SFD Report

Tansen Municipality
Nepal

Final Report

This SFD Report - SFD level 2 - was prepared by:
Environment and Public Health Organization (ENPHO)

Date of production: 06/07/2023
Last update: 10/11/2023

SFD Report Tansen Municipality, Nepal, 2023

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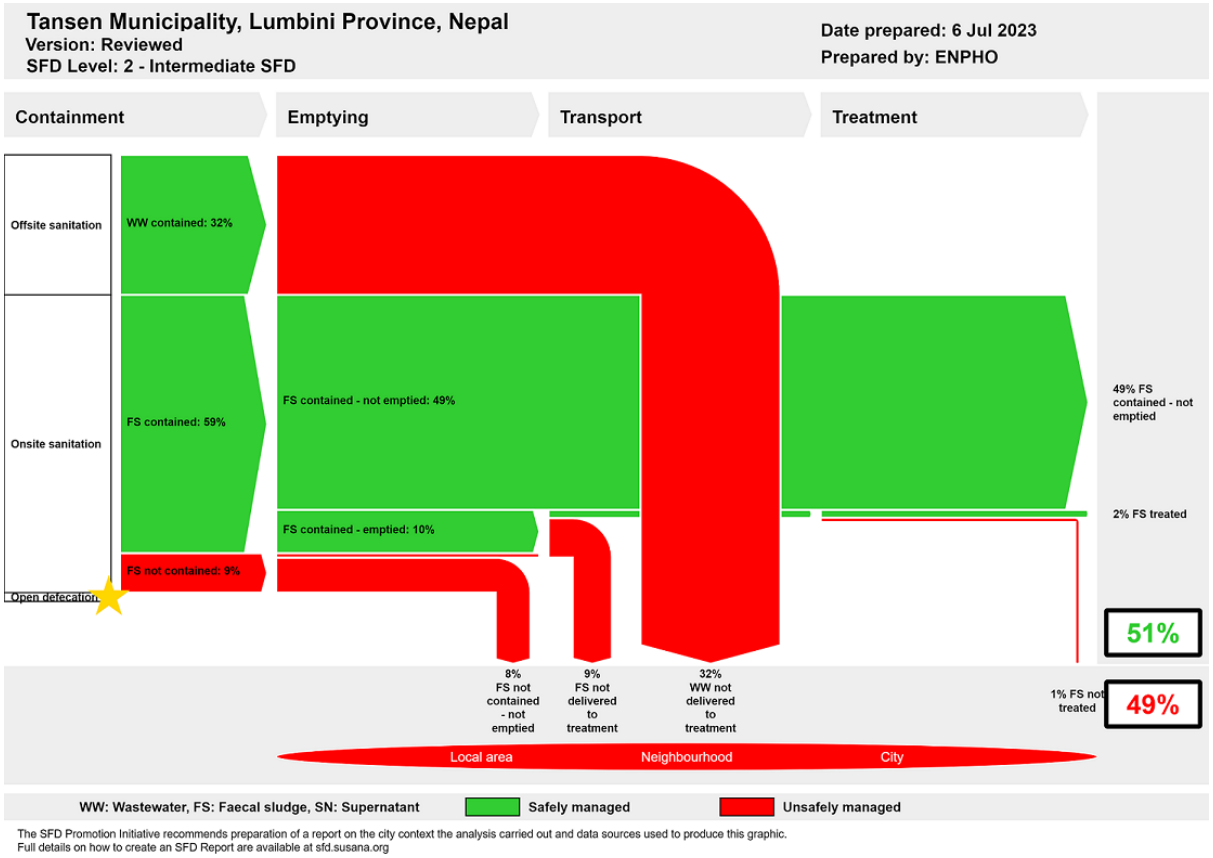
1. The SFD Graphic



2. Diagram information

SFD Level:

This SFD is a level 2- Intermediate report.

Produced by:

Environment and Public Health Organization (ENPHO.

