



Sanitation Capacity
Building Platform



Urban Faecal Sludge & Septage Management in Uttarakhand

A City Level Sanitation Study



National Institute of Urban Affairs



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TITLE

URBAN FAECAL SLUDGE & SEPTAGE MANAGEMENT IN UTTARAKHAND
A City Level Sanitation Study

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Foreword

Sanitation Capacity Building Platform (SCBP) established in 2016 is a platform anchored by NIUA and works as a collaborative initiative of experts and organisations committed to the goal of sanitation to support and build the capacity of towns/cities to plan and implement decentralized sanitation.

The Platform lends support to Ministry of Housing and Urban Affairs (MoHUA), Government of India, by focusing on urban sanitation and supports states and cities to move beyond Open Defecation Free (ODF) status by addressing safe disposal and treatment of human faeces.

The Platform partners include Center for Water and Sanitation (C-WAS) at CEPT University, CDD Society and BORDA, ECOSAN Services Foundation (ESF), Administrative Staff College of India (ASCI), UMC, Centre for Policy Research (CPR), iDeck and WASHi. The Platform also engages and supports Nodal AMRUT accredited training institutions, universities, research organisations and NGOs. SCBPs work on faecal Sludge and Septage Mangement (FSSM) is a Bill and Melinda Gates Foundation (BMGF) supported urban sanitation programme initiative. It is a knowledge platform on decentralised urban sanitation. It is a resource centre for Learning and Advocacy Material, important Government Orders and Reports, Training Modules, Workshop Reports and other publications produced under SCBP and partner organisations.

ABOUT NIUA

National Institute of Urban Affairs (NIUA) is premier institute for research, capacity building and dissemination of knowledge for the urban sector in India. It is registered as an autonomous body under the Ministry of Urban Development, Government of India. NIUA conducts research in emerging themes such as urbanization, urban policy and planning, municipal finance and governance, land economics, transit oriented development, urban livelihoods, environment and climate change and smart cities. NIUA supports innovations in the urban sector through informed dialogues, knowledge exchanges, training and capacity building. In its mission to promote evidence-based policy-making and urban scholarship, NIUA is currently engaged in inter-disciplinary research and proactive engagements with change agents, which involve projects that create & maintain digital interface solutions.

Urban Development Directorate, Uttarakhand¹

Urban Development Directorate (UDD) is the administrative department for local self- governments in the state, the Uttarakhand Housing department plays similar role for Urban Development Authority and the Town & Country planning department, are responsible for urban planning & development control. UDD, Uttarakhand works with the vision of Integrated development of the urban areas by making the cities vibrant, clean and infrastructural strong and to bring about improvement in the service delivery. The main objectives of UDD functions are:

- To improve the quality of life of all towns and cities with emphasis on preservation of their heritage.
- To provide gainful employment to the urban unemployed or underemployed poor through encouraging the setting up of self-employment ventures or provisions of wage employment.

Urban Development Directorate (UDD) is currently working on major national schemes like AMRUT, Swachh Bharat Mission, P-MAY (Urban) and NULM.

NIUA-UDD, Uttarakhand Engagement

National Institute of Urban Affairs (NIUA) has been formally engaged with Urban Development Directorate, Uttarakhand to provide support on mainstreaming decentralized sanitation solutions including faecal sludge and septage management. The main focus areas of NIUA's support includes Capacity Building, Technical support and Advocacy of all the 90 cities/towns of the state. A State Septage Management Committee (SSMC) has been constituted under this engagement, Chaired by Secretary, Urban Development Directorate and Co-chaired by Secretary, Uttarakhand Peyjal.

¹Urban Development Directorate, Govt. of Uttarakhand web portal

Summary: Findings and Recommendations

Dehradun

- Dehradun being the capital city and most populated (8,04,379 in 2018)¹ municipal area in the Uttarakhand state, has 7 existing sewage treatment plant. The city is around 34% seweraged and rest of the population is dependent on other types of Onsite Sanitation Systems (OSS) i.e. septic tanks, fully lined tank etc. Dehradun city has 6 sewerage zones and 7 STPs. Two STPs are proposed in the sewerage zones of Banjarawala and Raipur. Currently there are an estimated, over 35,000 HHs² that neither lies in the existing sewerage zone nor in the proposed sewerage zone. Besides the uncovered households, Dehradun has a large number of hotels and institutions that also generate large volumes of faecal sludge. Slums and informal settlement is also likely to be left out from the sewerage system.
- **Septage management:** There are around 25-30 cesspool vehicles in Dehradun city and these are daily collecting septage and discharging into the Kargi chowk STP at a designated decanting station within STP premises. Daily Faecal sludge and septage (FSS) generation for Dehradun is estimated to be 320 KLD (overall Dehradun city). In the absence of an organised septic tanks scheduled desludging and a planned co-mixing with sewage, there is a high risk of Kargi STP malfunctioning due to excess septage addition.

Recommendation:

- Co-treatment of septage with sewage should be done at all STPs. For which additional Holding Tanks and Sludge Drying Beds infrastructure needs to be created.
- Faecal Sludge Treatment Plant can be explored to cater to areas that are not covered with Sewerage connectivity.

¹Urban Development Directorate, Govt. of Uttarakhand

²Population of wards located in non-sewerage zone (Ward level data from Dehradun Nagar Nigam)

Haldwani-Bhimtal-Bhowali

- Haldwani Nagar Nigam with population 2,80,604 has around 10% sewerage network but no STP. Majority of the households have septic tanks and average emptying frequency is 5 years, There are 16 existing cesspool vehicles. These cesspool operators also provide services in the nearby towns of Bhimtal and Bhowali on demand basis(at a distance of 25 km and 30 km respectively).
- The emptied sludge is discharged into a designated sewer manhole and wastewater is currently flowing, untreated, into the Gaula river through sewer lines and gravity flow.

Recommendation:

- Haldwani city generates 110 KL of Faecal Sludge and Septage daily. Establishing a Faecal Sludge Treatment Plant would be a feasible solutions for Haldwani city.
- Septage from Bhimtal (5 KLD septage generation) and Bhowali (3 KLD septage generation) can be treated at Haldwani FSTP plant on cluster basis approach. Both the ULBs are required to procure at least one cesspool vehicle each to serve the local desludging need.

New Tehri

- New Tehri city(approx. 20,000 population), is mostly covered with sewerage network with almost 90% coverage. City has a 5 MLD STP which is currently functional at 50% capacity.³ Jal Sansthan owns a tractor mounted cesspool vehicle that serves the desludging demand from HHs not connected to STPs. The STP also receives septage from nearby town Chamba, on an average, thrice a month.

Recommendation :

- A Co Treatment facility can be created for mixing septage with sewage at the STP.
- Considering the expanding population of the town, a separate FSTP is also recommended.

Srinagar

- Srinagar municipal council is a mid size town with 44,000 population. The town generates 11.3 KLD of faecal sludge daily. There are two STPs in the towns with an installed capacity of 4.5 MLD.
- Tehri town is the educational hub, having Hemavati Nandan Bahuguna Base Teaching hospital and Veer Chandra Singh Garhwali Government Medical

³Uttarakhand Jal Sansthan

and Research Institute along with the temporary campus of National Institute of Uttarakhand. Currently, none of the institutes are served by sewerage network. The medical college and hospital together have around 80 big sized septic tanks connected with soak pits. NIT has around 25 big sized septic tanks connected with soak pits.

- There is a frequent demand for emptying faecal sludge from septic tanks of medical college and hospital and NIT Uttarakhand in Srinagar.

Recommendation:

- Either construct institutional level FSTPs in each of the institutions to cater to the rising demand for sludge treatment, or , set up at least one mid sized FSTP for the town.
- Co-treatment potential at 2 STPs is small(given their small size – 3.5 and 1 MLD respectively), but can still be explored.

Doiwala and Bageshwar

- In Doiwala and Bageshwar, there is no STPs and 100% population is dependent on septage systems. Majority of these are improperly designed or in damaged state because of which OSS emptying frequency is very low i.e. more than 10-15 years. Moreover, accessibility is an issue in case of Bageshwar, where more than 40% roads are inaccessible by four-wheeler emptier.
- There is a lack of desludging services in both the cities due to very low demand.

Recommendation:

- There are limited options for setting up an FSTP separately for Doiwala and Bageshwar. Co-treatment at the nearest STP should be considered.

Devprayag

- Devprayag is a small ULB with only 642 HHs and is situated on the banks of rivers and rises right above river with a steep slope on all banks. It has three small STPs with 1.4 MLD, 150 KLD and 75 KLD. It is challenging for Devprayag Peyjal Nigam to provide sewerage connections to all HHs because of its terrain. Also, more than 80% roads are less than 3m wide with very limited accessibility by four-wheelers.⁴

Recommendation:

- Improving the monitoring and functionality of existing STPs and connectivity of the existing STPs with the households should be a priority.

⁴Key Informant interview with Devprayag Municipal Council

Conclusion

- **Sludge generation context of very small towns.** While septage management is a challenge for most towns in India and in Uttarakhand, the very small towns of the state with populations less than 10,000 and with the existing open bottom leach pit tanks, may not generate enough quantity of sludge that can be then extracted, transported and treated in an FSTP.
- **Majority of the household toilets have an open pit based septage containment system.** These are large single circular pits/tanks with open bottom. These primarily sludge holding tanks where no primary treatment takes place of the stored sludge. These need to be emptied at short intervals and the sludge treated either through co treatment at an existing Sewage Treatment Plant(STP) or at a new constructed Faecal Sludge Treatment Plant(FSTP).
- **Septage management requires a range of measures and not just infrastructure.** States of Odisha, AP, Tamil Nadu, Maharashtra – have all developed state wide strategies to address septage management for all towns in a planned manner. This involves activities of assessment of septage generation in a town, development of norms and regulations to prevent indiscriminate dumping of septage, licencing of Sludge Tankers, doing a planned town wide regular desludging of all septic tanks once in 2-3 years on a rotational zoning basis, incentives to carry sludge to a designated place, etc. This requires hand holding support for towns to implement the step wise actions. NIUA is committing to support in Uttarakhand for the coming year with this support and capacity development of ULB officials and para state agencies to adopt FSM solutions.
- **Co Treatment of Septage with Sewage should be the first priority for towns with an existing STP.** However the co treatment should be done **in a planned manner with basic additional infrastructure** to ensure that the septage addition does not disrupt the STP functioning with an overload of sludge or inert matter.

Technology Recommendations from the study:

Co-treatment of septage with sewage

- Dehradun
- Tehri

Faecal Sludge Treatment Plant

- Cluster FSTP for Haldwani-Bhimtal-Bhowali
- Srinagar
- Dehradun

Introduction to the Research

In order to understand the urban sanitation situation challenges in the Uttarakhand state, a field based city assessment on septage and wastewater management was commissioned by NIUA. Based on the consultation with the Urban Development Directorate, Govt. of Uttarakhand, 9 towns were selected for this research study with diverse municipal board type i.e. Municipal corporation, Municipal Council and Notified area council. These towns were selected based on the various factors like size of the municipality, scope for sufficient funds, availability of existing treatment infrastructure in the city. The findings and outcomes of the study will be used to identify the potential of implementing appropriate approach for faecal sludge and septage management in these 9 cities of Uttarakhand state. The FSSM approach includes treatment options like co-treatment of septage with sewage, establishing faecal sludge treatment plant and deep row entrenchment (DRE) particularly in smaller towns with very low septage generation.

The key factors covered under this research were:

- Status of septage containment, conveyance, treatment systems and disposal in each city
- Analyse the strength of the official staff within municipal as well as parastatal departments and also annual budget and expenditure.

The methodology adopted to undertake the assessment study includes consultation and focussed group discussions with various stakeholders involved in FSSM service chain i.e. Municipal board, Uttarakhand Jal Nigam, Uttarakhand Jal Sansthan, households and cesspool operators. These FGDs and consultations were conducted through structured questionnaire prepared by NIUA, see annexure . Key information interviews were done with govt. officials and around 50 households from all the wards were interviewed in each city to document the service delivery context and service outcomes of the cities. Municipal and ULB norms, actual operations of ULBs and government departments were studied along with an analysis of the budgets

and expenditures of ULBs related to sanitation. Review of other secondary data such as DPRs, performance reports, annual budget documents etc. were used in the study. Following cities were selected for assessment:



| CITY | POPULATION (2018) |
|-----------|-------------------|
| Bhimtal | 14882 |
| Srinagar | 44000 |
| Devprayag | 3059 |
| Bhowali | 8457 |
| New Tehri | 19794 |
| Doiwala | 61370 |
| Bageshwar | 25045 |
| Haldwani | 280604 |
| Dehradun | 8,04,379 |

Uttarakhand State Profile



Location of Uttarakhand State

Uttarakhand state is located at the foothills of the Himalayan mountain ranges. The state shares inter-state boundaries with Himachal Pradesh in the west & northwest and Uttar Pradesh in the south. It lies in the northern part of India between the latitudes 28°43' N and 31°27' N and longitudes 77°34' E and 81°02' E and covering an area of 53,483 km². The elevation ranges from 210 to 7817 m.

Administratively the Uttarakhand state is divided into two regions i.e. Garhwal division on the west and the Kumaon division on the east consisting of 7 and 6 districts respectively. Dehradun, Haridwar, Uttarkashi, Tehri, Pauri, Rudraprayag and Chamoli, while the remaining six districts, viz., Pithoragarh, Bageshwar, Almora, Nainital, Champawat and Udhamsinghgarh, fall in Kumaon Division.¹ The total urban population of Uttarakhand state is 30.5 lakhs which is around 30% of the total population of the state. According to the current scenario, there are a total of 90 urban local bodies (ULBs) in the Uttarakhand State out of which 8 are Nagar Nigams (NN), 41 are Municipal Council/Nagar Palika Parishads (NPP) & 41 are Notified Area Council (NAC)/Nagar Panchayat.

Bhimtal



Public Toilet in poor condition

1. Bhimtal

1.1 City Profile

Bhimtal is a Nagar Panchayat (Notified Area Council) having a beautiful and one of the largest lake of Kumaun Central Himalayan Region of Nainital district, Uttarakhand, India. Bhimtal city is situated at a distance of approximately 300 km from the state capital Dehradun and 24km from the district headquarters Nainital. As per census 2011, there are 1,671 households and 7,722 people living in 7 wards in the town. In 2018, the nearby villages were added to the ULB and number of wards were increased to 9. As per the records available at ULB office, the current population of the town is 14,882 and the number of households is 2935. The average number of persons per household is 5.

1.1.1. Location and Connectivity

Bhimtal is situated at 29°21'N and 79°34'E at an altitude of 1345 m above mean sea level. This place is neighboured by Bhowali, Kathgodam and Sattal. The Himalayan mountain range borders the northern area of this town. Bhimtal is about 22kms away from the district headquarters Nainital.



1.1.2. Geography and Climate

Bhimtal constitute a part of the Lesser Himalaya with topography having series of ridges and small spurs. Latitudinally, this area belongs to sub-tropical part but altitudinally it has the characteristics of the sub-temperate climate. The



Community Toilets



Sewage Treatment Plant (1.25 MLD), Bhimtal

rock belt is made of Crystalline and Metamorphic rocks. Climate here is warm and temperate with mean annual temperature of 15.7°C and mean monthly min and max temperature range from 2°C to 15°C in the month of January and 18°C to 31°C in the month of May. The rainy season usually commences by the middle of June to September. Winter precipitation caused by winter disturbances ranges from 100 to 200cm and in monsoon it ranges from 175 to 100 cm.

Bhimtal is known as the 'lake district of India' due to the presence of Bhimtal Lake, which is the largest lake in Kumaon region. There is an island at the centre of the lake which has been developed as a tourist attraction and has an aquarium.

Soil of Bhimtal region is classed under mountainous region soil. Soil here have good retentive capacity for moisture due to their parent rock material-crystalline and metamorphic and are good arable land though the depth of the soil is very thin.

1.1.3. Accessibility

Based on the homogeneity in altitude, Bhimtal is divided into six physiographic units namely Valley plain, Subdued hills, Steep high hills, Level area, Valley and Valley bottom¹. Considering the topography of the city, Bhimtal has fairly good accessibility. As observed during field study, almost 70% of HHs have equal to or more than 3m right of way giving accessibility to cess pool vehicles.

1.2 Overview- Water and Sanitation

1.2.1. Water Supply

Bhimtal NPP has 5 borewells serving as the main source of water supply. There are no Water Treatment Plants (WTPs) in the city and water is directly supplied to HHs after addition of bleaching powder. Water Supply coverage is more than 90% in the city rest 10% are either dependent on natural streams for drinking water or community handpumps installed by Jal Sansthan.

1.2.2. Solid waste

As per Swachh Survekshan report prepared by the ULB, 2.5 Tonne Per Day (TPD) waste is generated and collected in the city out of which 1.8 TPD is wet waste and 0.7 TPD is dry waste. According to the same source, door to door collection and source segregation of solid waste is done in all 9 wards. There are total 12 vehicles collecting waste from designated 2935 collection points in the city covering all the wards. Collected waste is then dumped at a designated dumping site in the Haldwani city which is approximately 28Kms from Bhimtal.

¹R C Joshi, 2018



Containments & Greywater outlet directly discharging into open nallah

1.3 Wastewater (WW) and Faecal Sludge and Septage Management (FSSM)

The state government notified FSM Protocol for Septage Management G.O. No. 597/IV(2)UD2017-50 (Sa)/16 dated 22nd May 2017. The objective of the protocol was to streamline FSM operations in the State. The protocol was developed by Urban Development Department, Uttarakhand in consultation with the stakeholders. As per the protocol, all cities shall constitute Septage Management Committee (SMC) for implementation of septage management activities. Currently, in Bhimtal, the SMC has not been formed.

Grey water generated from non-sewered areas is discharged into open drains whereas in the areas served by sewer network, grey water is discharged into sewerage system. The grey water conveyed through open drains ends up in the natural water bodies of the city.

To understand and map the excreta management of the city along the sanitation service chain, a comprehensive level Shit Flow Diagram (SFD) is prepared.

