, thus containment system emptying beyond stipulated time are considered under containment damaged or collapsed category.
3. Average water level across city is greater than 15 mbgl. Considering rock type in unsaturated zones is coarse sand and gravels, vulnerability of the aquifers was found to be at significant risk.
4. Less than 25% sanitation facilities are located <10m from ground water sources and greater than 25% of sanitation facilities are located uphill of ground water sources.
5. Less than 25% drinking water is produced from ground water sources and protected boreholes, dug wells and springs with adequate sanitary facilities in place are used for production of drinking water.

6 Context-adapted SFD Graphic

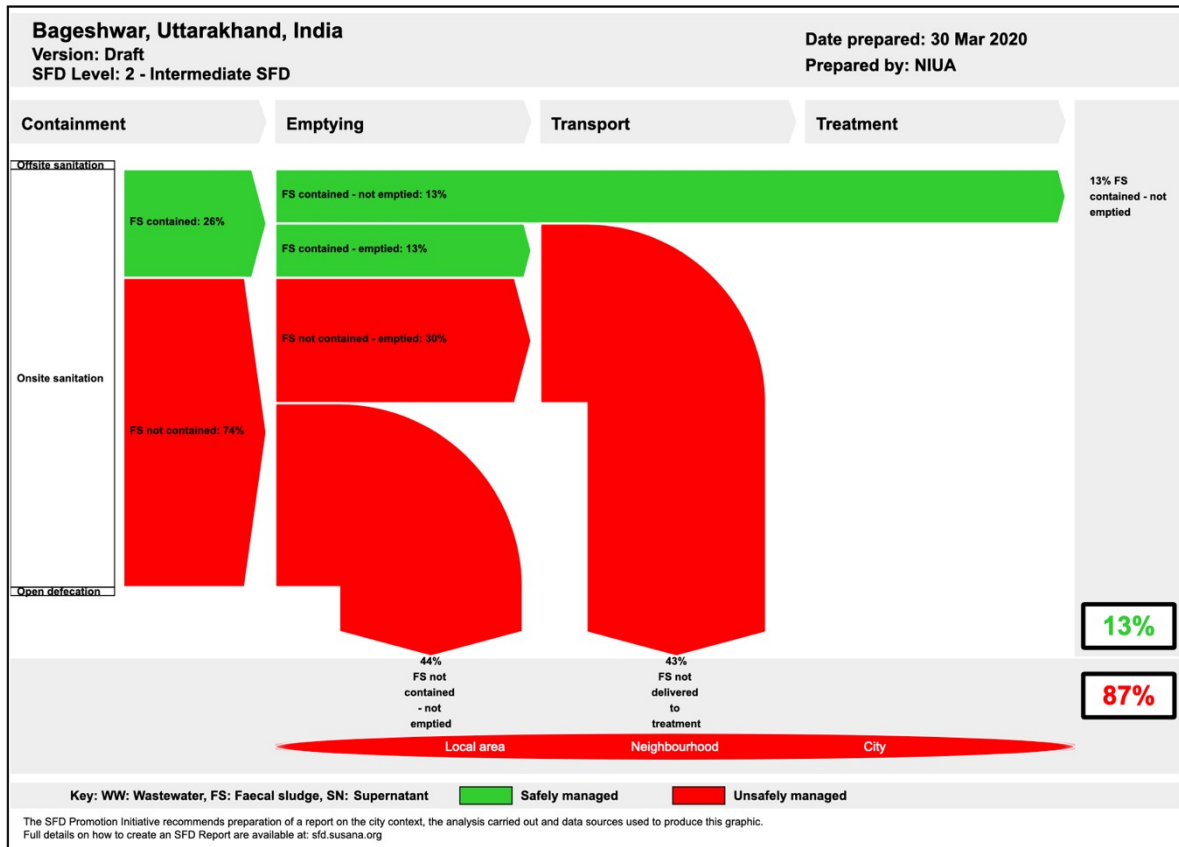


Figure 6: Context-adapted SFD graphic for Bageshwar (Source: SCBP/2021).

The difference suggested in the context-adapted SFD is at the containment stage for correctly designed septic tanks connected to soak pits (Figure 6). Although, these systems are considered to be safe practices, but to represent that those containment systems are correctly designed and properly functioning with regular emptying, hence a revised SFD context-adapted graphic is created manually for advocacy purposes. According to the assumption, 100% of the proportion of the content of the septic tank is solid Faecal Sludge (FS), which remains in the septic tanks. The FS collected in the septic tank is considered to be contained in the context-specific of local conditions, hence for overall SFD graphic 26% of FS is contained and 13% is emptied (represented green in colour at the containment stage) and the remaining 13% is FS still contained - not emptied, since a small portion of FS remains in the septic tank even after the desludging process. Overall, the excreta of 13% of the population is safely managed according to the context-adapted SFD graphic.

7 List of Data Sources

Reports and Literature

- District Ground Water Brochure of Bageshwar District, Uttarakhand.
- Ground Water Year Book of Uttarakhand, CGWB, 2015-2016.

Key Informant Interviews (KIIs)

- KII-1, 2020; Interview with Mr. Raj Dev Jayasi, Executive Officer, Bageshwar Nagar Palika Parishad.
- KII-2, 2020; Mr. Bhelwal, Assistant Engineer (A.E), Peyjal Nigam, Bageshwar.
- KII-2, 2020; Mr. Dinesh Chandra, Junior Engineer (J.E), Jal Sansthan, Bageshwar.
- KII-3, 2020; Mr. Dinesh Chandra, Sanitation Inspector (S.I), Bageshwar Nagar Palika Parishad.

Focus Group Discussions (FGDs)

- FGD-1, 2021; Focus Group Discussion with Sanitation Workers.
- FGD-2, 2021; Focus Group Discussion with Local People, Masons.

Field Observations

- Covering households - Slums, Lower Income Groups (LIG), Middle Income Groups (MIG) and Higher Income Groups (HIG) spread throughout the city.
- Survey of Public Toilet (1 No.).

SFD Promotion Initiative



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