Collaborating partners:

Tansen Municipality, Municipal Association of Nepal (MuAN), United Cities and Local Government – Asia Pacific (UCLG-ASPAC)

Status:

Final SFD report.

Date of Production: 06/07/2023

Tansen Municipality was established in March 1950. The municipality is located in Palpa

3. General city information

District, Lumbini Province. The municipality is divided into 14 political wards.

The municipality has a total population of 50,792 with 23,414 males and 27,378 females. (Census 2021, n.d.).

Out of all the wards, ward number 7 has the most residents (6,240), while ward number 13 has the fewest (1,715). The number of households in Tansen Municipality is 14,782. With a total of 1,840 households, Ward 7 has the most, while Ward 13 has the fewest, with a total of 546 households. Table 1 shows the total population and households in each ward (CBS, 2021).

The district's average yearly temperature is 24 °C. The average annual rainfall is 1,600 mm (Weather and Climate, n.d.).

4. Service outcome

The overview of different sanitation technologies across the sanitation value chain in the municipality is briefly explained in this section (ENPHO, 2023). Basic sanitation coverage in the municipality is 100%. Basic sanitation is defined as having access to facilities for the safe disposal of human waste (faeces and urine), as well as having the ability to maintain hygienic conditions, through services such as garbage collection, industrial/hazardous waste management, and wastewater treatment and disposal.

All the surveyed households in the municipality have access to basic toilet facilities. Among the households having their own toilets, 67.69% of households rely on various onsite sanitation systems whereas the remaining 32.31% rely on an offsite sanitation system.

Containment:

Different types of containment used to store faecal sludge in the onsite sanitation systems are: fully lined tanks (13%), lined tanks with impermeable walls and open bottom (48%), lined pits with semipermeable walls and open bottom (7%). In addition, 32% of the households are connected to the sewer network.

Emptying and Transportation:

There are regular emptying practices of the containments. Here, 18.11% of the households had emptied the containment at least once since installation. Both manual and mechanical desludging mechanism are practised.

The municipality lacks of a wastewater or faecal sludge treatment facility. The majority of faecal sludge emptied is used in agricultural lands as well as dumped of in the environment untreated. Households having a biogas digester installed utilize its energy in cooking and other purposes.

The SFD graphic shows that 51% of the excreta generated are safely managed while 49% of the excreta generated are unsafely managed. The safely managed percentage of FS generated by 49% of the population is temporary until the tanks and pits become full and the Faecal Sludge (FS) from the containment is emptied.

5. Service delivery context

Access to drinking water and sanitation has been defined as fundamental rights to every citizen by the constitution of Nepal. To respect, protect and implement the rights of citizen embedded in the constitution, the Government of Nepal (GoN) has enforced the Water Supply and Sanitation Law 2022 which emphasized on a right to quality sanitation services and prohibited direct discharge of wastewater and sewage into water bodies or public places.

Several policies have been in place to accomplish the sanitation needs of people. Particularly, NSHMP 2011 has proved to be an important strategic document for all stakeholders to develop uniform programs and implementation mechanisms at all levels. It strengthened institutional set up with the formation of Water and Sanitation Coordination Committee (WASH-CC) to actively engage in sanitation campaigns. The sanitation campaign was implemented throughout the country mainly focusing on achieving universal access to improved sanitation.

Nepal committed to the SDGs early on, and this commitment has been reaffirmed in key policy documents, such as the current 15th development plan and the 25-year long term vision 2100 that internalises the Goals. SDGs codes are assigned for all national development programmes through the Medium-Term Expenditure Framework. Further, Nepal has prepared the SDG status and roadmap to localize the SDG indicators with baselines and targets 2030.

6. Overview of stakeholders

The major stakeholders envisioned by the regulatory framework for faecal sludge management (FSM) in urban cities are presented in Table 1.

Table 1: Overview of Stakeholders.

Key Stakeholders	Institutions / Organizations
Public Institutions at Local Government	Tansen Municipality
Non-governmental Organizations	Environment and Public Health Organization (ENPHO)
Private Sector	Public Toilet Operators.
Development Partners, Donors	MuAN, BMGF, UCLG ASPAC

7. Credibility of data

The major data had been collected from random household sampling (ENPHO, 2023).