The service outcomes of the sanitation service chain are analysed below: -

1.3.1. Containment

- There are 2,935 households and all the households have access to Individual Household toilets (IHHTs), there are no slums in the city and therefore no community toilets, although, there are six public toilets, four of which have sewerage connections and two are connected to septic tanks.
- As per the ULB records, around 1,096 households (i.e 36%) have sewerage connections and the rest 1,839 (64%) are dependent on-site sanitation systems.
- Containments are dominantly rectangular in shape across the city and have varying sizes. Length, breadth and depth varies between 3ft to 12ft.
- Through key informant interviews (KII) and focus group discussions (FGDs) with municipal officials, 50 households, masons, emptiers and STP operators; households dependent on different types of onsite sanitation systems are estimated:-
 - 2% HHs are dependent on septic tanks connected to soak pits.
 - 4% HHs have fully lined tank without any overflow outlet.
 - 40% households are connected to lined pit with semi-permeable walls and open bottom.
 - 18% HHs are dependent on Containment (fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - with no outlet or overflow and rest .
 - 36% households are connected to sewerage system.
 - Open defecation is not practiced in the city.

1.3.2. Emptying

- Predominant method of emptying has been manual desludging wherein the dried sludge is emptied using buckets and put in a freshly dug pit nearby and later covered with soil.
- Nowadays, private cesspool operators are called from nearby Haldwani city on demand which is 30 km away from Bhimtal city.

1.3.3. Transportation

- There are no cesspool vehicles either owned by government or private players located in the town. Cesspool operators are called from Haldwani on demand.
- Cesspool tankers from Haldwani are mostly tractor mounted vacuum tankers with 3 KL capacity.
- The emptying charge is approximately Rs.6000/- per service.
- Faecal sludge emptied by vacuum tankers is disposed into sewer manholes in Haldwani city.
- There are four pumping stations with in the city that connects to STP supporting the off-site sanitation system of the city.

1.3.4. Treatment

- There is one 1.25MLD Sewage Treatment Plant (STP) built by Uttarakhand Peyjal Nigam and operated by Uttarakhand Jal Sansthan at a distance of about 2km from the ULB office on the road to Naukuchiya taal.
- Currently, the plant running at 66% of the capacity.
- The treatment of the STP is based on the Upflow Anaerobic Sludge Blanket technology.
- Plans are there to upgrade the STP to meet the stricter 10mg/l BOD of effluent discharge recommendations by National Green Tribunal.

1.3.5. Disposal/ Reuse

- At Haldwani the faecal sludge emptied in the sewer manhole directly which further enters into Gaula river without treatment as there is no STP or FSTP present in the town. Currently, Haldwani city has sewerage network laid in almost 15%-20% of the total city but does not have any STP facility yet.
- Currently, the proportion of FS and WW treated sludge are not being reused.

1.4 Assumptions

Following are the assumptions considered while preparing the SFD for Bhimtal city:

1. **Population:** As per KII, Bhimtal Nagar Palika Parishad receives almost 2,00,000 floating population every year. With a peak season of 4 months (mid-April to mid-August), it is assumed that maximum floating population which the city accommodates in a day 1639

Thus, the total population of the city becomes 16521 (14882+1639)

2. **Waste water:** As per KII, total water supply in the city is 135lpcd. Assuming total waste water generated is 80% of total water supply, it is coming out to be 108lpcd.

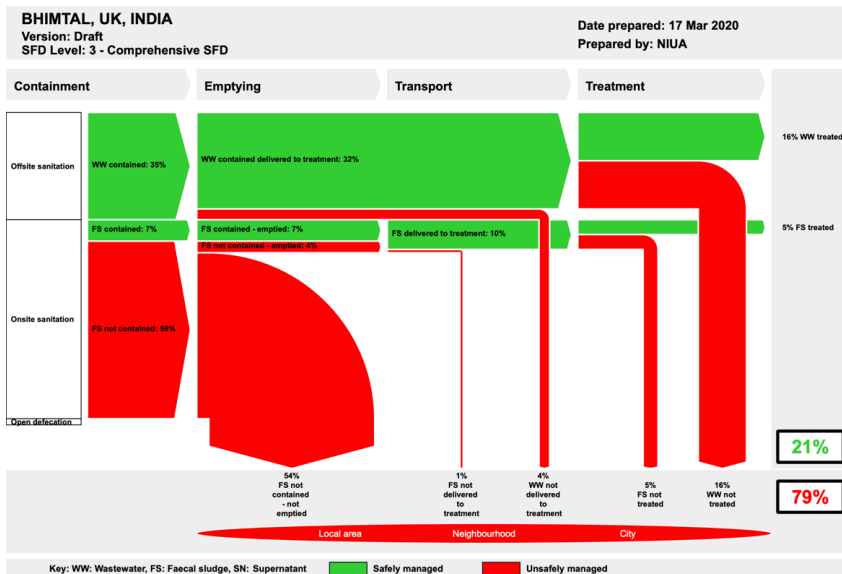
3. **Containment, emptying and treatment:**

Maximum emptying frequency for septic tank – four years, fully lined tank one year and 10 years for lined pit with semi permeable walls and open bottom are considered, thus containment system emptying beyond stipulated time are considered under containment damaged or collapsed category. As the proportion of faecal sludge emptied by vacuum tankers and individual households by themselves are unknown, hence it is assumed that 50% of FS is delivered to treatment plant

4. **Risk of ground water:** Average water level of across city is greater than 15 mbgl². Considering rock type in unsaturated zones is coarse sand and gravels, vulnerability of the aquifers was found to be at significant risk. 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 causing significant risk to lateral separation. 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.

Thus, overall risk to ground water contamination is estimated to be low in Bhimtal but in case of containment type - lined pit with semipermeable walls and open bottom, 50% of the households are considered at low (i.e.20%) and 50% is considered at significant risk.

²CGWB, 2015-16



1.5 Budget, Funding and Proposed Projects

Funding is received under municipal budget and through finance commission and no other sources of funding are available under any special scheme for the ULB. There is no fixed annual budget for sanitation in Bhimtal although in the FY 2019-20, the annual budget of Bhimtal NPP was 1.97 crore. Jal Nigam is currently conducting a HH survey to plan for sewerage network across the city.

1.6 Way forward

- ULB shall prepare a City level strategy on FSSM including decentralized liquid waste management; DWWTs are suitable for residential colonies, Hotels and Institutions generating >10 KLD ww and having >500 sq.m of green space.
- As evident from the study, Bhimtal has more than 50% households connected to onsite sanitation systems. Approximately 38% households are dependent on collapsed or damaged types systems which may contaminate the groundwater if not desludged regularly. Moreover, such systems should be retrofit with improved systems like septic tanks and properly designed twin pit systems as per IS code recommendations.
- Bhimtal has one 1.25MLD STP which is running with utilization of around 66%. Currently, faecal sludge is transported to Haldwani city and is discharged into designated manholes. Thus, ULB can think of a cluster level approach to treat the septage at Haldwani STP or in a dedicated FSTP in Haldwani.
- Population dependent on on-site sanitation system (64%) in the city is

generating approximately 3.1kld of faecal sludge. With the current capacity of STP (total 1.25 MLD), Co-treatment of FS with sewage can be a viable option. Areas within a radius of 10–12 km of an STP can potentially bring their FSS to be co-treated in the STP.

- Based on the current FS generation, the ULB would require one vacuum tanker of 3KL capacity. The private operators can be used for their emptying service to meet the requirement.
- Co-composting of treated faecal sludge with municipal solid waste would provide a solution for FSM and manure produced from composting can be used in agriculture.

2. References

- CGWB. (2015-16). *Ground Water Year Book*.
- R C Joshi, M. S. (2018). *Physico-Chemical Characteristics of Soil in Bhimtal Gadhera Catchment Kumaun Himalaya, Uttarakhand*. JETIR.

3. Officers Contacted

| Name | Designation | Department | Contact Details | Information Collected |
|---------------------|-------------|--------------|--------------------|---|
| Mr. Vijay Pal Bisht | E.O. | Bhimtal NPP | 9837860090 | ULB Data & City Sanitation Information |
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| Mr. B.C. Pal | A.E. | Jal Sansthan | 9412034539 | Information related to water and sanitation |

Bageshwar



Greywater directly entering to Gomti River

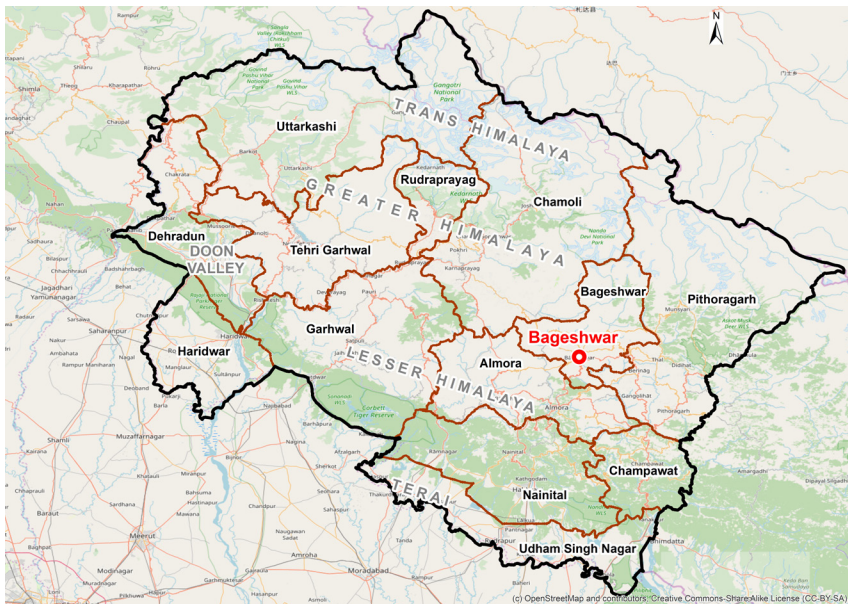
1. Bageshwar

1.1 City Profile

Bageshwar is a Nagar Palika Parishad (Municipal Council) in Bageshwar district, Uttarakhand. The total population of the city as per Census 2011 is 9,079 which increased after expansion to 25,045.¹ There are 4,808 households within municipal boundary; this suggests the average household size in the city to be 5.21. In the year 2018, there was delimitation of boundary and total number of wards increased from 7 to 11. The geographical area of the city is 8.5 km square.²

1.1.1. Location and Connectivity

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 situated at a distance of approximately 320 km from the state capital Dehradun.



1.1.2. Geography and Climate

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

¹Key Informant Interview, Bageshwar Nagar Palika Parishad

²Key Informant Interview, Bageshwar Nagar Palika Parishad



Greywater directly entering to Gomti River



Open discharge of oil and grease from a hotel

slope is towards south with an average elevation of 1,004 m above 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 has 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 1634 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 city.³

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.

1.1.3. Accessibility

Based on KII and field based study, approximately 40% of the households in the city have roads more than 3 meters right of way which is easily accessible. Whereas, due to rough terrain and topography remaining 60% of the households are inaccessible.

1.2 Overview- Water and Sanitation

1.2.1. Water Supply

Bageshwar NPP has an infiltration well & one mini tube-well. The city has one Water Treatment Plant (WTP) with a capacity of 1.2 MLD, water is directly supplied to households after treatment. 85% of households in the town have water supply connections by Uttarakhand Jal Sansthan.⁴ Average water supply in the city is 120 lpcd.⁵ Additionally, there are households dependent on other sources like natural streams and nearby community tube wells for domestic water usage.⁶

1.2.2. Solid waste

As per the ULB sources the total solid waste generated in the city is 6.2TPD. Door to door collection is 100% and source segregation of solid waste is 60%.⁷

³<https://en.climate-data.org/asia/india/uttarakhand/bageshwar-175571/>

⁴Service Level Benchmarks, Bageshwar 2018-19

⁵Service Level Benchmarks, Bageshwar 2018-19

⁶Primary Survey

⁷Service Level Benchmarks, Bageshwar 2018-19

Forty-two sanitary workers collect waste from the commercial areas and in addition thirty-four women are engaged to collect dry waste from households which are inaccessible by roads. Households use their wet waste themselves and the dry waste like plastic, rubber, glasses are recycled after segregation.⁸ Collected waste is then dumped at an unscientific dumpsite near Malta Road in the city.⁹

1.3 Wastewater (WW) and Faecal Sludge and Septage Management (FSSM)

The state government notified FSM Protocol for Septage Management G.O. No. 597/IV(2)UD2017-50 (Sa)/16 dated 22nd May 2017. The objective of the protocol was to streamline FSM operations in the State. The protocol was developed by Urban Development Department, Uttarakhand in consultation with the stakeholders. As per the protocol, all cities shall constitute Septage Management Committee (SMC) for implementation of septage management activities. Currently, in Bageshwar the SMC has been formed and one meeting has been held in this regard.

Grey water in the city is either disposed of through drains or through soak pits that are connected with bathroom and kitchens. There are no storm water drains in the city.¹⁰ Natural water bodies like lakes and natural streams serve as catchment for rain water run-off.

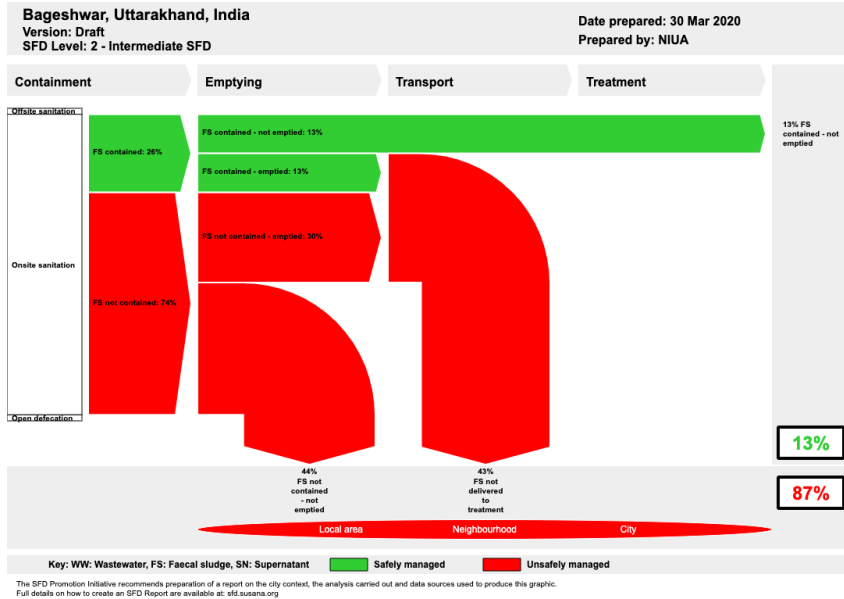
To understand and map the excreta management of the city along the sanitation service chain, a comprehensive level Shit Flow Diagram (SFD) is prepared.

⁸Key Informant Interview, Bageshwar Nagar Palika Parishad

⁹Key Informant Interview, Bageshwar Nagar Palika Parishad

¹⁰Service Level Benchmarks, Bageshwar 2018-19

The service outcomes of the sanitation service chain are analyzed below: -



1.3.1. Containment

- There are 4808 households and 100% households have access to individual household toilets and there are no notified slums in the city. Additionally, there are nine public toilets and four community toilets all of which are connected to septic tanks.
- As per the ULB records, all 4808 households have onsite containment systems as there is no sewerage network in the city.¹¹
- Through key informant interviews (KII) and focus group discussions (FGDs) with municipal officials, 50 households, masons, emptiers; households dependent on different types of onsite sanitation systems are estimated:–
 - 6% HHs are dependent on septic tanks connected to soak pits.
 - 14% HHs have fully lined tank without any overflow outlet.
 - 40% households are connected to lined pit with semi-permeable walls and open bottom.
 - 40% HHs are dependent on Containment (fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - with no outlet or overflow and rest.
 - Open defecation is not practiced in the city.

¹¹Service Level Benchmarks, Bageshwar 2018-19



Community Toilets



Large and unscientifically constructed containments

1.3.2. Emptying

- Predominant method of emptying is manual desludging wherein the dried sludge is emptied using buckets and put in a freshly dug pit nearby and later covered with soil.
- The average desludging frequency of the containments is more than 10 years.
- There is no cesspool operator available in the town.

1.3.3. Transportation

- There are no cesspool vehicles either owned by government or private players located in the town.
- Buckets are used for desludging; the emptied sludge is dumped into a fresh pit in the backyard of the households.
- The emptying charge is approximately Rs.4000/- per service.

1.3.4. Treatment

- The amount of wastewater generated is 3MLD and the amount of faecal sludge generated is 12KLD.
- Bageshwar NPP doesn't have an STP or FSTP. The emptied sludge is dumped in a pit in the backyards of the households, which is then covered with soil until it dries up.

1.3.5. Disposal/ Reuse

- In Bageshwar, faecal sludge is not treated due to absence of faecal sludge and septage treatment options.
- Currently, there is no treatment of sludge or wastewater, therefore reuse cannot be done.

1.4 Assumptions

Following are the assumptions considered while preparing the SFD for Bageshwar city:

1. **Population:** As per KII, Bageshwar Nagar Palika Parishad receives almost 2500 tourist per day for 30 days as floating population every year. This is considered to be the peak time to receive maximum tourists due to Uttrayani Mela which is in the month of January.

Thus, the design population of the city becomes 27545 (25045+2500)

2. **Waste water:** As per KII, water supply in the city is 120lpcd. Based on the water supply, assuming total waste water generated is 80% of total water supply, it is coming out to be 2.6 MLD.
3. **Containment, emptying and treatment:** Maximum emptying frequency for septic tank – four years, fully lined tank one year and 10 years for

lined pit with semi permeable walls and open bottom are considered, thus containment system emptying beyond stipulated time are considered under containment damaged or collapsed category.

- 4. Risk of ground water:** Average water level across city is greater than 15 mbgl¹². Considering rock type in unsaturated zones is coarse sand and gravels, vulnerability of the aquifers was found to be at significant risk.

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 causing significant risk to lateral separation. 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.

Thus, overall risk to ground water contamination is estimated to be low in Bageshwar but in case of containment type - lined pit with semipermeable walls and open bottom, 50% of the households are considered at low (i.e. 20%) and 50% is considered at significant risk because of households with such containments along the riverside where groundwater level is less than 5mbgl.