Altogether, 359 households and 35 institutions were surveyed from 14 wards of Tansen municipality. Primary data on emptying, transportation and current sanitation practices in the municipality are triangulated with the data obtained from Key Informant Interviews (KIIs) with Municipal Officers, the operators of public toilets, and the sanitation, and environmental section of the municipality. Also, a data sharing and validation workshop with key stakeholders was performed.

8. Process of SFD development

Data on sanitation situation were collected through household and institutional surveys. Enumerators from the municipality were mobilized after providing orientation on sanitation technologies, objectives of the survey and proper use of mobile application, KOBOCOLLECT for data collection for the survey. Along with this, KIIs were conducted with officers and engineers of the municipality and the Water Supply and Sanitation Users Committee. Types of sanitation technologies used in various locations have been mapped using ARCGIS. For the Shit Flow Diagram (SFD) graphic production, initially, a relationship between sanitation technology used in questionnaire survey and Shit Flow Diagram Promotion Initiative (SFD PI) methodology was made. Then, data were fed into SFD graphic generator to produce the SFD graphic.

8. List of data sources

The list of data sources to produce this executive summary is as follows:

- CBS. (2021). National Population and Housing Census 2021. Kathmandu, Nepal: Central Bureau of Statistics. Retrieved from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://unstats.un.org/unsd/demographic-social/census/documents/Nepal/Nepal-Census-2011-Vol1.pdf
- ENPHO. (2023). Sanitation Situtaion Assessment: Tansen Municipality. Unpublished.
- MoFAGA. (2017). Ministry of Federal Affairs & General Administration. Retrieved from Government of Nepal, Ministry of Federal Affairs & General Administration: https://www.sthaniya.gov.np/gis/.
- Census 2021. (n.d.). Retrieved from https://censusnepal.cbs.gov.np/results/population?province=2&district=20&municipality=13
- Weather and Climate. (n.d.). Retrieved from tcktcktck.org.

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Abbreviations

ENPHO	Environment and Public Health Organization
FS	Faecal Sludge
FSM	Faecal Sludge Management
GoN	Government of Nepal
HH	Household
JMP	Joint Monitoring Programme
KII	Key Informant Interview
KM	Kilometres
mm	Millimetre
MoEST	Ministry of Education, Science and Technology
MoFAGA	Ministry of Federal Affairs and General Assembly
MoH	Ministry of Health
MoHP	Ministry of Health and Population
MoUD	Ministry of Urban Development
MoWS	Ministry of Water Supply
MuAN	Municipal Association of Nepal
NPC	National Planning Commission
NUWSSP	National Urban Water Supply and Sanitation Sector Policy
NWSSP	National Water Supply and Sanitation Policy
ODF	Open Defecation Free
RWSSNP	Rural Water Supply and Sanitation National Policy
SCEIS	Sector Coordination and Efficiency Improvement Section
SDG	Sustainable Development Goal
SDP	Sector Development Plan
SFD	Shit Flow Diagram
SFD PI	Shit Flow Diagram Promotion Initiative
SN	Supernatant
UCLG ASPAC	United Cities and Local Governments Asia Pacific
UNICEF	United Nations Children's Education Fund
VDC	Village Development Committee
WASH	Water, Sanitation and Hygiene
WASH-CC	Water, Sanitation and Hygiene Coordination Committee
WHO	World Health Organization
WSP	Water Supply Providers
WSUC	Water Supply and User's Committee
WW	Wastewater

1. City context

Tansen Municipality is one of the oldest municipalities in the country, established in March 1950. It is located in Palpa District, Lumbini Province. The Municipality has a total of 14 political wards.

Tansen Municipality occupies an area of 109.8 square kilometres. The municipality is enclosed by Bagnaskali Rural Municipality in the East, Ribdikot Rural Municipality in the West, Bagnaskali Rural Municipality in the North and Tinau and Mathagadi Rural Municipality in the South (Nepal Archives, n.d.). Figure 1 shows the geo-political map of Tansen Municipality.