1.5 Budget, Funding and Proposed Projects

Funding is received under municipal budget and through finance commission and no other sources of funding are available under any special scheme for the ULB. There is no fixed annual budget for sanitation in Bageshwar although the income and expenditure of Bageshwar for 2017-18 & 2018-19 is:

Income and Expenditure Statement of Bageshwar Nagar Palika Parishad

| Year | Income | Expenditure | Net Balance |
|---------|----------|-------------|-------------|
| 2017-18 | 7.51 Cr. | 7.51 Cr. | 0 |
| 2018-19 | 8.80 Cr. | 8.80 Cr. | 0 |

1.6 Action plan and Way forward

- ULB shall prepare a City level strategy on FSSM including decentralized liquid waste management; DWWTs are suitable for residential colonies, Hotels and Institutions generating >10 KLD WW and having >500 sq.m of green space.
- Desludging potential is itself is low in both the cities, it will take more to time for any desludging operators to get desludging demand as the population increases. At the moment, options for setting up FSTP separately

¹²CGWB, 2015-16

for Bageshwar are slim. So, co-treatment at the nearest STP should be considered.

- As evident from the study, Bageshwar has 100% households connected to onsite sanitation systems. Approximately 40% households are dependent on collapsed or damaged types systems which may contaminate the groundwater if not desludged regularly. Moreover, such systems should be retrofit with improved systems like septic tanks and properly designed twin pit systems as per IS code recommendations.
- As the emptying is majorly done manually, based on the current FS generation and limited road accessibility, ULB would require 2 small vacuum tankers of varying capacity. However, due to more than 50% area is inaccessible by four-wheelers, vacutugs or 500 to 1000 litres capacity desludging vehicle would be appropriate for ULB to procure cesspool vehicles for this purpose and for proper disposal.

2. References

- District Ground Water Brochure of Bageshwar District, Uttarakhand
- <https://cdn.S3waas.gov.in/s3a7aeed74714116f3b292a982238f83d2/uploads/2018/03/2018031395-1.pdf>
- <https://en.climate-data.org/asia/india/uttarakhand/bageshwar-175571/>
- Service Level Benchmarks, Bageshwar 2018-19
- Key Informant Interview, Bageshwar Nagar Palika Parishad
- Primary Survey

3. Officers Contacted

| Name | Designation | Department | Contact Details | Information Collected |
|--------------------|-------------|--------------|-----------------|---|
| Mr. Raj Dev Jayasi | E.O | ULB | 7409739149 | ULB Data & City Sanitation Information |
| Mr. Bhelwal | A.E | Peyjal Nigam | 9634816878 | Water and Sanitation Details |
| Mr. Dinesh Chandra | J.E | Jal Sansthan | 9411138246 | Information related to water and sanitation |
| Mr. Rajat | S.I. | ULB | 9639826501 | Information related to solid waste and budget |

Doiwala



Greywater outlets from HHs into main drain

1. Doiwala

1.1 City Profile

Doiwala is a Nagar Palika (Municipal Council) and a town in Dehradun District of Uttarakhand. Because of the presence of Jolly Grant Airport, the town is a strategically important location in the state. Doiwala is situated at a distance of approximately 20 km from the state capital and district headquarters Dehradun. As per census 2011, the total population of the city was 8,709 living in 7 wards but in the year 2018, the nearby villages were added to the ULB and number of wards increased to 20. As per the records available at ULB, the current population of the town is 61,370 and the total number of households is 12,302. The average number of persons per household is 5.

1.1.1. Location and Connectivity

Doiwala is located at 30.18°N 78.12°E with an average elevation of 484 meters.¹ The area comes under Doon Valley's Terai and Bhabhar region and it is notable for its location near the center of the triangle formed by the three important metropolitan and cultural regions of Uttarakhand - Dehradun, Haridwar and Rishikesh, all three regions being within an hour's drive from the town



¹ Indian Railways

1.1.2. Geography and Climate

Doiwala lies in the intermontane valley portion, of Dehradun district, is underlain by alluvial fan deposits. These fan deposits are called as 'Doon Gravels' and characterized by boulders and pebbles embedded in sandy and silty matrix. The clasts are mainly composed of quartzite, sandstone and phyllite, which are mainly derived from the Krol belt of the Himalayas. Pebbles, Siwalik conglomerates are also present in the Doon Gravels. These Doon Gravels are highly porous and they have a significant permeability. Groundwater occurs under unconfined and semi confined conditions.²

Climate here is generally warm and temperate with average temperature 22.6 °C. Here, June is the warmest month of the year with temperatures averaging 30.5 °C and January being the coldest month has temperatures averaging 13.1 °C. During the monsoon season, there is often heavy and protracted rainfall. There is a difference of 633mm of precipitation between the driest and the wettest months, i.e. August being the wettest receives 642mm rainfall whereas April being the driest receives only 9mm rainfall.

1.1.3. Accessibility

Base on KII and primary survey it was found that the city has approximately more than 90% pucca roads whose right of way is more than 3 meters which allows households to be accessible by cess pool operators.³

1.2 Overview- Water and Sanitation

1.2.1. Water Supply

The main source of water supply in the city is ground water. Groundwater is extracted using 27 tube wells. All the households (100%) in the city have water supply connections by Jal Sansthan.⁴ Average water supply in the city is 135 lpcd.⁵

1.2.2. Solid waste

Currently, an estimated 2 tons of waste is generated in the city per day.⁶ Door to door collection is 95% and source segregation of solid waste is also 95%.⁷ However, there are no dumpsites in the city and all the waste is transferred to Shishambara, which is approximately 40 km from the city and was initially started to manage waste from Dehradun city.

²Ground Water Brochure, District Dehradun, CGWB, 2011

³Key Informant Interview, Doiwala Nagar Palika

⁴Service Level Benchmarks, Doiwala 2018-19

⁵Service Level Benchmarks, Doiwala 2018-19

⁶City Sanitation Plan, Swachh Bharat Mission, MoHUA

⁷Service Level Benchmarks, Doiwala 2018-19

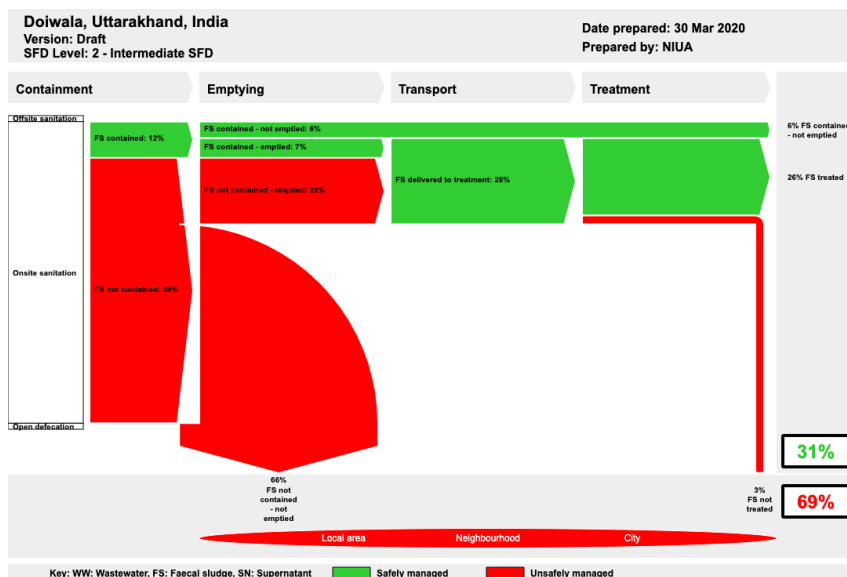
1.3 Wastewater (WW) and Faecal Sludge and Septage Management (FSSM)

The state government notified FSM Protocol for Septage Management G.O. No. 597/IV(2)UD2017-50 (Sa)/16 dated 22nd May 2017. The objective of the protocol was to streamline FSM operations in the State. The protocol was developed by Urban Development Department, Uttarakhand in consultation with the stakeholders. As per the protocol, all cities shall constitute Septage Management Committee (SMC) for implementation of septage management activities. Currently, in Doiwala, the SMC has been formed but no meetings have been held.

Grey water in the city is either disposed of through drains or through soak pits that are connected with bathroom and kitchens. Most of the households in the city are connected with drains which are mostly open drains. The drains discharge to agricultural fields and in Saung River, which serves as the catchment area for rain water run-off.

To understand and map the excreta management of the city along the sanitation service chain, a comprehensive level Shit Flow Diagram (SFD) is prepared.

The service outcomes of the sanitation service chain are analysed below: -





Solid waste, Material Recovery Facility, Doiwala



Circular pit (Onsite containment system)

1.3.1. Containment

- There are 12,302 households and all the households have access to Individual Household toilets (IHHTs). There is one notified slum in the city. There are two public toilets and two community toilets all of them connected to septic tanks with soak pits.
- As per the ULB records, all the households are dependent on on-site sanitation systems.
- Through key informant interviews (KII) and focus group discussions (FGDs) with municipal officials, 50 households, masons and emptiers; households dependent on different types of onsite sanitation systems are estimated:-
 - 9% HHs are dependent on septic tanks connected to soak pits.
 - 1% HHs have fully lined tank without any overflow outlet.
 - 2% households are connected to lined pit with semi-permeable walls and open bottom.
 - 88% HHs are dependent on Containment (fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - with no outlet or overflow and rest.
- Doiwala is declared open defecation free.⁸ However, during primary survey one household was observed not having access to IHHT within premises leading them to either use community toilet or defecate in open. Even though it is a small percentage it has been considered while preparing SFD for the city.

1.3.2. Emptying

- As per the field, 70% HHs with onsite containments systems have never been emptied in the city.
- Main mode of emptying in Doiwala is by Cess Pool Operators.
- Average desludging frequency in Doiwala is more than 10 years.

1.3.3. Transportation

- There is no government operated cesspool operator in the city, households are served by private operators which are operated from Dehradun.
- Apart from the cess pool operators from Dehradun, there is only one private operator from Doiwala itself. Though the operator is not registered with the ULB, it works in line with the ULB's instructions.
- Cess pool operators take sludge to Kargi STP which is around 20 km from Doiwala.
- The emptying charge is approximately Rs.4000/- per service.

⁸Service Level Benchmarks, Doiwala 2018-19



Open Drains on streets



Cesspool Vehicle

1.3.4. Treatment

- The amount of wastewater generated is 6.6MLD and the amount of faecal sludge generated is 26.6KLD.
- Faecal Sludge that is being emptied is taken to Kargi STP whose treatment capacity is 68 MLD.
- At present, 300 ₹ fees is charged by Jal Sansthan, STP from the cess pool operators to dispose-off sludge.

1.3.5. Disposal/ Reuse

- Since, there is no STP/ FSTP in Doiwala, there is no reuse of sludge and waste water in the city.
- Dried sludge in Kargi STP is given to farmers for free of cost and water after chlorination is used for gardening and remaining water is discharged into Bindal Rao Naala.

1.4 Assumptions

Following are the assumptions considered while preparing the SFD for Doiwala city:

1. **Population:** As per KII, Doiwala Nagar Palika receives almost 2,000 floating population every day on a peak tourist day.
Thus, the design population of the city becomes 63,370 (61,370+2000)
2. **Waste water:** As per KII, total water supply in the city is 135 lpcd. Assuming total waste water generated is 80% of total water supply, it is coming out to be 6.8 MLD.
3. **Containment, emptying and treatment:**
4. Maximum emptying frequency for septic tank – four years, fully lined tank one year and 10 years for lined pit with semi permeable walls and open bottom are considered, thus containment system emptying beyond stipulated time are considered under containment damaged or collapsed category.
5. **Risk of ground water:** Average water level of across city is greater than 15 mbgl⁹. Considering rock type in unsaturated zones is coarse sand and gravels, vulnerability of the aquifers was found to be at significant risk. 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 causing significant risk to lateral separation. 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.
Thus, overall risk to ground water contamination is estimated to be low in Doiwala.

⁹CGWB, 2015-16



Door to Door Collection service

1.5 Budget, Funding and Proposed Projects

Funding is received under municipal budget and through finance commission and no other sources of funding are available under any special scheme for the ULB. There is no fixed annual budget for sanitation in Doiwala although the income and expenditure for Doiwala Nagar Palika is presented below:

Income and Expenditure Statement of Doiwala Nagar Palika

| Year | Income | Expenditure | Net Balance |
|---------|-------------|-------------|-------------|
| 2016-17 | 1,40,81,491 | 1,29,26,154 | 11,55,337 |
| 2017-18 | 2,86,25,298 | 2,71,99,801 | 14,25,497 |
| 2018-19 | 3,03,74,972 | 3,07,01,446 | 3,26,474 |

1.6 Action plans and Way forward

- ULB shall prepare a City level strategy on FSSM including decentralized liquid waste management; DWWTs are suitable for residential colonies, Hotels and Institutions generating >10 KLD ww and having >500 sq.m of green space.
- As evident from the study, Doiwala has 100% households connected to onsite sanitation systems. Approximately 88% households are dependent on collapsed or damaged types systems which may contaminate the groundwater if not desludged regularly. Moreover, such systems should be retrofit with improved systems like septic tanks and properly designed twin pit systems as per IS code recommendations. ULB should formulate an effective financial support mechanism for retrofitting of faulty containments.

- Population dependent on on-site sanitation system (100%) in the city is generating approximately 27 KLD of faecal sludge. FSTPs must be proposed as there are no treatment plants in the city. FSTP can be set up but for funds, Doiwala is neither an AMRUT town nor a Ganga town under NMCG. Therefore, alternative sources of funding need to be explored for constructing and operating the FSTP. Land constraints can also be another important factor that has to be taken care of due to its topography and land availability
- Co-treatment of faecal sludge at STPs in Dehradun can be explored based on the proximity of the HHs from the STP location.
- Based on the current FS generation, the ULB would require three to six vacuum tanker of varying capacities. Private operators can be used for their emptying service to meet the requirement.
- Co-composting of treated faecal sludge with municipal solid waste would provide a solution for FSM and manure produced from composting can be used in agriculture.

2. References

- City Sanitation Plan, MoHUA
- Swachh Surveykshan MIS 2020
- Ground Water Brochure, District Dehradun, CGWB, 2011
- Google Toilet Locator
- Census of India, 2011
- City Sanitation Plan, GIZ
- <https://en.climate-data.org/>
- Audit, Doiwala Nagar Palika

3. Officers Contacted

| Name | Designation | Department | Contact Details | Information Collected |
|------------------------|--------------------|----------------------|-----------------|---|
| Mr. Vijay Pratap Singh | Executive Officer | Doiwala Nagar Palika | 8126369879 | ULB data and Swachh Surveykshan information |
| Mr. Parmeet | Sanitary Inspector | Doiwala Nagar Palika | 9759079977 | Swachh Surveykshan |

Srinagar



Handpump connected to sand filter

1. Srinagar

1.1 City Profile

Srinagar is a Nagar Palika (Municipal Council) and a major town on the banks of River Alakananda in Pauri Garhwal District of Uttarakhand. It is a major educational hub and an strategically important location on the famous Chota Char Dham Yatra of Uttarakhand. In 2019, Current population of Srinagar is 44,000 after delimitation of boundaries in 2018, which is spread over 13 wards in a total area of 13 sq. km.¹¹ There are 6,038 Households²² with average household size of 7.28 in the town. Since Srinagar is a major town on Chota Char Dham Yatra and an important educational hub, the floating population during its peak time can reach upto 10,000 persons in a day. There are no notified slums in Srinagar.

1.1.1. Location and Connectivity

Srinagar is located at 30.22°N 78.78°E at an altitude of 560 metres (1837 feet) above msl. It is in Pauri Garhwal District and can be reached by NH58 from Rishikesh, at a distance of 100 km. Other major towns near Srinagar are Pauri (district headquarter), Devprayag and Rudraprayag which are about 35 kms, 32 kms and 33 kms away respectively. Across Alaknanda river, there's Kirti Nagar Urban Local Body in Tehri Garhwal District.



¹¹City Sanitation Plan and Swachh Surveykshan MIS 2020

1.1.2. Geography and Climate

Srinagar city is located in Lesser Himalayas. It is mainly situated at the bottom of the quadrangular river of rocks and sand deposited by the Alaknanda River. Beneath these boulder-sand terraces is the hard rock Proterozoic phyllite known as Pauri Phyllite.

Srinagar is the hottest place in the Garhwal Hills. In summers the temperature reaches 45°C on some days from May to July. It has chilly winters and the temperature can fall as low as 2°C in December and January.³³

Households which are near to Alaknanda river have groundwater water table at around 30 feet.⁴⁴

1.1.3. Accessibility

More than 80% households have pucca roads with road width 3 metres and above which allows households to be accessible by cess pool operators.⁵⁵ For rest of the 20% HHs either road width is less than 3 metres, or inaccessible area because of rough terrain.

1.2 Overview- Water and Sanitation

1.2.1. Water Supply

The main source of water in the city is the Alaknanda River flowing through the city which is supported by few perennial natural water springs known as “Gadhera”. 85% of households in the city have water supply connections provided by Uttarakhand Jal Sansthan.⁶⁶ Rest of the HHs are dependent on tankers for Water Supply. There are 4 water treatment plants with a total capacity of 11.5 MLD. Water supply per capita per day is 170 litres in Srinagar.⁷⁷ Water from the Alaknanda River is stored in the tanks where it is filtered through sedimentation process and disinfected by chlorination process before supplying to HHs.

1.2.2. Storm water

Around 15% of the Urban Area (UA) is covered with storm water drainage network. It is reported that 30% of the area faces incidence of water logging/ flooding especially during monsoons.⁸⁸ Alaknanda River serves as the catchment for rain water run-off.

³SBM City Profile 2020

³<http://hnbgu.ac.in/forms/contentpage.aspx?lid=51>

⁴Field based survey

⁵Key Informant Interview, Srinagar Nagar Palika

⁶Service Level Benchmarks, Srinagar 2018-19

⁷Key Informant Interview, Jal Sansthan, Srinagar

⁸Service Level Benchmarks, Srinagar 2018-19

1.2.3. Solid waste

Currently, an estimated 8 tonnes of garbage is produced in the city per day in which around 2 tonnes is Construction and Demolition waste (C&D)., whereas none of C&D waste is currently being managed. Srinagar has two primary waste transfer stations from where waste is transported to the dumping site. The plant for solid waste processing is near the new bus station which is around 0.5 Km away from Nagar Palika office. There is also a Material Recovery Facility (MRF) at the dumping site in which 2 ton of dry waste and 2.5 Ton of wet waste is separated.⁹⁹ The collected solid waste is currently not being disposed of scientifically.