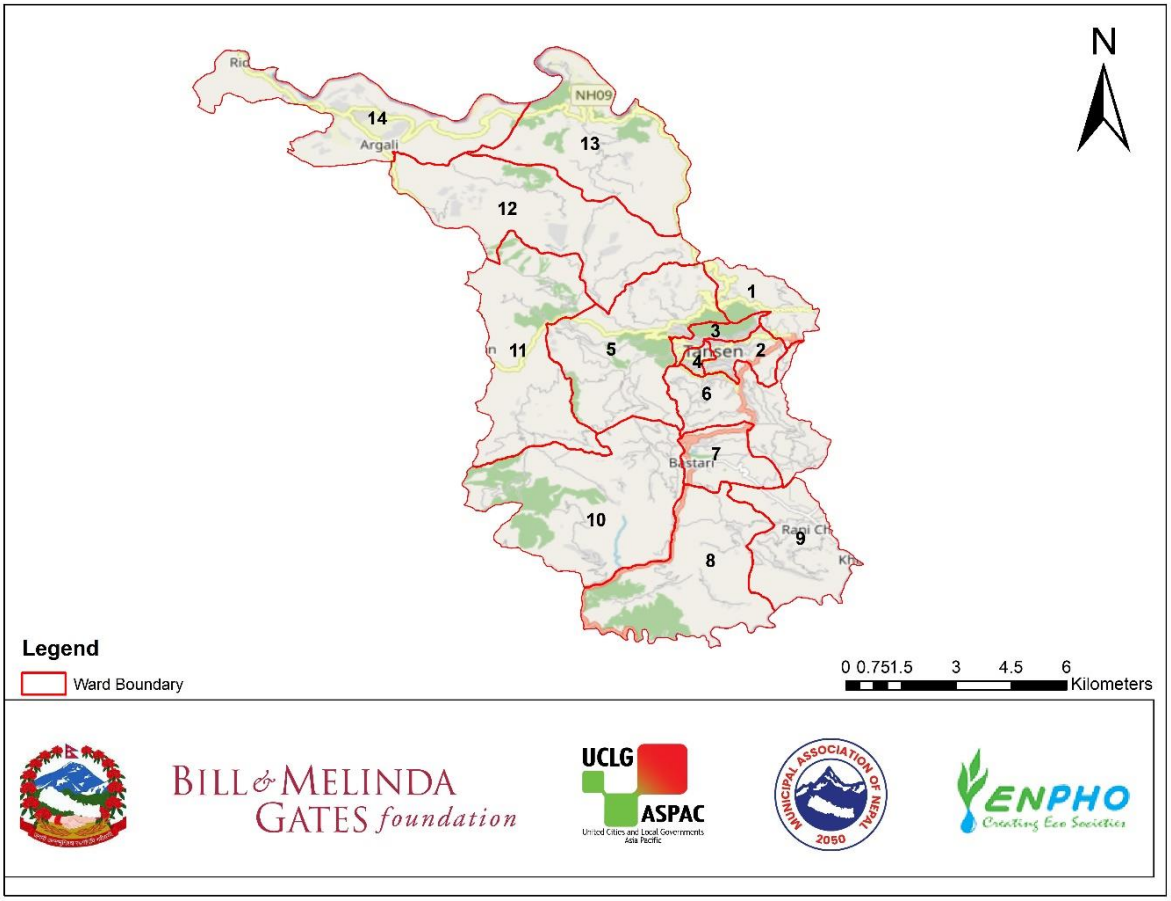

Figure 1: Map of Tansen Municipality with ward boundaries.

1.1 Population

There are 50,792 people living in Tansen Municipality, with 23,414 men and 27,378 women. Out of all the wards, ward number 7 has the most residents (6,240), while ward number 13 has the fewest (1,715). The number of households in Tansen Municipality is 14,782. With a total of 1,840 households, Ward 7 has the most, while Ward 13 has the fewest, with a total of 546 households. Table 1 shows the total population and households in each ward (CBS, 2021).

Table 1: Ward Wise Household and Population Data.

Wards	Households	Population	Male	Female
1	1,407	4,888	2,252	2,636
2	1,294	3,999	1,856	2,143
3	1,715	5,579	2,519	3,060
4	1,145	3,699	1,725	1,974
5	1,027	3,663	1,737	1,926
6	1,248	4,495	2,090	2,405
7	1,840	6,240	2,925	3,315
8	791	3,011	1,406	1,605
9	996	3,321	1,488	1,833
10	774	2,813	1,293	1,520
11	546	1,992	930	1,062
12	628	2,261	1,009	1,252
13	510	1,715	780	935
14	861	3,116	1,404	1,712
Total	**14,782**	**50,792**	**23,414**	**27,378**

(Census 2021, n.d)

1.2 Climate

There is neither too much cold nor too much heat in the municipality because the maximum summer temperature is up to 35 degrees Celsius and the lowest winter temperature is up to 0 °C, while the average temperature is 24 °C. Palpa district has a subtropical climate. The annual rainfall is 1,600 mm (Tansen Municipality, n.d.).

1.3 Topography

Its geographic location is 27°50' North to 27°53' North latitude and 83°31' East to 83°35' East longitude. Tansen municipality occupies an area of 109.8 square kilometres (Tansen Municipality, n.d.).

2 Service Outcomes

2.1 Overview

Data on sanitation situation were collected through household and institutional surveys(ENPHO, 2023). A total of 359 households were sampled from 14,782 households distributed in 14 wards (further details are presented in section 4). The results obtained after the triangulation and validation of the data with all the data sources including literature reports, Key Informant Interviews (KIIs) and a validation workshop is presented in this section.

2.1.1 Sanitation Status

Palpa District was declared as an open defecation free zone on 7th April 2018. It suggests that everyone has access to basic sanitation facilities, where it is defined as having access to facilities for the safe disposal of human waste (faeces and urine), as well as having the ability to maintain hygienic conditions, through services such as garbage collection, industrial/hazardous waste management, and wastewater treatment and disposal. The sanitation situation assessment conducted by ENPHO in 2022 showed that 100% of surveyed households in the municipality have access to basic sanitation coverage. (ENPHO, 2023).

Offsite sanitation refers to a sanitation system in which excreta (referred to as wastewater) is collected and transported away from the plot where they are generated. An offsite sanitation system relies on sewer technology for transport (Susana, 2018). Here in the municipality 32.31% of the households rely on offsite sanitation systems.

The sewer network serves the households from ward 1, 2, 3, 4, 5, 6 and 7 with about 3.5 km of pipe connection. The wastewater of the sewer network is being disposed of untreated into the river as the municipality does not have a treatment plant (KII-1, 2023).

Onsite sanitation refers to a sanitation technology or sanitation system in which excreta (referred to as faecal sludge) is collected and stored and emptied from or treated on the plot where they are generated (Susana, 2018). Figure 2 shows the types of sanitation system in the municipality where onsite sanitation systems are prevalent. 67.69% households rely on onsite sanitation technologies in the municipality.

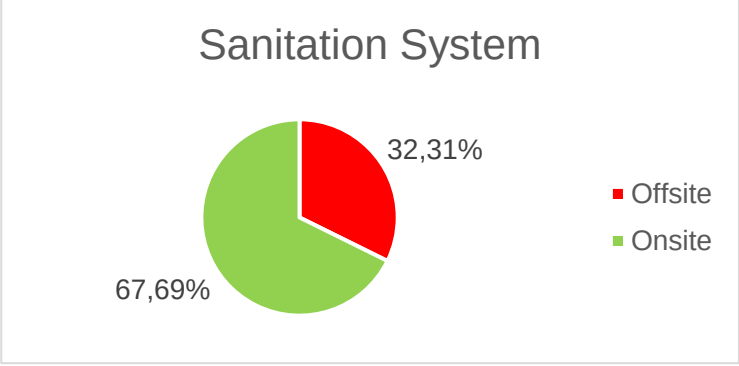

Figure 2: Household sanitation status of Tansen Municipality (ENPHO, 2023).