1.3 Wastewater (WW), Faecal Sludge and Septage Management (FSSM)

Srinagar was declared as Open Defecation Free (ODF) City. The state government notified FSM Protocol for Septage Management G.O. No. 597/IV(2) UD2017-50 (Sa)/16 dated 22nd May 2017. The objective of the protocol was to streamline FSM operations in the State. The protocol was developed by Urban Development Department, Uttarakhand in consultation with the stakeholders. As per the protocol, all cities shall constitute Septage Management Committee (SMC) for implementation of septage management activities. On 11th July 2018, Septage Management Cell (SMC) was constituted in the presence of Sub District Magistrate. SMC holds meetings every 6 months.¹⁰¹⁰ Key decisions during SMC meetings were registering all the cess pool operators and mandating them to dispose faecal sludge in sewer line manhole near 3.5 MLD STP.



Sewage is conveyed through Nallahs after tapping

⁹⁹City Sanitation Plan, Swachh Bharat Mission, MoHUA

¹⁰¹⁰Key Informant Interview, Srinagar Nagar Palika



Greywater directly entering to the river through open drains

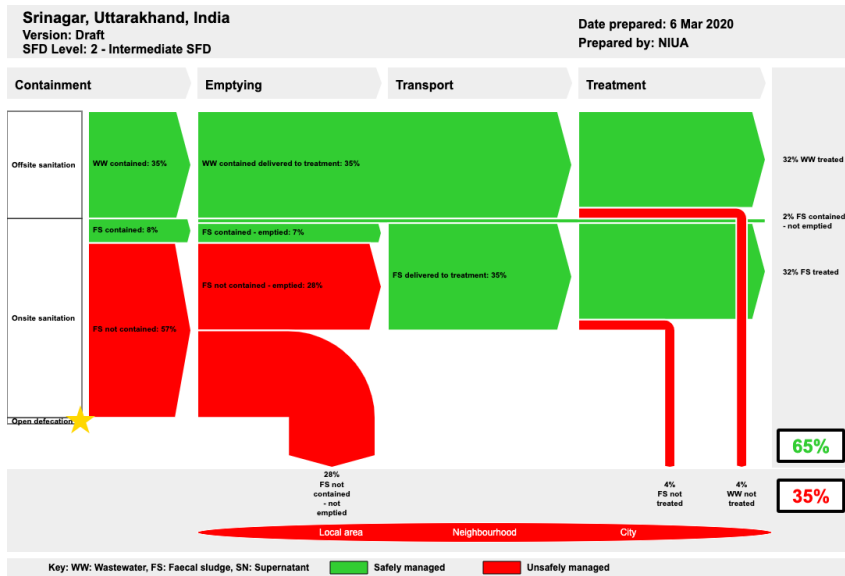


MLD STP Plant in Srinagar

Grey water

Grey water generated from non-sewered areas is discharged into nallahs which is partly intercepted and diverted into STP for treatment. In the few nallahs which are not intercepted yet, the grey water conveyed ends up in the natural water bodies of the city. During field-based study, it was observed that few households have connected their containment system's overflow into drains. Such households were estimated to be less than 1%, hence they are not considered into SFD graphic. In the areas served by sewer network, grey water is discharged into sewerage system.

To understand and map the excreta management of the city along the sanitation service chain, a comprehensive level Shit Flow Diagram (SFD) is prepared. The relevant data for preparation of SFD is collected and triangulated through field-based survey conducted in 50 households, key informant interviews (KII) and focus group discussions (FGDs) with municipality, Jal Sansthan, desludgers, masons and STP operators in February 2020.



1.3.1. Containment

- Based on the study conducted, 98% of HHs have pucca structures.
- All HHs have individual toilets.
- Srinagar has 5 Public Toilets (PTs) with around 45 toilet Seats. All PTs are connected to sewer.



Ghat development at river bank under NMCG

- It was observed that in general containment size of many households is 10 feet in length by 10 feet in breadth by 8 feet in depth.
- Around 36% of the total HHs have sewerage connections and 30% of the HHs have containment with septic tank type structure which are connected to soak pit.
- Similarly, other types of onsite sanitation system prevalent in the city are lined pit with semi permeable walls and open bottom and fully lined tanks with HHs 24% and 10% respectively.

1.3.2. Emptying

- Based on the study conducted, in general it was found that 75% HHs with onsite containments systems have never emptied their systems.
- Majorly emptying service in Srinagar is by government owned cesspool tankers. There are few instances of households relying on manual scavenging, where sludge is disposed-off by digging a pit near to premise of house where barren land is available.
- There is one government owned emptier and a few private operators which mainly serve the medical college and hospitals.

1.3.3. Transportation

- 36% of Population is served by sewer network.
- Jal Sansthan has a tractor mounted cess pool vehicle with a capacity of 3000l.
- No private cesspool operators are registered with the ULB, although they mainly operate in educational institutions.

- Cess Pool operators discharge faecal sludge into sewer manholes close to Sewage Treatment Plant (STP) of 3.5 MLD capacity.

1.3.4. Treatment

- There are two Sewage Treatment Plants in Srinagar. Capacity of plants near New Bus Stand and National Institute of Technology, Srinagar is 3.5 MLD and 1 MLD respectively.
- The amount of wastewater generated is 4.7MLD and the amount of faecal sludge generated is 11.3KLD.
- The New Bus Stand STP is currently receiving wastewater to the tune of 30% of its designed capacity whereas 1 MLD plant is receiving 37%.¹¹¹¹
- Both STPs are constructed and currently being operated by Uttarakhand Peyjal Nigam.
- The 3.5 MLD STP is based on Moving Bed Biological Reactor (MBBR) technology whereas 1 MLD STP is based on Sequential Batch Reactor (SBR) Technology.

1.3.5. Disposal/ Reuse

Treated sludge from STPs is used as manure by giving it to the farmers of nearby villages for free of cost.

The treated wastewater after disinfection by chlorination process is disposed into the River Alaknanda.

1.4 SFD Graphic

Following are the assumptions considered while preparing the SFD of Srinagar city

Containment, emptying and treatment:

1. Maximum emptying frequency for septic tank – four years, fully lined tank one year and ten years for lined pit with semi permeable walls and open bottom are considered, thus containment system emptying beyond stipulated are considered under containment damaged or collapsed category

As the proportion of faecal sludge emptied by vacuum tankers and individual households by themselves are unknown, hence it is assumed that 50% of FS is delivered to treatment plant.

Based on the study, it was found that more than 90% of these septic tanks and lined pit with semi permeable walls and open bottom systems are being emptied beyond their stipulated time and hence such systems have been considered under category of ‘containment damaged or collapsed’ in SFD.

¹¹National Institute of Urban Affairs

Containment systems which were reported as fully lined tanks during field based study are considered damaged as their frequency of emptying is found beyond one year.

1.5 Budget and funding

Income and Expenditure Statement of Srinagar Nagar Palika

| Year | Income | Expenditure | Net Balance |
|---------|-------------|-------------|-------------|
| 2016-17 | 4,51,80,000 | 4,65,49,000 | (13,69,000) |
| 2017-18 | 4,85,99,000 | 5,42,84,000 | (56,84,000) |

- Audited income and expenditure for years 2016-17 and 2017-18 was around Rs. 5 crores.
- Municipality's sources of income are just 4% through user charges and fees. At present, the ULB is dependent on the grants from the government.
- Sources for funding in sanitation sector include Swachh Bharat Mission and National Mission for Clean Ganga.

1.6 Way forward

- ULB shall prepare a City level strategy on FSSM including decentralized liquid waste management; DWWTs are suitable for residential colonies, Hotels and Institutions generating >10 KLD WW and having >500 sq.m of green space.



Solid waste into the main drain

- As evident from the study, Srinagar has 64% households connected to onsite sanitation systems. 56% households are dependent on collapsed or damaged types systems which may contaminate the groundwater if not desludged regularly. Moreover, such systems should be retrofit with improved systems like septic tanks and properly designed twin pit systems as per IS code recommendations.
- ULB should formulate an effective financial support mechanism for retrofitting of faulty containments.
- As evident from the study, there is a huge demand for emptying faecal sludge from septic tanks of medical college and hospital, either an in-house or an exclusive Faecal Sludge Treatment Plant or co-treatment at the existing STPs after checking the compatibility of the STPs can be proposed.
- Srinagar has two STPs which are running with a combined utilization of around 35%. Currently, faecal sludge emptied by cess pool operators are discharged into designated manholes which may cause operational problems as the STPs are not designed for treating faecal sludge. Hence, it is necessary to check the compatibility of co-treatment of FS with sewage at the plant
- It is estimated that 11.3 kld of faecal sludge is generated in the city. With the current capacity of STP (total 4.5 MLD), Co-treatment of FS with sewage can be a viable option.
- Based on the current FS generation, the ULB would require four vacuum tankers of 3KL capacity. The private operators can be used for their emptying service to meet the requirement.
- Co-composting of treated faecal sludge with municipal solid waste would provide a solution for FSM and manure produced from composting can be used in agriculture.

Devprayag



Sewer Manhole and sewer lines

1. Devprayag

1.1 General City Information

Devprayag is a Nagar Palika (Municipal Council) situated in Tehri Garhwal district, Uttarakhand, India. It is situated at the confluence of Bhagirathi and Alaknanda rivers. The current population of the town is 3,059 and the number of households is 642. As per census 2011, the population was 2,868 and the number of households was 609. There are four wards in the town, namely Shanthi, Mandir, Ganesh and Dhaneshwar wards. It is one of the smallest municipalities in the state. The town is also at the border of Tehri Garhwal and Garhwal districts with some households and an entire ward falling within the jurisdiction of Garhwal district. It is also a famous pilgrimage centre on the Chota Char Dham circuit in Uttarakhand.

1.1.1. Location and Connectivity

Devprayag is situated at 30.15°N and 78.60°E at an altitude of 472 m above msl. The geographical area of the town is 6 sq.km. Devprayag is located on NH 58 which connects Ghaziabad with Badrinath at a distance of 74km from Rishikesh. The nearest major town is Srinagar which is at a distance of 37km. Devprayag is located at a distance of 78 km from the district headquarters Tehri and 116 km from the state capital Dehradun.







1.1.2. Geography and Climate

Devprayag constitutes a part of the Lesser Himalayas with topography having a series of ridges and small spurs. The town is situated on the banks of rivers and rises right above river with a steep slope on all banks. Devprayag area is covered by soil/ slope wash and river borne deposit resting over Garhwal group of rocks. The river borne material consists of boulders of quartzite, gneisses, metabasics and schists mixed with silt, sand, cobbles and pebbles. The Garhwal group of rocks consists mainly of quartzite. The soils are basically the product of fluvial process of the river Bhagirathi and its tributaries (Bhilangana, Balganga etc.). The alluvial soil of the area is dry, porous, sandy loam, faint yellow, alkaline and consists of clay and organic matter.

January is the coldest month with mean minimum and mean maximum temperatures of 19.6°C and 4.6°C respectively. Temperature becomes highest usually during June, having mean minimum and mean maximum temperatures of 32.6°C and 36.5°C respectively. Rainfall occurs almost throughout the year. Maximum rainfall is recorded during the monsoon period i.e. from July to September. During the non-monsoon season, rainfall is quite low in November and increases from December onward till March. The average annual rainfall of the district is 1395 mm.

1.1.3. Accessibility

Devprayag is a very unique town as a matter of fact that around 80% of the households in the town are not accessible by 3m wide road. The main roads are

narrow and only two-wheelers ply on it. There are no access roads to most of the households, they are accessible only through stairs. So accessibility is a big problem in this town

1.2 Overview- Water and Sanitation

1.2.1. Water Supply

Devprayag Nagar Palika has 3 borewells which serves as the main sources for drinking water supply. There are no WTPs in the city. However, water from borewells is supplied to households after chlorination. All the establishments in the town have piped water supply with an average water supply of 135lpcd.

1.2.2. Solid waste

Currently, an estimated 600 kg of Municipal Solid Waste is generated of which 70% is wet waste, 20% is recyclable waste and 10% is inert waste. 100% door to door collection of solid waste is being done in all 4 wards. The waste is collected through pushcarts and rickshaws from 630 gates (collection points). The collected waste is then segregated, composted and stored at Koodaghar in ward no.2. A solid waste management processing plant is under construction in Velivand area which is situated on NH58 and is 300m away from Alaknanda river.

1.3 Wastewater(WW), Faecal Sludge and Septage Management(FSSM)

Devprayag has been declared as Open Defecation Free (ODF) town. The state government notified FSM Protocol for Septage Management G.O. No. 597/IV(2) UD2017-50 (Sa)/16 dated 22nd May 2017. The objective of the protocol was to streamline FSM operations in the State. The protocol was developed by Urban Development Department, Uttarakhand in consultation with the stakeholders. As per the protocol, all cities shall constitute Septage Management Committee (SMC) for implementation of septage management activities. Septage Management Committee has been formed in Devprayag with members as prescribed in the Septage Management Protocol and there have been two meetings conducted in this regard. In brief, conclusion of the meetings was to plan to connect as many households as possible to the sewerage network and provide septage management services to the remaining households in a sustainable manner.

In the areas served by sewerage network, grey water is being disposed off through sewerage and in the rest of the areas grey water is disposed off through open-drains. The grey water conveyed through the sewerage is treated at STP and that passing through the open drains ends up in the natural water bodies without any treatment.



1.4 MLD Soil Based Technology STP

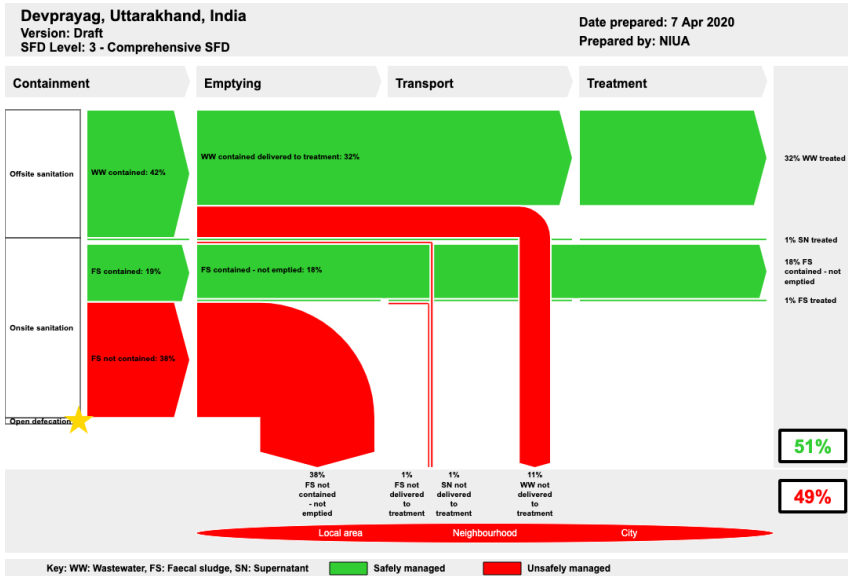


150 KLD Sequential Batch Reactor STP



1.4 MLD Soil Based Technology STP

To understand and map the excreta management of the city along the sanitation service chain, a comprehensive level Shit Flow Diagram (SFD) is prepared. The relevant data for preparation of SFD is collected and triangulated through field-based survey conducted in 50 households, key informant interviews (KII) and focus group discussions (FGDs) with municipality officials, Jal Sansthan and Jal Nigam officials, desludgers, masons and STP operators in February 2020.



1.3.1. Containment

- There are 642 households and all the households have access to Individual Household toilet.
- There are no slums and no community toilets in the town.
- As per the discussions with the ULB officials, sewerage mains have been laid and STPs have been constructed. The process of providing sewerage connections is underway at a swift pace.
- The ULB and the Peyjal Nigam have identified 112 establishments whose toilets cannot be connected with the sewerage network because of various reasons including being away from the network or lying below the sewerage line.
- As per the ULB and Peyjal Nigam officials, as on date. 56% households have sewerage connections, 26% HHs dependent on lined tank with open bottom, 12% HHs on septic tanks, and 6% HHs on fully lined tanks.
- There are eight public toilets, four of which are functional, wherein two are connected to sewer and other two are connected to septic tank and the rest are being considered for renovation.
- There are 13 hotels, resorts and rest houses in the town that cater to the pilgrimage tourist population of the town, all of which except one is connected to septic tanks.

1.3.2. Emptying

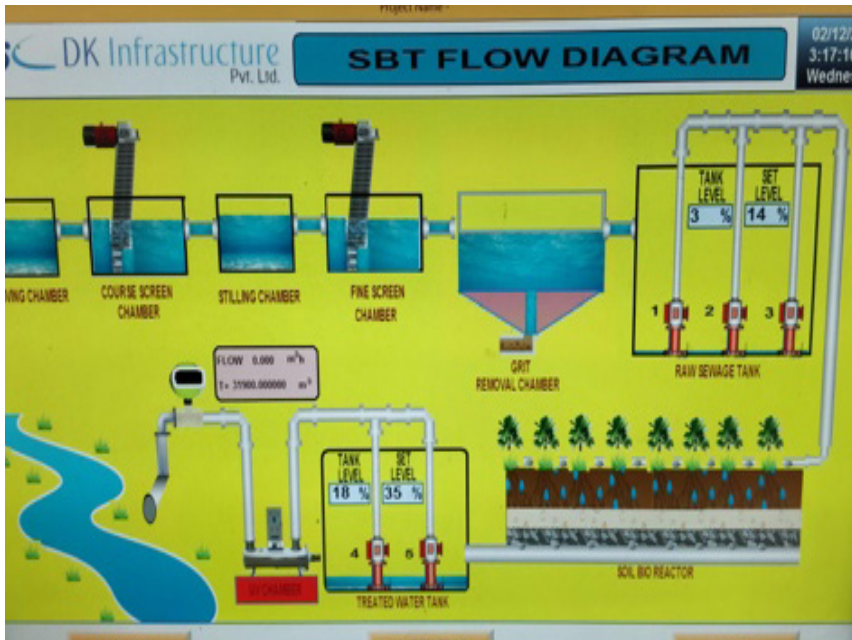
- Based on the field based study, it was found that about 20% HHs with onsite containments have never emptied their systems.
- Predominant method of desludging has been manual desludging wherein the dried sludge is emptied using buckets and put in a freshly dug pit nearby and later covered with soil. This is due to inaccessibility as well as lack of availability of desludging operators in the town.
- Few toilets which cannot be connected to the sewer because of gradient issues have been provided with pumps in the containment to pump the wastewater from tank to the sewer.
- Some households abandon the containment once it is filled up and prefer to construct a new containment for sustaining toilet usage.