2.1.2 Types of Containment

67.69% of the households in the municipality use an onsite sanitation system. The different types of containments installed to store faecal sludge is explained as follows.

13.17% of households use fully lined tanks in their houses which is a rectangular onsite sanitation technology which is used to safely store faecal sludge. There are no outlets or overflow to discharge effluent. The walls and bottom of tank are totally lined and sealed. Figure 3 shows the types of fully lined tank constructed at household level in Tansen Municipality.

Figure 3: Fully Lined Tank.

Also, 2.06% of the households in the municipality are connected to a biogas digester that uses natural anaerobic decomposition of organic matter under controlled conditions. Figure 4 shows the types of biogas dgesters built at household level in Tansen Municipality.

Figure 4: Biogas Digester.

Figure 5 shows the types of lined tanks with impermeable walls and open bottom built at household level in Tansen Municipality.

Figure 5: Lined Tank with Impermeable walls and Open Bottom.

69.96% of the households in the municipality have built lined tanks with impermeable walls and open bottom, which is a rectangular onsite technology where the walls of the tank are lined and the bottom of the tank is not lined and allows infiltration of effluents. Similarly, 10.29% of the households have single pits installed by assembling pre-cast concrete rings one after another. Table 2 shows the percentage of households with different types of containments in the municipality.

Table 2: Types of containments in households of Tansen Municipality (ENPHO, 2023).

Types of Containment	Percentage
Biogas digester	6.58%
Fully lined tank	13.17%
Lined tank with impermeable walls and open bottom	69.96%
Single pit	10.29%
Grand Total	**100.00%**

Figure 6 shows the distribution of various types of sanitation technologies in different wards of Tansen Municipality.

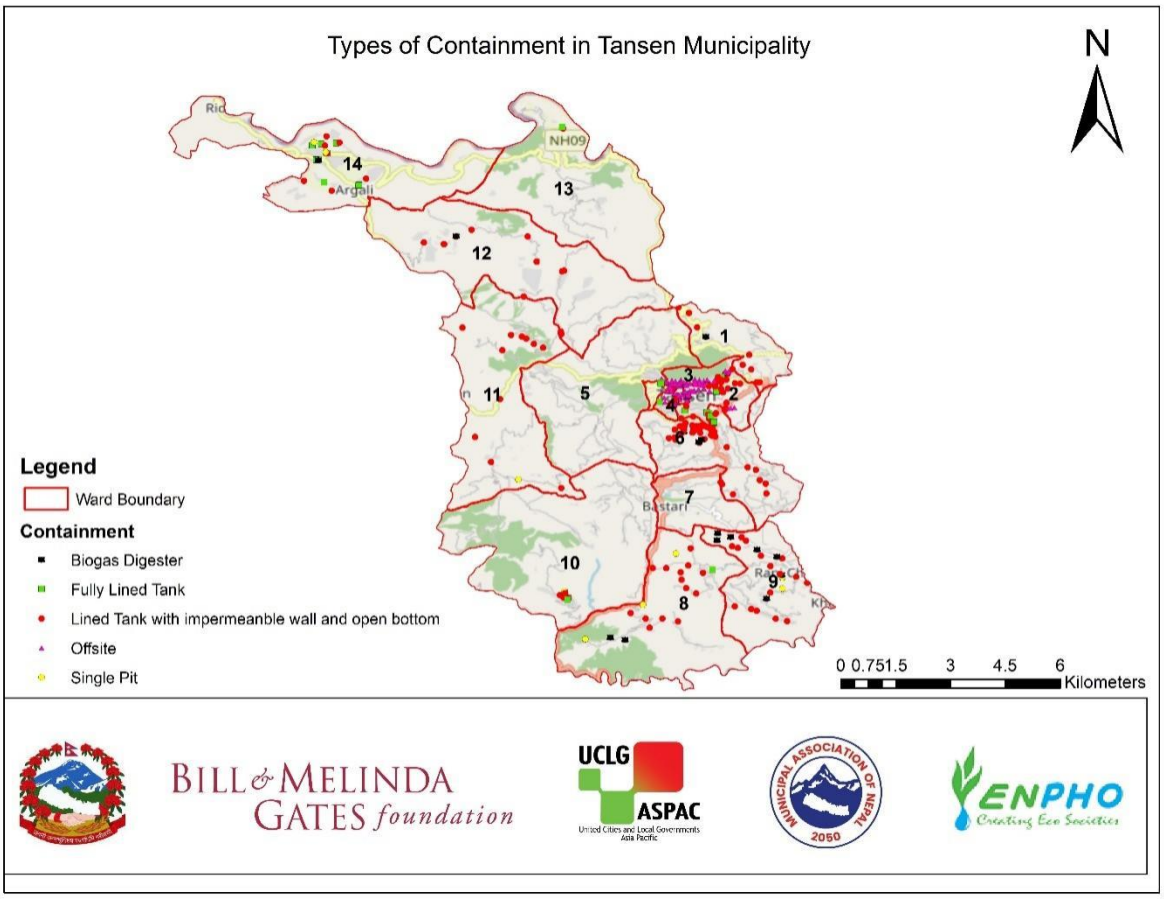

Figure 6: Sanitation Technologies installed in household levels (ENPHO, 2023).

The types of household containments in the municipality are re-categorized to match the containments defined by Shit Flow Diagram Promotion Initiative (SFD PI). The biogas digester used to treat household organic waste is also utilized by households to store and treat their faecal sludge. For the purpose of generating the SFD graphic, the biogas digester is modelled as a fully lined tank. Similarly, single pits constructed by assembling pre-cast concrete rings one above another are classified as lined pits with semi-permeable walls and open bottom. Table 3 shows the types of containment re-categorized according to Shit Flow Diagram Promotion Initiative (SFD PI).

Table 3: Types of containment re-categorized according to Shit Flow Diagram Promotion Initiative (SFD PI) (ENPHO, 2023).

Containments	Percentage
Fully lined tank	13%
Lined pit with semipermeable walls and open bottom	7%
Lined tank with impermeable wall and open bottom	48%
Offsite	32%
Grand Total	**100%**

2.1.3 Emptying and Transportation

Emptying is one of the major components of the sanitation value chain. It ensures proper functioning of containment basically for septic tank which functioned well until the volume of sludge is one-third of the total column of the tank. Also, in other containments, regular emptying prevents overflow of the sludge and blockages (Linda Strande, 2014). Figure 7 represents the map of Tansen Municipality showing the status of sanitation technology that has been emptied at least once.