1.3.3. Transport

- There are no cesspool vehicles either owned by government or private players located in the town. Cesspool operators if required can be called from nearby towns on demand.

1.3.4. Treatment

- The quantity of wastewater generated is approximately 3.3 MLD and the quantity of faecal sludge generated is 1 KLD.



Treatment process of SBT based STP



Public Toilet Complex

- There are three Sewage Treatment Plants (STPs) in Devprayag, all of them built by Uttarakhand Peyjal Nigam out of which, two are currently operated and maintained by Peyjal Nigam itself and one by Uttarakhand Jal Sansthan.
- Bah Bazaar STP has a capacity of 1.4 MLD which is based on Soil Based Technology (SBT) and the capacity of STP at Shanti Bazaar and Sangam Bazaar is 75 KLD and 150 KLD based on Sequential Batch Reactor technology (SBR).
- Bah Bazaar STP has a utilization capacity of 4%, Sangam bazaar STP 87% and Shanti bazaar STP 40%.

1.3.5. Disposal and Reuse

- The treated wastewater is tested for its quality which are consistently found to be within the CPCB prescribed effluent discharge standards.
- The treated wastewater is let off into the river and the sludge is used for gardening within the STP premises.

1.4 Assumptions

Following assumptions were taken while preparing the SFD for Devprayag town:

1. Floating Population:

As per KII, Devprayag NPP receives almost 2,000 floating population per day during peak season (from May to October). Thus, the design population of the city becomes 5,059 (3059+2000). The floating population depends on 13 hotels and rest houses (having about 175 rooms which are 100% full during peak season) and 4 functional public toilets.

2. Containment, emptying and treatment:

Maximum emptying frequency for septic tank has been considered to be four years, for fully lined tank one year and for lined pit with semi permeable walls and open bottom, thus containment system emptying beyond stipulated duration are considered under containment damaged or collapsed category

Based on the study, it was found that more than 20% of these septic tanks and lined pit with semi permeable walls and open bottom systems are being emptied beyond their stipulated time and hence such systems have been considered under category of 'containment damaged or collapsed' in SFD. Containment systems which are reported as fully lined tanks during field based study are considered damaged as their frequency of emptying is found beyond one year.

3. Risk of ground water:

As majority of the households are situated much above the river and river bed and water is supplied through municipal supply, the overall risk to ground water was calculated to be low in town but cases with open bottom containments, risk to ground water was considered significant.

1.5 Budget and funding

The total income of Devprayag Municipal Council in the year 2018-19 was approximately 3.42 crores from tax revenue, rents, fees, user charges, schemes and grants. The total expenditure for the same period was approximately 3.36 crores. The main sources of funds for sanitation are from Swachh Bharat Mission and National Mission for Clean Ganga.

1.6 Action plans and Way forward

- As evident from the study, as on date Devprayag has 44% households connected to onsite sanitation systems for which the Uttarakhand Pey Jal Sansadhan Vikas Evam Nirman Nigam is trying to connect with the sewerage. 112 household toilets have been identified which cannot be connected to sewer network due to gradient problems. For such households the Nigam is trying to provide them with pumps which can transport the septage from tank to the nearest point in the sewer.
- As 80% of the households cannot be accessed by a 3m wide road, cess pool vehicles will not be in a position to reach them to empty their onsite containment. Hence, it is proposed that the Nigam plan to connect all the toilets with sewerage either conventionally or in the method mentioned above.
- Devprayag has three STPs among which Bah Bazaar STP is running under-utilized at just 4% capacity. Faecal sludge emptied by cess pool operators if any can be discharged into designated manholes of Bah Bazaar STP after testing the compatibility of cotreatment with sewage at the plant to avoid operational problems as the STP are not designed for treating faecal sludge.

2. References

- 1.IND: Uttarakhand Emergency Assistance Project Subproject : Devprayag Water Supply System
- 2. City Sanitation Plan Devprayag, prepared by GIZ

3. Officers Contacted

| Name | Designation | Department | Contact Details | Information Collected |
|-------------------------|----------------------------|---------------------------------|-----------------|--|
| Mr. Rajiv Saini | Executive Engineer | Uttarakhand Jal Sansthan | 9897598019 | Water supply and STP details |
| Mr. Amit Singh | Assistant Project Engineer | Uttarakhand Peyjal Nigam | 7895199246 | Sewerage and and STP details |
| Mr. Balwant Singh Bisht | Executive Officer | Nagar Palika Parishad Devprayag | 9412407363 | Sanitation overview, Toilet accessibility and budget details |

Bhowali



Public Water Taps installed by Jal Sansthan

1. Bhowali

1.1 City Profile

Bhowali is a Municipal Council or Nagar Palika Parishad (NPP) in the Nainital district of Uttarakhand. It is also known as a health resort during the pre-independence era due to its salubrious climate and rejuvenating environs. As per census 2011, there are 1411 households and 6308 people living in 7 wards of the city. In 2018, the municipal boundaries were extended by including 3 nearby villages into Bhowali municipal council. As per the records available at ULB office, the current population of the city is 8457 and the number of households is 2237. The average number of persons per household is 5. This city has an area of 6.78 sq km.

1.1.1. Location and Connectivity

Bhowali is located at 29.38°N 79.52°E at an altitude of 1654 m amsl. Bhowali is a gateway to many places in the Kumaon division like Almora and Bageshwar for people coming from the Haldwani route. Many Lakes neighbor Bhowali like Bhimtal, Saat tal, Naukuchiatal, Nal Damyanti Tal, Sukha Tal, and Khurpa Tal. It is situated at a distance of approximately 300 km from the state capital Dehradun and 13 km from the district headquarters Nainital. The Himalayan mountain range borders the northern area of this city. Bhowali's strategic location has led to its popularity among tourists and also as a point of junction of Nainital District.



1.1.2. Geography and Climate

Bhowali constitute a part of the Lesser Himalaya with topography having series of ridges and small spurs. Latitudinally, this area belongs to sub-tropical part but altitudinally it has the characteristics of the sub-temperate climate. The rock belt is made of Crystalline and Metamorphic rocks. Climate here is warm and temperate with mean annual temperature of 12.5°C and mean monthly min and max temperature range from 2°C to 13°C in the month of January and 15°C to 25°C in the month of May. The rainy season usually commences by the middle of June to September and on an average the city receives 1671mm of rainfall every year.

Soil of Bhowali region is classed under mountainous region soil. Soil here have good retentive capacity for moisture due to their parent rock material-crystalline and metamorphic and are good arable land though the depth of the soil is very thin.

1.1.3. Accessibility

Based on the homogeneity in altitude, Bhowali is divided into six physiographic units namely Valley plain, Subdued hills, Steep high hills, Level area, Valley and Valley bottom¹. Considering the topography of the city, Bhowali faces challenges when it comes to accessibility. More than 60% households have pucca roads with road width 3 metres and above which allows households to be accessible by cess pool operators.²

1.2 Overview- Water and Sanitation

1.2.1. Water Supply

Bhowali NPP has 4 borewells serving as the main source of water supply. There are no WTPs in the city and water is disinfected by chlorination process before supplying to HHs. 85% of households in the city have water supply coverage by Jal Sansthan.³ Rest of the HHs are dependent on natural streams, community handpumps/ water-taps installed by Jal Sansthan and individual bore wells for drinking water. Average water supply in the city is 120 lpcd.

1.2.2. Solid waste

As per the Swachh Survekshan report prepared by the ULB, 2 TPD waste is generated and collected in the city out of which 0.8TPD is dry waste and 1.2 TPD is wet waste. Out of total waste generated 1.8 TPD is disposed safely. According to the same source, door to door collection and source segregation of solid

¹(R C Joshi, 2018)

²Key Informant Interview, Srinagar Nagar Palika

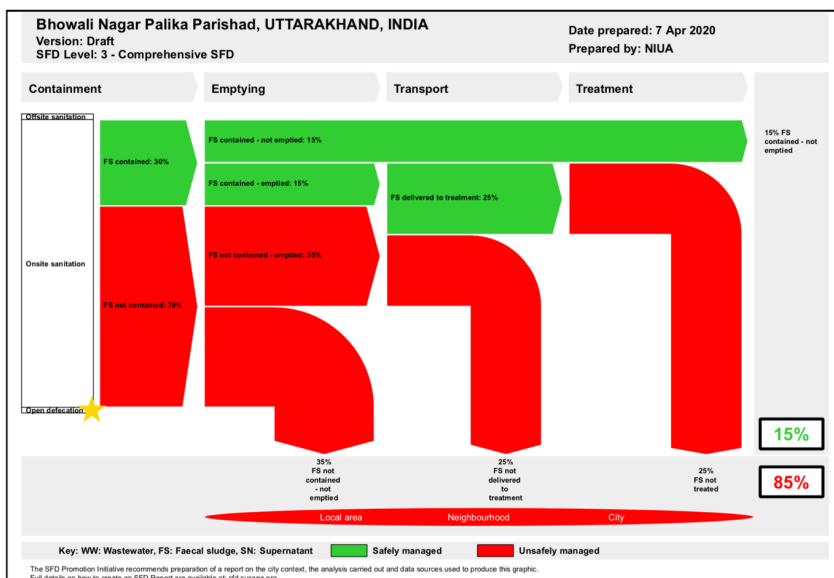
³Service Level Benchmarks, Srinagar 2018-19

waste is done in all 7 wards. There are total 2 vehicles collecting waste from 8 gates (collection points) in the city covering all the wards. Collected waste is then dumped at the designated dumping sites in Haldwani city which is 36 Kms from Bhowali.

1.3 Waste Water (WW) and Faecal Sludge and Septage Management (FSSM)

The state government notified FSM Protocol for Septage Management G.O. No. 597/IV (2)UD2017-50 (Sa)/16 dated 22nd May 2017. The objective of the protocol was to streamline FSM operations in the State. The protocol was developed by Urban Development Department, Uttarakhand in consultation with the stakeholders. As per the protocol, all cities shall constitute Septage Management Committee (SMC) for implementation of septage management activities. Currently, in Bhowali, the SMC has not been formed. Since the entire city is unserved in terms of sewerage network, the grey water is disposed-off through open drains leading to the natural water bodies of the city. The total wastewater generated in the city is approximately 0.8 MLD while the faecal sludge generation is around 3.3 KLD.

To understand and map the excreta management of the city along the sanitation service chain, a comprehensive level Shit Flow Diagram (SFD) is prepared.



The service outcomes of the sanitation service chain are analyzed below: -

1.3.1. Containment

- There are 2237 households and all the households have access to Individual Household toilets. There are 5 slums in the city having 226 households in total and there are no community toilets in the city. There are 7 public toilets having 19 seats for males and 13 seats for females, which are connected to septic tanks.
- As per the ULB records, there is no sewerage connection in the city and the entire city is dependent on-site sanitation systems.
- Containments are dominantly rectangular and square in shape across the city and have varying sizes. Length and breadth varies between 3ft to 15ft. Depth may vary between 3ft to 10ft.
- Through key informant interviews (KII) and focus group discussions (FGDs) with municipal officials, 50 households, masons, households dependent on different types of onsite sanitation systems are estimated: –
 - 16% HHs are dependent on septic tanks connected to soak pits.
 - 16% HHs have lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a ‘significant risk’ of groundwater pollution.
 - 14% households are connected to lined pit with semi-permeable walls and open bottom; households which are at up-hills or having a properly designed lined pits emptying at regular intervals, considered there is a low risk of groundwater contamination.
 - 54% HHs are dependent on Containment (fully lined tanks, partially lined tanks and pits, and unlined pits) failed, damaged, collapsed or flooded - with no outlet or overflow and rest.
- Open defecation is not practiced in the city.

1.3.2. Emptying

- Predominant method of emptying has been manual desludging wherein the dried sludge is emptied using buckets and put in a freshly dug pit nearby and later covered with soil.
- Nowadays, private cesspool operators are called from nearby Haldwani city on demand which is 30 km away from Bhowali city.

1.3.3. Transportation

- There are no cesspool vehicles either owned by ULB or private players located in the city. Cesspool operators are called from Haldwani on demand by house owners individually.
- Cesspool tankers from Haldwani are mostly tractor mounted vacuum tankers with 3 KL capacity.



: HHs discharging grey water into open drains



HHs discharging grey water into open drains

- The emptying charge is approximately Rs.6000/- per service.
- Faecal sludge emptied by vacuum tankers is disposed into sewer manholes in Haldwani city.

1.3.4. Treatment

- There is no STP within the city boundary of Bhowali NPP.
- Surveying is undergoing across the ULB for preparation of a sewerage plan for Bhowali city.

1.3.5. Disposal/ Reuse

- The faecal sludge emptied directly into the sewer manhole in Haldwani city, which further enters into Gaula river without treatment as there is no STP or FSTP present in the city. Currently, Haldwani city has sewerage network laid in almost 15%-20% of the total city but does not have any STP facility yet.
- In cases of manual desludging, faecal sludge is commonly disposed in some natural water body/ streams/ storm water drains, open ground or put in a freshly dug pit nearby and later covered with soil.
- Currently, the faecal sludge and wastewater are neither treated nor being reused.

1.4 Assumptions

Following are the assumptions considered while preparing the SFD for Bhowali city:

1. **Population:** As per KII, Bhowali Nagar Palika Parishad receives almost 1600 floating population on any peak day during tourist season of 4 months (mid-April to mid-August) since it serves as a transit point for tourists travelling to Ramgarh, Haldwani, Mukteshwar, Bhimtal, Almora, Ranikhet, Bageshwar and Nainital. Thus, the total population of the city becomes 10057 (8457+1600).

2. **Waste Water:** As per KII, water supply in the city is 120lpcd. Assuming total waste water generated is 80% of total water supply, it is coming out to be 0.8 mld.

3. **Containment, emptying and treatment:** The average desludging frequency of the containments is around 15 years, although in cases with fully lined tank without any overflow outlet it is assumed to be 1 year and septic tanks desludging frequency to be 5 years, thus containment system emptying beyond stipulated time are considered under containment damaged or collapsed category.

As the proportion of faecal sludge emptied by vacuum tankers and individual households by themselves are unknown, hence it is assumed that 50% of FS is transported and discharged into sewers



Public Hand Pumps installed by Jal Sansthan

⁴ CGWB, 2015-16

4. **Risk of ground water:** Average water level of across city is greater than 15 m bgl⁴. 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 resulting into low risk to lateral separation. 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.

Thus, overall risk to ground water contamination is estimated to be low in Bhowali but in case of containment type - lined pit with semipermeable walls and open bottom, 50% of the households are considered at low (i.e.15%) and 50% is considered at significant risk.

1.5 Budget and Funding and Proposed Projects

There is no fixed annual budget for sanitation in Bhowali NPP. Although approximately Rs.70 lakh is spent on salaries of sanitary workers like door to door waste collectors, contractual sanitation workers, street sweepers and on procurement of essential supplies for sanitation. Jal Nigam is currently conducting a HH survey to plan for sewerage network across the city.

1.6 Action plans and Way forward

- ULB shall prepare a City level strategy on FSSM including decentralized liquid waste management; DWWTs are suitable for residential colonies, Hotels and Institutions generating >10 KLD ww and having >500 sq.m. of green space.
- As evident from the study, 100% of the households in Bhowali are connected to onsite sanitation systems. Approximately 54% households are dependent on collapsed or damaged types systems which may contaminate the groundwater if not desludged regularly. Moreover, such systems should be retrofit with improved systems like septic tanks and properly designed twin pit systems as per IS code recommendations.
- Bhowali has no STP within the city. Currently, faecal sludge is transported to Haldwani city and is discharged into designated manholes. Thus, ULB can think of a cluster level approach to treat the septage at Haldwani STP or in a dedicated FSTP in Haldwani
- It is estimated that 3.3 kld of faecal sludge is generated in the city. Co-treatment of FS with sewage can be a viable option. Areas within a radius of 10–12 km of an STP can potentially bring their FSS to be co-treated in the STP.
- Based on the current FS generation, the ULB would require one vacuum tanker of 3KL capacity. The private operators can used for their emptying service to meet the requirement.

- Co-composting of treated faecal sludge with municipal solid waste would provide a solution for FSM and manure produced from composting can be used in agriculture.

2. References

- CGWB. (2015-16). Ground Water Year Book.
- R C Joshi, M. S. (2018). Physico-Chemical Characteristics of Soil in Bhimtal Gadhera Catchment Kumaun Himalaya, Uttarakhand. JETIR.
- SLB-Performance Grant Report. (2019-2020). Bhowali: Nagar Palika Parishad.

3. Officers Contacted

| Name | Designation | Department | Contact Details | Information Collected |
|-------------------|-------------|--------------|--------------------|---|
| Mr. Ishwar Rawat | E.O. | Bhowali NPP | 9411544917 | ULB Data & City Sanitation Information |
| Mr. Surya Prakash | A.E. | Jal Nigam | eeed.btl@gmail.com | Water and Sanitation Details |
| Mr. B.C. Pal | A.E. | Jal Sansthan | 9412034539 | Information related to water and sanitation |

New Tehri



1. New Tehri

1.1 General City Information

Tehri is a Nagar Palika (Municipal Council) in Uttarakhand, India. It is the district headquarters of Tehri Garhwal district. The current population of the town is 19,794 and the number of households is 4,284. As per the census 2011, the total population was 24,014 and the number of households was 6,125. The decrease in the population is due to external migration owing to relocation of some families to other districts and outward migration of construction workers after the dam and township project was completed.

Tehri also known as New Tehri, was planned to accommodate people of Old Tehri town which got submerged after the construction of Tehri dam, one of India's highest dam. Old Tehri was completely vacated in 2004 and people were relocated to New Tehri as well as some other locations in Dehradun and Haridwar districts. Old Tehri was located in the valley but New Tehri is developed atop overlooking the reservoir.

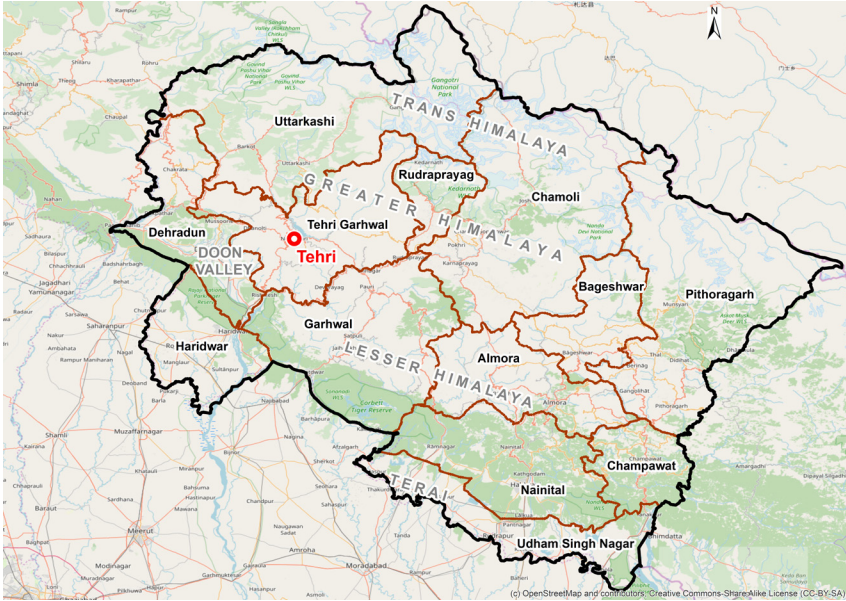
There are 11 wards in the town. Ward number 1 is right next to the reservoir also known as Suman Sagar Lake also where Old Tehri is submerged. Ward number 1,2 and 3 predominantly houses Tehri Hydro Development Corporation India Ltd. (THDC). Ward numbers 4 to 6 has residences along with main market, temple, mosque and gurudwara. Ward no. 7-9 has both private residences and government quarters. Ward no. 10 and 11 have predominantly government offices including District Magistrate and allied offices.

The town was initially planned over 200 acres of naturally terraced slopes, valleys and dome shaped formations cascading down to a flat terrace. There is one major curvilinear spine. A low rise medium density compact pattern of development can be observed in the whole town with 2-3 storey form of development. Most of the educational and institutional buildings are located in the higher terraces away from residential clusters. There are some large open spaces in the heart of the town that are used as public spaces for meetings, gatherings and recreational activities. Almost 50% of the households in the town are government quarters where employees of THDC, Central Industrial Security Force, District Administration and Town administration and other government offices live. Tehri being a planned town has more than 80% of households accessible by more than 3m wide road.

1.1.1. Location and Connectivity

The town is located at 30.3739°N and 78.4325°E in Lesser Garhwal Himalaya belt on a ridge at an elevation of 1750m above msl. The area of the town is 37.06 sq.km. It is located at a distance of 100 km from state capital Dehradun.

The town is situated on the banks of river Bhagirathi. River Bhilangana also confluences with river Bhagirati near the town.



1.1.2. Geography and Climate

The soils of the study area are basically the product of fluvial process of the river Bhagirathi and its tributaries (Bhilangana, Balganga etc.). The alluvial soil of the area is dry, porous, sandy, faint yellow and consists of clay and organic matter. Soils of the area are slightly acidic. January is the coldest month whereas temperature becomes highest usually during June. Rainfall, in the study area, occurs almost throughout the year. Maximum rainfall is recorded during the monsoon period i.e. from July to September. There is slight decrease in rainfall from December till March. Rest of the year rainfall is quiet low.

1.2 Overview- Water and Sanitation

1.2.1. Water Supply

Tehri municipal council receives water from Tehri dam reservoir. All the establishments in the town have piped water supply with an average water supply of 135 lpcd. People also fetch water from natural sources like springs and natural streams for drinking purposes.

1.2.2. Solid waste

As per City Swachhatha Plan of the city, 12 TPD of Municipal Solid Waste is generated of which 70% is wet waste, 20% is recyclable waste and 10% is inert

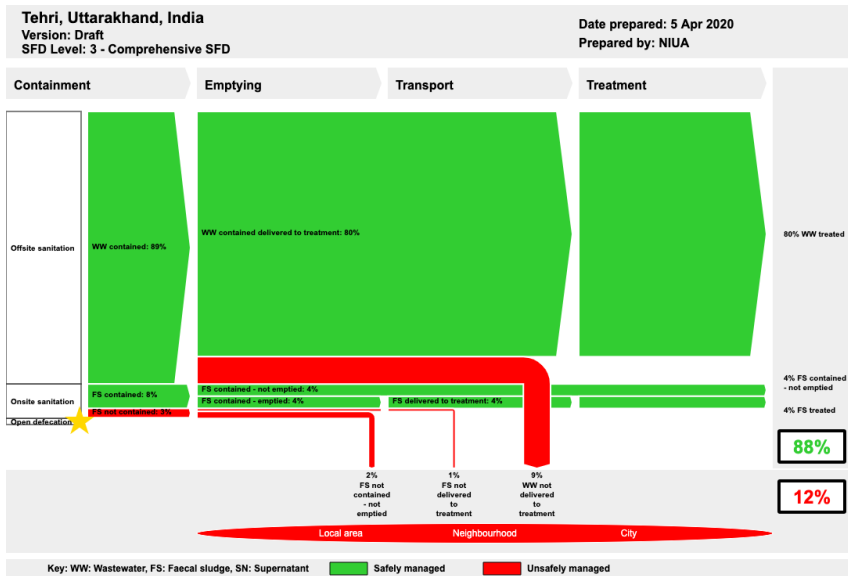
waste. 100% door to door collection of solid waste is done in all 11 wards. The waste is collected through push-carts and rickshaws from 6125 gates (collection points). The collected waste is then segregated, composted and compacted at Solid Waste Processing and Disposal site located in Mukri which is about 19 km away from the town.

1.3 Wastewater (WW), Faecal Sludge and Septage Management(FSSM)

Tehri has been declared as Open Defecation Free (ODF) town. The state government notified FSM Protocol for Septage Management G.O. No. 597/IV(2) UD2017-50 (Sa)/16 dated 22nd May 2017. The objective of the protocol was to streamline FSM operations in the State. The protocol was developed by Urban Development Department, Uttarakhand in consultation with the stakeholders. As per the protocol, all cities shall constitute Septage Management Committee (SMC) for implementation of septage management activities. There is no Septage Management Committee (as per the state septage protocol) formed in the town and the establishment of same is in progress.

Greywater generated in the town and disposed of along with sewage in the sewerage network of the town and there are no open drains in the town.

To understand and map the excreta management of the city along the sanitation service chain, a comprehensive level Shit Flow Diagram (SFD) is prepared.



The SFD Promotion Initiative recommends preparation of a report on the city context, the analysis carried out and data sources used to produce this graphic. Full details on how to create an SFD Report are available at: sfd.susana.org

The relevant data for preparation of SFD is collected and triangulated through field-based survey conducted in 50 households, key informant interviews (KII) and focus group discussions (FGDs) with municipality officials, Jal Sansthan and Jal Nigam officials, desludgers, masons and STP operators in February 2020.

1.3.1. Containment

- There are 4284 households and all the households have access to individual household toilets.
- 89% households have sewerage connections, 8% are connected to community septic tanks and 3% have damaged fully lined tanks. There are no slums and no community toilets in the town. Action plan is being drawn to connect the remaining households to the sewerage network as well.
- It was observed during field based study that in the Kemsari Tinshed colony which have around 40 households, the toilets and containment systems are in damaged conditions. Some containments are leaking and some are being manually emptied.
- There are 17 public toilets with a cumulative total of about 60 seats. 3 public toilets with 5 seats are connected to septic tank and rest are connected to sewerage.

1.3.2. Emptying

- The average desludging frequency of the community septic tank is 1 year.
- Tehri Hydro Development Corporation owns a desludging vehicle with a capacity of 3000l which empties the community septic tanks and transport it to the STP for co-treatment.
- Households in the Tinshed colony manually desludge their containment system with buckets.
- Uttarakhand Jal Sansthan also owns a cesspool vehicle with a capacity of 3000l.

1.3.3. Transportation

- The Uttarakhand Jal Sansthan office as well as THDC own a desludging vehicle each, which helps in emptying and transporting faecal sludge for treatment.
- The cesspool operator charges INR 10,000 from HHs that includes INR 2000 as tipping fee (paid to Jal Sansthan) for discharging into Tehri STP.
- There is no private registered desludging vehicle in the town.

1.3.4. Treatment

- It is estimated that quantity of faecal sludge generated is 0.9 KLD.
- There is one Sewage Treatment Plant (STP) in Tehri built by Uttarakhand Peyjal Nigam and currently being operated by Uttarakhand Jal Sansthan located at Bhagiratipuram in ward no.3 which is around 15 km from the town centre.



- The capacity of the plant is 5 MLD based on Aerobic Sludge Process (ASP) technology and receives approximately 2.5 MLD of wastewater, thus utilization capacity is around 50%.
- The STP receives faecal sludge from the nearby town of Chamba on an average thrice a month and from THDC once in six months.
- The faecal sludge is currently discharged into a designated manhole thus undergoes for co-treatment of faecal sludge at the STP.

1.3.5. Disposal/ Reuse

- The treated waste water is tested for its quality which has been consistently found to be within the NGT prescribed effluent discharge standards.
- The treated wastewater is let off into the river and the dried sludge is used for gardening within the STP premises and also for agricultural purposes by farmers.

1.4 Assumptions

Following assumptions are taken while preparing the SFD for Tehri town:

1. Floating Population:

As per SWM DPR, Tehri town is expected to receive 3,29,130 tourists in 2020 which comes up to 902 tourist per day. Tourist arrive throughout the year specially to see the reservoir. Thus, the design population of the city becomes 20,696 (19794+902).

2. Containment, emptying and treatment:

Maximum emptying frequency for septic tank has been considered to be four years, for fully lined tank one year and for lined pit with semi permeable walls and open bottom, thus containment system emptying beyond stipulated duration are considered under containment damaged or collapsed category.

As the proportion of faecal sludge emptied by vacuum tankers and individual households by themselves are unknown, hence it is assumed that 50% of FS is delivered to treatment plant.

Containment systems which were reported as fully lined tanks during field based study are considered damaged as their frequency of emptying is found beyond one year.

3. Risk of ground water:

Average water level across the town is greater than 15 m below ground level. Considering rock type in unsaturated zones is coarse sand and gravels, vulnerability of the aquifers was found to be at significant risk.

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 causing significant risk to lateral separation. 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.

Thus, overall risk to ground water was estimated to be low in Tehri municipal council area.

1.5 Budget and funding

The total income of Tehri municipal council in the year 2018-19 was approximately 11.18 crore rupees from tax revenue, rents, fees, user charges, schemes and grants. The total expenditure for the same period was approximately 10.61 crore rupees. The main sources of funds for sanitation are from Swachh Bharat Mission and National Mission for Clean Ganga.

1.6 Action plans and Way forward

- ULB shall prepare a city level strategy on FSSM including decentralized liquid waste management
- As evident from the study, Tehri has 3% households connected to onsite sanitation systems which are damaged, such systems should be retrofit with improved systems like septic tanks and properly designed twin pit systems as per IS code recommendations.
- ULB should formulate an effective financial support mechanism for retrofitting of faulty containments.
- Tehri has one STP with utilization capacity of around 50%. Faecal sludge

emptied by cess pool operators is being discharged into designated manholes. It is necessary to test the compatibility of cotreatment with sewage at the plant to avoid operational problems as the STP is not designed for treating faecal sludge.

- It is estimated that 0.9kld of faecal sludge is generated in the city. With the current capacity of STP (total 5 MLD with 50% utilization), co-treatment of FS with sewage could be a feasible option.
- Co-composting of treated faecal sludge with municipal solid waste would provide a solution for FSM and manure produced from composting can be used in agriculture.

2. References

- 1.SWM Master Plan New Tehri
- 2. Detailed Project Report for Bhagiratipuram 5MLD, ASP Sewage Treatment Plant, Tehri

3. Officers Contacted

| Name | Designation | Department | Contact Details | Information Collected |
|------------------------|--------------------|------------------------------|-----------------|------------------------|
| Mr. Ashish Topwal | Sanitary Inspector | Nagar Palika Parishad, Tehri | 9058324272 | Sanitation information |
| Mr. Rajendar Sajwan | Executive Officer | Nagar Palika Parishad, Tehri | 9411185348 | City information |
| Mr. Mahavir Singh Rana | Assistant Engineer | Uttarakhand Jal Sansthan | 9411719344 | STP Details |

Haldwani



Cesspool operator emptying septic tanks

1. Haldwani

1.1 General City Information

Known as the ‘Gateway of Kumaon’, Haldwani is the third most populous city in the state Uttarakhand. It is a Nagar Nigam in Nainital district. The city of Haldwani along with its twin township of Kathgodam forms the Haldwani-Kathgodam Municipal board in the Nainital district of Uttarakhand.¹ There are 60 number of wards in the city. The total population of the city according to Census 2011 is 2,01,46² which increased after delimitation of boundaries to 2,80,604. There are 53,962 households within municipal boundary according to the data provided by the municipality; this suggests the average household size in the city to be 5.2. The city has 22 notified slum settlements. The geographical area of the city is 42 km square.³

1.1.1. Location and Connectivity

Haldwani lies between 29.22°N latitude & 79.52°E longitude.⁴ Haldwani is well connected through road networks. It is connected to the country’s capital Delhi via buses and railway easily. The connectivity to state capital Dehradun is also good. Haldwani is at an average elevation of 432 m above msl. The drainage of the area is mainly controlled by Gaula River, as it is located on its right bank.⁵

Figure 1: Location of Haldwani



¹ euttaranchal.com

² Census, 2011

³ Key Informant Interview, Haldwani Nagar Nigam

⁴ Latlong.net

1.1.2. Geography and Climate

The climate here in Haldwani city is mild, and generally warm and temperate. The average temperature in the city is 22.8 °C, with June being the hottest month has an average temperature of 29.6 °C and with an average temperature of 13.9 °C January is the coldest month of the year. Haldwani receives an average rainfall of around 2095 mm per year, precipitation is lowest in November with an average of 5 mm and with an average of 649 mm, July receives the highest rainfall in the city.⁶

The rock formation is mainly comprised of poorly sorted unconsolidated sediments viz, cobbles, boulders, gravel, pebbles, sand and silt with intervening clay layers. The soils here are natural, dynamic, heterogeneous, non-renewable resource, which support plant and animal life. The soils have developed from rocks like granite, schist, gneiss, limestone, phyllites, shales, slate, sand stone etc. under cool and moist climate.

1.1.3. Accessibility

Based on KII and primary survey, maximum parts of the city have roads more than 3 meters right of way which is easily accessible to cess pool operators for desludging.

1.2 Overview- Water and Sanitation

1.2.1. Water Supply

Haldwani NN has around 40 tube wells in the city which caters to 40% water demand in the city. The city has five WTP's with a capacity of 32.5 MLD & remaining 60% demand is met through 32 MLD water from Gaula River that is treated in the WTPs.⁷ Average water supply in the city is 134 lpcd.⁸

1.2.1. Solid waste

As per the ULB sources there is 100% door to door collection, Nagar Nigam collects waste from 26 wards and the remaining 34 wards are covered by a private party contractor. Source segregation of solid waste is being done at designated Material Recovery Facilities. Collected waste is dumped at an unscientific landfill, Gaula Rokhar which is at Gaula by-pass Road near Indira Nagar in the periphery of the city.⁹

⁵ Key Informant Interview, Haldwani Nagar Nigam

⁶ <https://en.climate-data.org/asia/india/uttarakhand/haldwani-4074/>

⁷ Key Informant Interview, Haldwani Nagar Nigam

⁸ Service Level Benchmarks, Haldwani 2018-19

⁹ Key Informant Interview, Haldwani Nagar Nigam

1.3 Waste Water, Grey Water, Faecal Sludge and Septage

- Around 10% Sewerage network has been laid in the city but there is no existing sewage treatment plant (STP) in Haldwani. In order to treat the sewage from existing sewerage network, a STP of treatment capacity 28 MLD is to be commissioned in the city by 2021 and due to absence of any treatment facility, sewage is going into the Gaula river at the end. There is another project of approx. Rs. 300 crores by Asian Development Bank that is in its planning phase for extending sewer network in the new areas added to the city after delimitation¹⁰. The town has been declared and certified ODF.¹¹ There are 32 public toilets and no community toilets in Haldwani NN and all public toilets are connected to septic tanks.¹²
- The state government notified FSM Protocol for Septage Management G.O. No. 597/IV (2) UD2017-50 (Sa)/16 dated 22nd May 2017. The objective of the protocol was to streamline FSM operations in the State. The protocol was developed by Urban Development Department, Uttarakhand in consultation with the stakeholders. As per the protocol, all cities shall constitute Septage Management Committee (SMC) for implementation of septage management activities. Currently, in Haldwani NN, the SMC has been formed. The total wastewater generated in the city is approximately 31 MLD while the faecal sludge generation is around 110 KLD.



Open drains for grey water



Tractor mounted cesspool vehicle

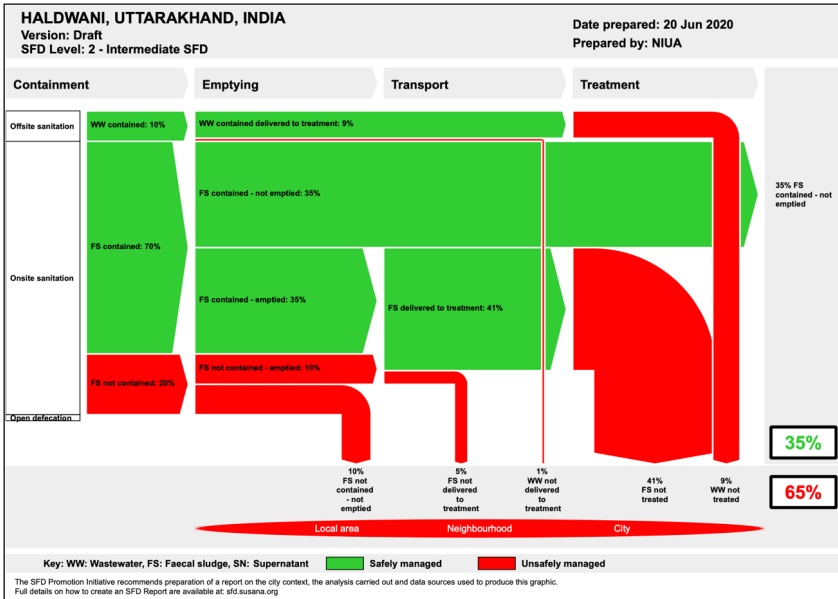
¹⁰Key Informant Interview, Haldwani Nagar Nigam

¹¹Key Informant Interview, Haldwani Nagar Nigam

¹²Key Informant Interview, Haldwani Nagar Nigam

To understand and map the excreta management of the city along the sanitation service chain, a comprehensive level Shit Flow Diagram (SFD) is prepared.

SFD



1.3.1. Containment

- There are 53,962 households and all the households have access to Individual Household toilet. There are 22 notified slums in the city with very poor sanitation infrastructure.¹³ As per the Swacchta Survekshan 2020, the city has approximately 10% sewerage network coverage and that is in the older part of the city and remaining households are dependent on on-site sanitation systems.¹⁴ Presently there are plans running parallelly to extend the sewer network to the old as well as new areas of the city. The total faecal sludge generated is estimated to be 110 KL per day in the city.
- Through key informant interviews (KII) and focus group discussions (FGDs) with municipal officials, households and cesspool operators, different types of onsite sanitation systems are estimated: –
- 50% of the total HHs are dependent on septic tanks connected to soak pits. The tanks which two chambers and connected to soak pit with emptying within 5 years are considered septic tanks containment systems in the SFD graphic

¹³Key Informant Interview, Haldwani Nagar Nigam

¹⁴Service Level Benchmarks, Haldwani 2018-19

¹⁵Swachh Survekshan 2020



Wastewater through sewer lines flowing to Gaula river



Slum area near Haldwani railway station having no Community toilet

- 10% HHs are connected to sewer networks¹⁵
- Approximately 16% and 24% of the overall households have their toilets connected to fully sealed tanks and circular lined pit with semi-permeable walls and open bottom respectively. Fully lined tanks are single chamber tanks with no outlet overflow are considered for SFD graphic. Lined pit with semi-permeable walls and open bottom are the circular tanks either single or double, these tanks are made up of precast cement rings or masonry work with open bottom
- Open defecation is not practiced in the city

1.3.2. Emptying

- The average desludging frequency of the containments is 4-5 years.
- Predominant method of desludging is through vacuum tankers.
- There are around 16 private cesspool operators available in the town. However, none of them are registered at the ULB office.¹⁶

1.3.3. Transportation

- Greywater generated from households dependent on onsite sanitation systems is carried through open drains
- There are no cesspool vehicles owned by government but there are a number of private players doing the desludging in the town.
- Approximate charge for emptying ranges from Rs. 3000 to 4000 per service.

¹⁶FGD with local cesspool operators



Designated sewer manhole for cesspool desludge septage operators to

1.3.4. Treatment

- Grey water carrying through open drains is disposed at Gaula river without treatment
- Haldwani NN doesn't have an STP or FSTP. The cesspool vehicles empty the FS/septage into a designated manhole, from where it is directed towards Gaula river through existing sewerage network and is discharged without treatment.

1.3.5. Disposal/ Reuse

In Haldwani, faecal sludge is not treated due to unavailability of faecal sludge and septage treatment options.

Currently, there is no treatment of faecal sludge and wastewater, therefore safe reuse cannot be done.

1.4 Assumptions

Following assumptions were taken while preparing the SFD for Bageshwar city:

1. Floating Population:

As per KII, Haldwani Nagar Nigam receives almost 10,000 floating population per day throughout the year as it is one of the major commercial and educational hubs of the state. Thus, the total population of the city becomes 2,90,604 (2,80,604 + 10,000).

2. Waste Water:

As per KII, water supply in the city is 134 lpcd. Assuming total waste water generated is 80% of total water supply, it is coming out to be 31 MLD.

3. Containment, emptying and treatment:

Based on the KII with cesspool operators and households in different wards, it was observed that there is a high dependency on septic tanks as onsite sanitation systems. Other types of OSS are fully lined tanks and circular lined pits with semi-permeable walls and open bottom. The emptying frequency for septic tank has been considered to be four years, for fully lined tank it is considered as one year and ten years for circular lined pit with semi-permeable walls and open bottom. Thus, containment systems which are getting emptied beyond the stipulated duration are considered under containment damaged or collapsed category. There are 32 public toilets in Haldwani NN and all are connected to the septic tanks.

Based on the study, it was found that the emptied septage from the septic tank by cesspool vehicle is discharged into a designated manhole, from where it is directed towards Gaula river through existing sewerage network and is discharged without treatment.

As the proportion of faecal sludge and septage emptied by vacuum tankers is unknown, hence it is assumed that 50% of FS is transported and discharged into designated sewer manhole. Also, the percentage of fully lined tanks and circular lined pits with semi-permeable walls and open bottom which are emptied beyond one year and ten years respectively is unknown, hence, 50% of such containment types are considered under containment damaged or collapsed category.

4. Risk of ground water:

Average water level of 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.

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 causing significant risk to lateral separation.

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.

Thus, overall risk to ground water was calculated to be low in Haldwani NN but cases with open bottom containments, risk to ground water was considered significant.



Image 7: Wastewater flowing into Gaula river through sewer lines

1.5 Budget & funding

In Haldwani, there is no specific budget allocated for sanitation work, however, it is drawn from the overall ULB budget as required. During the financial year 2018-19, the total income of Haldwani NN was approximately 22.5 crore rupees from tax revenue, rents, fees and user charges. Apart from this, the city received 7.19 crores (quarterly) from state finance commission, approx. 5 crores from 14th finance commission and 10 crores under AMRUT (2018-19) scheme which is further directed to Peyjal nigam for infrastructure development.¹⁷

1.6 Action Plan and Way Forward

- Currently, Haldwani NN does not have an STP. However, 10% sewerage network is currently laid in the city that is acting as a conveyance channel for wastewater to the Gaula river, since there is no STP. Implementation of Sewage treatment facility should be the priority for Peyjal Nigam.
- As evident from the study, the per day septage generation in Haldwani is 110 KL (overall) and more than 50% of the households presently in Haldwani are connected to onsite sanitation systems. Septic tank is the most common OSS in the HHs. This shows the potential for establishing Faecal sludge and septage treatment facility in the city, since average desludging period of HHs is around 4-5 years and around 15 cesspool vehicles are emptying containment system daily.
- Cesspool operators are also providing services in nearby towns Bhimtal and Bhowali. So, FSSM cluster-based approach can be explored for Haldwani, Bhimtal and Bhowali.
- Households with damaged or improper designed containment system should be encouraged to retrofit their existing containment systems & new constructions must include properly designed septic tanks with soak pits in their building regulations.
- ULB does not own the cesspool vehicle and neither are the private operators monitored or registered. The ULB can procure few cesspool vehicles for facilitating the desludging requirements of the town and also registering the private cesspool operator in order to track actual septage generation per day in the city.
- Co-composting of treated faecal sludge with municipal solid waste would provide a solution for FSM and manure produced from composting can be used in agriculture.

¹⁷Key Informant Interview, Haldwani Nagar Nigam

2. References

- euttaranchal.com
- Census, 2011
- Latlong.net
- <https://en.climate-data.org/asia/india/uttarakhand/haldwani-4074/>
- District Ground Water Brochure of Nanital District, Uttarakhand
- Service Level Benchmarks, Bageshwar 2018-19
- Key Informant Interview, Haldwani Nagar Nigam
- Primary Survey

3. Officers Contacted

| Name | Designation | Department | Contact Details | Information Collected |
|---------------|-------------|----------------------|-----------------|---|
| Chandra Singh | A.E | Haldwani Nagar Nigam | 9410712033 | ULB Data & City Sanitation Information |
| V.S. Rawat | A.E | Peyjal Nigam | 9012387407 | Water and Sanitation Details |
| M. Tiwari | A.E | Peyjal Nigam | 9927439261 | Information related to water and sanitation |
| Amol Aswal | S.I. | Haldwani Nagar Nigam | 9897505287 | ULB Data & City Sanitation Information |

Dehradun



**0.71-M.L.D-STP
PLANT, SALAWALA**

0.71 MLD STP- SALAWALA
Const. by: **RAMKY INFRASTRUCTURE**
LTD HYDERABAD
Under JNIRM Scheme
Client: Uttarakhand Peypal Nigam

Salawala STP 0.71 MLD, Dehradun

1. Dehradun

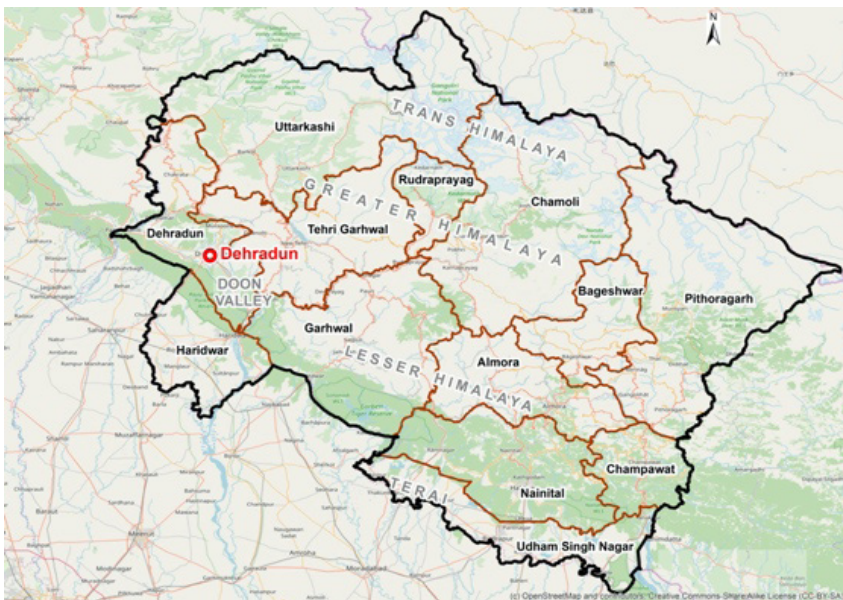
1.1 City Profile

Dehradun is the capital of the Indian state of Uttarakhand, near the Himalayan foothills. Dehradun is the administrative headquarters of Dehradun district. The city is governed by Municipal Corporation which comes under Dehradun Metropolitan Region, Uttarakhand. As per Census India, population of Dehradun in 2011 is 569,578. which increased after expansion to 8,04,379. There are 1,67,577 households within municipal boundary; this suggests the average household size in the city to be 4.8. In the year 2018, there was delimitation of boundary and total number of wards increased from 60 to 100. The geographical area of the city is 100 km square.

1.1.1. Location and Connectivity

Dehradun lies at 30.3164° N, 78.0321° E. It is part of the Garhwal region and lies along NH7 with the distance of 236 kilometres north of India's capital New Delhi, 168 kilometers from Chandigarh and is served by Dehradun railway station and Jolly Grant Airport, Doiwala. It is one of the counter magnets of the National Capital Region Delhi which is being developed as an alternative centre of growth to help ease the migration and population explosion and also establish a smart city at Dehradun.

Figure 1: Location of Dehradun



It is well connected and in proximity to Himalayan tourist destinations such as Mussorie, Auli and the Hindu holy cities of Haridwar and Rishikesh; along with the Himalayan pilgrimage circuit of Chota Char Dham.

1.1.2. Geography and Climate

The city of Dehradun mainly lies in Doon Valley. Doon Valley has the Himalayas to its north, the Shivalik range to its south, the sacred river Ganga to its east and the river Yamuna to its west. The city of Dehradun is surrounded by river Song on the east, river Tons on the west, Himalaya ranges on the north and Sal forests in the south. The Doon Valley is situated between the two most important rivers of India. i.e. Ganga and Yamuna, located in a picturesque setting. Dehradun is surrounded by dense forest all around and number of streams and canals dissect the city in the north-south direction. It lies 674m above mean sea level.

The average annual temperature in the city is 21.8 °C, June being the warmest month has an average temperature of 29.4 °C and with an average temperature of 12.6 °C January is the coldest month. Dehradun receives an average rainfall of around 1896 mm per year, the driest month is April with 16 mm of precipitation and with an average of 567 mm, August receives the highest rainfall in the city.¹

Rock formations are characterized by fissures, fractures, veins and joints which provide the secondary porosity. The secondary porosity and permeability help forming the local bodies of groundwater. Soil here is moderately deep, well-drained, thermic coarse loamy soils, strong, stoniness, associated with shallow excessively drained, loamy skeletal soil. The soil is also associated with excessively drained soils with loamy surface and slight to moderate erosion

1.1.3. Accessibility

Based on KII and field-based study, 100% of the city Dehradun is connected with roads having ROW more than 3m which makes it accessible to cess pool operators.

1.2 Overview- Water and Sanitation

1.2.1. Water Supply

Dehradun city is divided into four divisions namely, North Division, South Division, Raipur Division and Pithuwala Division. North Division receives water from Gilogi River and Masifall River, it goes to two different Water Treatment Plants (WTPs) Purkul Treatment plant with a capacity of 15 MLD and Sahansai Ashram Treatment plant with a capacity of 14 MLD respectively. Water is directly supplied to households after treatment which include softening and

¹<https://en.climate-data.org/asia/india/uttarakhand/dehradun-3679/>

chlorination. 95% of households in this division have Jal Sansthan water supply connections. Average water supply in this division is 135 lpcd.

In South Division sources of water are Bandal River, Bijapur Canal and tube-wells. There is one Water treatment plant namely Dilaram WTP with a capacity of 27.5MLD in this division. Bandal River is situated 14 kms from Dilaram WTP. The discharge of this river is approximately 15MLD & 8MLD in winter and summer respectively. Water is transported to the Dilaram WTP from Bandal River through gravity and after filtration processes water is stored and supplied to consumers. The distance between Bijapur Canal to Dilaram WTP is around 10km. Discharge of this river is around 8MLD & 6MLD in winter and summer respectively. Filtration processes are done in the Dilaram WTP and water is then stored and supplied to the consumers. Approximately 27MLD water demand is met through these two rivers and 173MLD water is supplied through tube-wells after chlorination. 95% of households in this division have Jal Sansthan water supply connections. Average water supply in this division is 135 lpcd.

Raipur division receives water from Maldevta River, it goes to Kessarwala WTP with capacity 3.6MLD which is the only WTP of this division. Remaining water is extracted from tube-wells which is supplied to the households after primary treatment, chlorination. 80% of households in this division have Jal Sansthan water supply connections. Average water supply in this division is 100lpcd.

Pithuwala division does not have any WTPs. The source of water supply here is tube-wells. Water is supplied to the households after primary treatment, chlorination. 80% of households in this division have Jal Sansthan water supply connections. Average water supply in this division is 100lpcd.

1.2.2. Solid waste

As per the ULB sources the average solid waste generation in the city is 290 TPD. Door to door collection is 100%, source segregation of solid waste is 68% and there is 100% processing of waste.² Out of the total 100 wards Nagar Nigam is responsible for solid waste collection in 31 wards and Chennai MSW pvt. ltd. collects waste from the remaining 69 wards. There are 2599 sanitation workers deployed under various categories for solid waste management in the city, the type of workers includes: Permanent, ULB appointed contractual, Concessionaire, SHG, others including informal waste pickers.³ There are three Garbage collection points in the city: Kargi Chowk, Dhoranwala and Indranagar. A fully functional Material Recovery Facility with a compactor is available

²Swachh Survekshan 2020, Dehradun

³Key Informant Interview, Dehradun Nagar Nigam

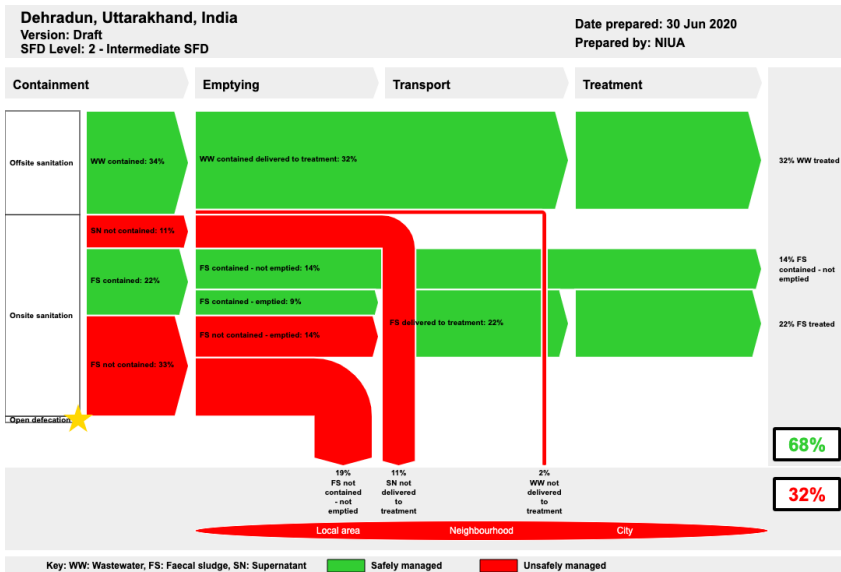
at Kargi Garbage collection point, here waste is segregated and recycled. Remaining of the waste from Kargi after recycling and waste from the other two garbage collection points are transported to Sisamwara Processing Plant which is 25kms away from Dehradun Nagar Nigam and waste is processed there.

1.3 Wastewater (WW) and Faecal Sludge and Septage Management (FSSM)

The state government notified FSM Protocol for Septage Management G.O. No. 597/IV(2)UD2017-50 (Sa)/16 dated 22nd May 2017. The objective of the protocol was to streamline FSM operations in the State. The protocol was developed by Urban Development Department, Uttarakhand in consultation with the stakeholders. As per the protocol, all cities shall constitute Septage Management Committee (SMC) for implementation of septage management activities. Currently, in Dehradun the SMC has been formed.

Gray water in most households of the city are directed to soak pits directly and few areas are served with nine nalahs & two storm water drains where gray water is directed to it through small drains following natural gravity.⁴

To understand and map the excreta management of the city along the sanitation service chain, a comprehensive level Shit Flow Diagram (SFD) is prepared.



⁴SBM City Profile 2020, Dehradun



Cess-pool vehicle, Jal Sansthan Dehradun

The service outcomes of the sanitation service chain are analyzed below: -

1.3.1. Containment

- There are 1,67,577 households, 100% of these households have access to Individual Household toilets. There are 128 notified slums in the city.⁵ Additionally, there are 31 public and community toilets.
- Dehradun has 6 sewerage zones, namely, Kargi zone, Rispana zone, Indra nagar zone, Vijay colony zone, Salawala zone and Doon vihar zone. Currently, these zones are partially served with sewerage network covering 57,173 households which is 34% of the total households in the city.
- Two more STPs, Banjarawala and Raipur are proposed and expected to be implemented by next 3-4 years.
- Remaining, 66% i.e. 1,10,404 households have onsite containment systems.
- Through key informant interviews (KII) and focus group discussions (FGDs) with municipal officials, masons, emptiers; households dependent on different types of onsite sanitation systems are estimated:-
 - 34% HHs are connected to sewer network
 - 12% HHs are dependent on septic tanks connected to soak pits.
 - 11% HHs are dependent on septic tanks connected with open drains.
 - 10% HHs are dependent on lined tanks with semi permeable walls and open bottom.
 - 33% HHs are dependent on Containment failed, damaged, collapsed or flooded - with no outlet or overflow and rest
- Open defecation is not practiced in the city

⁵SBM City Profile 2020, Dehradun

1.3.2. Emptying

- Predominant method of emptying is by cess pool operators which is carried out by private players.
- There is no registered cesspool operator available in the city.
- There are around 25 cesspool vehicles in the city, owned by private players.
- The average desludging frequency of the containments is 5-8 years.

1.3.3. Transportation

- There are no cesspool vehicles owned by government but there are private players operating in the city.
- The emptying charge is approximately Rs.1500-2200 per service depending on the distance of the household from the STP.
- A tipping fee of Rs. 400 is charged by Kargi STP from the desludging operators.

1.3.4. Treatment

- The amount of wastewater generated is 87MLD and the amount of faecal sludge generated is 320KLD.
- There are 7 STPs in the city, their design capacity and utilised capacity are mentioned in the table below:

| Sl. No. | STP | Design Capacity (in MLD) | Utilized Capacity as of March, 2020 |
|---------|-------------------|--------------------------|-------------------------------------|
| 1 | Kargi | 68 | 16% (23.53MLD) |
| 2 | Motharawala-I | 20 | 60% (12MLD) |
| 3 | Motharawala-II | 20 | 25% (5MLD) |
| 4 | Indranagar | 5 | 20% (1MLD) |
| 5 | Jakhan doon Vihar | 1 | 30% (0.3MLD) |
| 6 | Salawala | 0.71 | 42.25% (0.29MLD) |
| 7 | Vijay Colony | 0.42 | 71.43% (0.3MLD) |

- All the STPs mentioned in the above table run on Sequential Batch Reactor technology (SBR).
- Kargi STP receives 25-30 trucks septage daily, the trucks discharge septage at a designated decanting station within the STP premises. Currently, there is no properly designed co-treatment infrastructure nor any treatment of septage with sewage.
- There is no provision of cotreatment options in any of the STPs mentioned above.

1.3.5. Disposal/ Reuse

- The treated wastewater is tested for its quality which has been consistently found to be within the CPCB prescribed discharge standards.

- The treated wastewater is let off into the river and the sludge is used for gardening within the STP premises as well as for farming in the nearby villages.



The Only STP with circular SBR tank: Motharawala STP 20 MLD, Dehradun

1.4 Assumptions

Following are the assumptions considered while preparing the SFD for Dehradun city:

1. Population:

As per KII, Dehradun Nagar Palika receives almost 4500 tourist per day as floating population every year.

Thus, the total population of the city becomes 8,08,879 (8,04,379+4500)

2. Waste water:

Water supply in the city is 135lpcd. Based on the water supply, assuming total waste water generated is 80% of total water supply, it is coming out to be 108lpcd.

3. Containment, emptying and treatment:

Maximum emptying frequency for septic tank has been considered to be four years, for fully lined tank one year and for lined pit with semi permeable walls and open bottom, thus containment system emptying beyond stipulated duration are considered under containment damaged or collapsed category. Based on the study, it was found that about 23% of septic tanks and 10% of lined pit with semi permeable walls and open bottom systems are being emptied beyond their stipulated time and hence such systems have been considered under category of 'containment damaged or collapsed' in SFD.

4. Risk of ground water:

Average water level across city is greater than 15m bgl⁶. Considering soil type to be fine sand, silt and clay, vulnerability of the aquifers was found to be at low risk.

Less than 25% sanitation facilities are located <10m from ground water sources and less than 25% of sanitation facilities are located uphill of ground water sources causing low risk to lateral separation.

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.

Thus, overall risk to ground water contamination is estimated to be low in Dehradun.

1.5 Budget, Funding and Proposed Projects

Proposed Projects:

Two more STP zones, Banjarawala and Raipur are proposed, it is to be funded by ADB.

Annual Budget:

- Annual income from property and other taxes 2018-19: 29 Cr.
- Annual Expenditure related to SWM, sanitation related procurements, compost plant and development of recreational areas in 2018-19 is approx. 8 Cr.
- AMRUT, Sewerage & Septage management 2017-18: 15 Cr.
- 14th Finance Commission 2019-20: 33,00,49,600
- 14th Finance Commission 2020-21: 11,58,75,000

1.6 Action Plan and Way Forward

- ULB shall prepare a City level strategy on FSSM including decentralized liquid waste management; DWWTs are suitable for residential colonies, Hotels and Institutions generating >10 KLD WW and having >500 sq. m of green space.
- As evident from the study, Dehradun has 66% households connected to onsite sanitation systems as on date. 28% households are dependent on collapsed or damaged types systems which may contaminate the groundwater if not desludged regularly. Moreover, such systems should be retrofit with improved systems like septic tanks and properly designed twin pit systems as per IS code recommendations.
- Dehradun has seven STPs all of them running underutilized compared to their design capacity. Faecal sludge emptied by cess pool operators can be discharged into designated manholes of the STPs after testing the compatibility of cotreatment with sewage at the plant to avoid operational problems as the STPs are not designed for treating faecal sludge.

⁶(CGWB, 2015-16)

- It is estimated that 320kld of faecal sludge is generated in the city. With the current capacity of STP (total 115.13MLD), co-treatment of FS with sewage can be a viable option.
- Co-composting of treated faecal sludge with municipal solid waste would provide a solution for FSM and manure produced from composting can be used in agriculture.

2. References

- District Ground Water Brochure of Dehradun District, Uttarakhand
- <https://en.climate-data.org/asia/india/uttarakhand/dehradun-3679>
- Service Level Benchmarks, Dehradun 2018-19
- Key Informant Interview, Dehradun Nagar Nigam
- Swachh Survekshan 2020, Dehradun
- SBM City Profile 2020, Dehradun
- Primary Survey

3. Officers Contacted

| Name | Designation | Department | Contact Details | Information Collected |
|-------------------|---------------------------------|-----------------------------|-----------------|--------------------------------------|
| Yashreor Mal | Executive Eng. | Jal Sansthan North Division | 9411395651 | Water supply details |
| Maneesh Semwal | Executive Eng. | Jal Sansthan South Division | 9411113820 | Water supply details & STP details |
| Ashish Kathait | Nodal Officer, AMRUT | Nagar Nigam | 7533907778 | Water, Sanitation details |
| Dr. Kailash Joshi | Senior Municipal Health Officer | Nagar Nigam | 9412055329 | SBM & Solid waste Management details |
| Meenakshi Mittal | A. E | Jal Nigam | 9760318282 | STP details |
| Sumit Anand | Executive Eng. | Jal Nigam | 7302888775 | STP details |
| Ramesh Lingwal | Senior Accountant | UDD | 8395889555 | Finance details |
| Ankit Bhandari | Consultant, AMRUT | UDD | 8433126472 | Finance details |

Annexure

Survey Questionnaires

ULB

OFFICIAL DETAILS

| Sl. No. | QUESTIONS | RESPONSE | |
|---------|---|----------------------------------|----|
| 1 | Name of the contact person | | |
| 2 | Gender | | |
| 3 | Position/designation | | |
| 4 | Department | | |
| 5 | Contact details | Email ID | |
| | | Ph. No. | |
| 7 | Do you have a Septage Management Cell in your city? | Yes | No |
| 8 | If no, why? | | |
| 9 | If yes, is the SMC structured as per the Septage Protocol fixed by the State? | Yes | No |
| 10 | If yes, are all the members of the Cell empaneled? | Yes | No |
| 11 | If no, what are the positions yet to be mobilised? | From Nagar Nigam (NN) | |
| | | From Nagar Palika Parishad (NPP) | |
| 12 | How many meetings are held by the SMC till date? | | |
| | i) If Yes, what were the outcomes of these meetings? | | |
| | ii) How often are these meetings held? | | |

CITY ASSESSMENT

| Sl. No. | QUESTION | RESPONSE | | | | | | | | | |
|---------|--|------------------|------------|------------|-----------------------|---------------|------------------|-----------------|----------------|-----------|--|
| 13 | Name of the City | | | | | | | | | | |
| 14 | District | | | | | | | | | | |
| 15 | Division | Garhwal Division | | | | | Kumaon Division | | | | |
| 16 | Area of the city (in sq kms) | | | | | | | | | | |
| 17 | Type of ULB | Nagar Nigam | | | Nagar Palika Parishad | | | Nagar Panchayat | | | |
| 18 | Geographical Zone | Terai | | Doon | Lesser Himalaya | | Greater Himalaya | | Trans Himalaya | | |
| 19 | Landuse Percentage (number of building in relevant categories if possible) | Residential | Commercial | Industrial | Mixed | Institutional | Vacant | Green | Agriculture | Transport | |
| 20 | Number of administrative divisions (wards) | | | | | | | | | | |
| 21 | Total Population (ward wise) | 2011 Census | | | | | | | | | |
| | | Latest (sour | | | | | | | | | |
| 22 | Floating population (diurnal and that stays) | | | | | | | | | | |
| 23 | Annual Population Growth Rate | | | | | | | | | | |
| 24 | i) Total number of HHs in the city | | | | | | | | | | |
| | ii) No. of HH within municipal boundary (ward-wise) | | | | | | | | | | |
| 25 | Is the city ODF? | Yes | | | | | No | | | | |

JAL SANSTHAN

OFFICIAL DETAILS

| Sl. No. | QUESTIONS | RESPONSE |
|---------|----------------------------|----------|
| 1 | Name of the contact person | |
| 2 | Gender | |
| 3 | Position/designation | |
| 4 | Department | |
| 5 | Contact details | Email ID |
| | | Ph. No. |

CITY ASSESSMENT

| Sl. No. | QUESTION | RESPONSE |
|---------|---|----------|
| 6 | Water supply coverage (ward-wise) | |
| 7 | Sources of water supply | |
| 8 | How much water is supplied to the city? | |
| 9 | No. of WTPs with capacity | |
| 10 | Water supply per capita per day (lpcd) | |
| 11 | No. of HHs with access to IHHT (ward-wise) | |
| 12 | Sewerage network coverage (ward-wise). | |
| | i) If no network, then future plan? | |
| | ii) If yes, no. of HHs connected to sewerage network. | |
| | iii) No. of HHs where toilet discharges goes directly to a centralised sewer | |
| | iv) No. of HHs where toilet discharges goes directly to open drain or storm sewer | |
| | v) One time connection charges | |
| | vi) Monthly charges collected if any | |

CAPACITY BUILDING & TRAINING

| Sl. No. | QUESTION | RESPONSE |
|---------|---|------------------|
| 13 | HAVE YOU RECEIVED ANY TRAINING (SPECIFY WHO PROVIDED THE TRAINING)? | ON WATER |
| | | ORIENTATION |
| | | WORKSHOP |
| | | EXPOSURE VISIT |
| | | ADVANCE TRAINING |
| | | ON FSSM |
| | ORIENTATION | |
| | WORKSHOP | |
| | EXPOSURE VISIT | |
| | ADVANCE TRAINING | |
| 14 | NUMBER OF OFFICIALS TRAINED? | |
| 15 | WHICH OFFICIALS ATTENDED THOSE MEETINGS | |

FUNDING & SCHEMES

| Sl. No. | QUESTION | RESPONSE |
|---------|---|----------|
| 16 | How much is the Department budget for sani | |
| 17 | Where does the budget come from (e.g. taxes, grants, etc.)? | |
| 18 | Revenue generated from STPs? | |
| 19 | How do you recover the O&M expenses? | |

| JAL NIGAM | | | |
|------------------|--|----------|-----|
| OFFICIAL DETAILS | | | |
| Sl. No. | QUESTIONS | RESPONSE | |
| 1 | Name of the contact person | | |
| 2 | Gender | | |
| 3 | Position/designation | | |
| 4 | Department | | |
| 5 | Contact details | Email ID | |
| | | Ph. No. | |
| CITY ASSESSMENT | | | |
| Sl. No. | QUESTION | RESPONSE | |
| 6 | Waste water generated in the city/town (MLD) | | |
| 7 | Approximate FSS generated (KLD) | | |
| 8 | Total number of STPs | STP 1 | |
| | | STP 2 | |
| | | STP 3 | |
| 9 | Capacity of STP | STP 1 | |
| | | STP 2 | |
| | | STP 3 | |
| TECHNICAL | | | |
| Sl. No. | QUESTION | RESPONSE | |
| 10 | Functional status of sewerage network | | |
| 11 | Distance of the STP from the City | STP 1 | |
| | | STP 2 | |
| | | STP 3 | |
| 12 | Utilised capacity of STP | STP 1 | |
| | | STP 2 | |
| | | STP 3 | |
| 13 | Current average flow received at the STP per day | STP 1 | |
| | | STP 2 | |
| | | STP 3 | |
| 14 | Treatment technology used at STP | STP 1 | |
| | | STP 2 | |
| | | STP 3 | |
| 15 | Design Inlet | STP 1 | BOD |
| | | | COD |
| | | | TSS |
| | | STP 2 | BOD |
| | | | COD |
| | | | TSS |
| | | STP 3 | BOD |
| | | | COD |
| | | | TSS |

| TECHNICAL | | | |
|-----------|---|----------|-----|
| Sl. No. | QUESTION | RESPONSE | |
| 16 | Actual sewage characteristics at the inlet | STP 1 | BOD |
| | | | COD |
| | | | TSS |
| | | STP 2 | BOD |
| | | | COD |
| | | | TSS |
| | | STP 3 | BOD |
| | | | COD |
| | | | TSS |
| 17 | Average effluent quality | STP 1 | BOD |
| | | | COD |
| | | | TSS |
| | | STP 2 | BOD |
| | | | COD |
| | | | TSS |
| | | STP 3 | BOD |
| | | | COD |
| | | | TSS |
| 18 | Last 2 years monthly average at inlet | STP 1 | BOD |
| | | | COD |
| | | | TSS |
| | | STP 2 | BOD |
| | | | COD |
| | | | TSS |
| | | STP 3 | BOD |
| | | | COD |
| | | | TSS |
| 19 | Last 2 years monthly average at outlet | STP 1 | BOD |
| | | | COD |
| | | | TSS |
| | | STP 2 | BOD |
| | | | COD |
| | | | TSS |
| | | STP 3 | BOD |
| | | | COD |
| | | | TSS |
| 20 | Does the STP receive Faecal Sludge? | STP 1 | |
| | | STP 2 | |
| | | STP 3 | |
| 21 | What is the characteristics of the FS received? | STP 1 | BOD |
| | | | COD |
| | | | TSS |
| | | STP 2 | BOD |
| | | | COD |
| | | | TSS |
| | | STP 3 | BOD |
| | | | COD |
| | | | TSS |

| TECHNICAL | | | |
|-----------|---|-------------------------------------|--|
| Sl. No. | QUESTION | RESPONSE | |
| 22 | IS THE FS COTREATED IN THE EXISTING STPs? | STP 1 | IF YES, HOW IS IT TREATED? |
| | | | IF NO, WHERE IS THE FS COLLECTED DISPOSED? |
| | | | DO YOU USE THE DRIED SLUDGE? |
| | | STP 2 | IF YES, DISTRIBUTOR/SELLER TO WHOM? |
| | | | RATE OF SELLING THE DRIED SLUDGE? |
| | | | IF YES, HOW IS IT TREATED? |
| | | | IF NO, WHERE IS THE FS COLLECTED DISPOSED? |
| | | | DO YOU USE THE DRIED SLUDGE? |
| | | | IF YES, DISTRIBUTOR/SELLER TO WHOM? |
| | | STP 3 | RATE OF SELLING THE DRIED SLUDGE? |
| | | | IF YES, HOW IS IT TREATED? |
| | | | IF NO, WHERE IS THE FS COLLECTED DISPOSED? |
| | | DO YOU USE THE DRIED SLUDGE? | |
| | | IF YES, DISTRIBUTOR/SELLER TO WHOM? | |
| | | RATE OF SELLING THE DRIED SLUDGE? | |

| CAPACITY BUILDING & TRAINING | | | |
|------------------------------|---|----------|------------------|
| Sl. No. | QUESTION | RESPONSE | |
| 23 | HAVE YOU RECEIVED ANY TRAINING (SPECIFY WHO PROVIDED THE TRAINING)? | ON WATER | ORIENTATION |
| | | | WORKSHOP |
| | | | EXPOSURE VISIT |
| | | | ADVANCE TRAINING |
| | | ON FSSM | ORIENTATION |
| | | | WORKSHOP |
| | | | EXPOSURE VISIT |
| | | | ADVANCE TRAINING |
| 24 | NUMBER OF OFFICIALS TRAINED? | | |
| 25 | WHICH OFFICIALS ATTENDED THOSE MEETINGS | | |

| FUNDING & SCHEMES | | | |
|-------------------|---|----------|--|
| Sl. No. | QUESTION | RESPONSE | |
| 26 | How much is the Department budget for sanitation? | | |
| 27 | Where does the budget come from (e.g. taxes, grants, etc.)? | | |
| 28 | Revenue generated from STPs? | | |
| 29 | How do you recover the O&M expenses? | | |

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