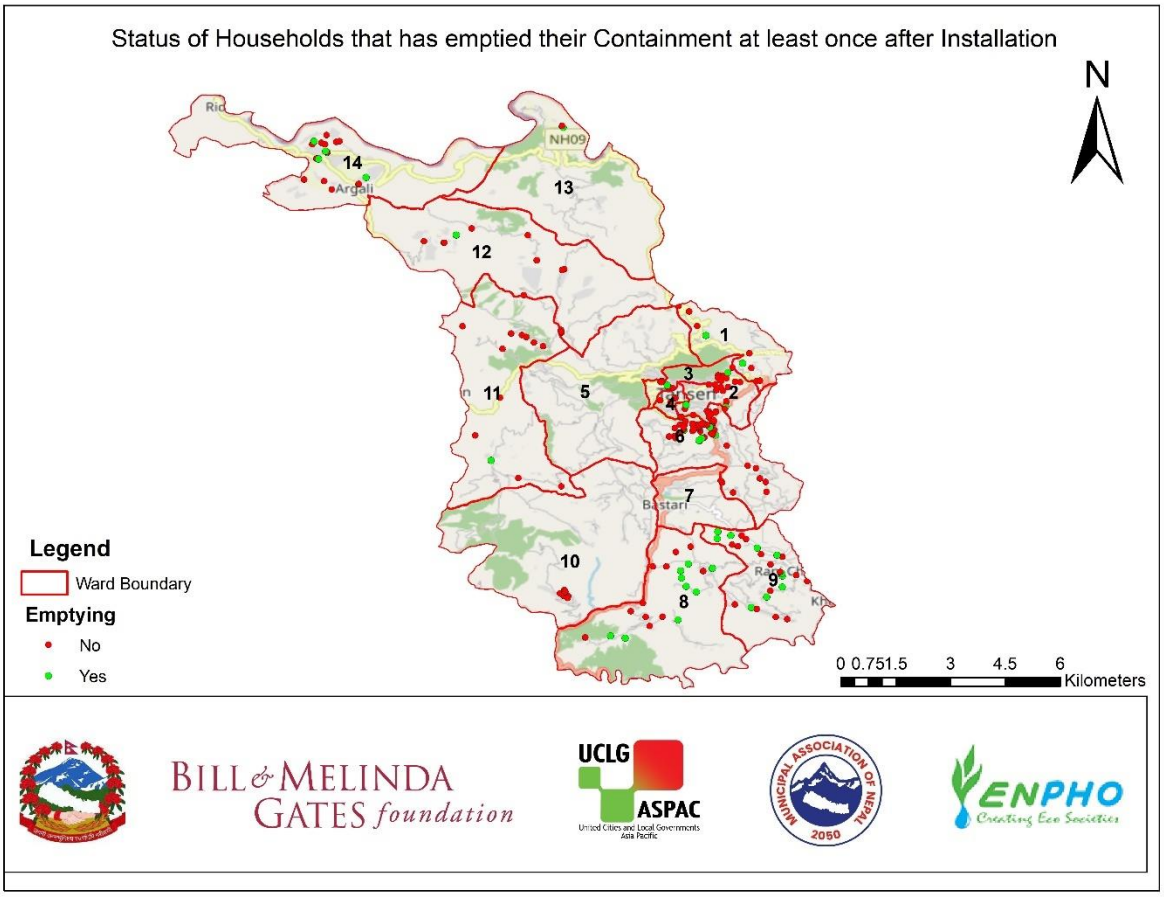

Figure 7: Status of household which have emptied their containment at least once.

Here 12.26% of the households have emptied the containment at least once since installation through manually or mechanical emptying services. Whereas the remaining households have not emptied their containment as it has not been filled yet. Table 4 displays the overall proportion of containment that has been emptied at least once since installation.

Table 4: Overall Emptying percentage of Containment at least once since installation (ENPHO, 2023).

Containment	Never emptied	Emptied at least once	Not Applicable
Biogas digester	0.00%	4.46%	0.00%
Fully lined tank	8.08%	0.84%	0.00%
Lined tank with impermeable walls and open bottom	42.62%	4.74%	0.00%
Offsite	0.00%	0.00%	32.31%
Single pit	4.74%	2.23%	0.00%
Grand Total	**55.43%**	**12.26%**	**32.31%**

There are not any private desludging service providers within the municipality. A desludging service provider from Butwal Sub-metropolitan City is providing the service in the municipality. The service provider is equipped with seven desludging vacuum trucks with a tank capacity of 4,200 litres (3 trucks) and 3,800 litres (4 trucks). It charges NPR 12,000 to 15,000 (USD 90 to 113) per trip for the rectangular containments which also varies according to travel distance (KII-4, 2023).

Figure 8: Desludging vacuum truck from Butal Sanitary Pvt. Ltd.

2.1.4 Treatment and Disposal/Reuse

Tansen Municipality does not have any form of treatment plant for wastewater or faecal sludge. Figure 9 shows the percentage of perception of people residing in the municipality about disposal of Faecal Sludge (FS) after the onsite sanitation system is emptied. Application in farms and composting is the most commonly practised way for disposal of FS, which are both considered as an unsafely managed practice.

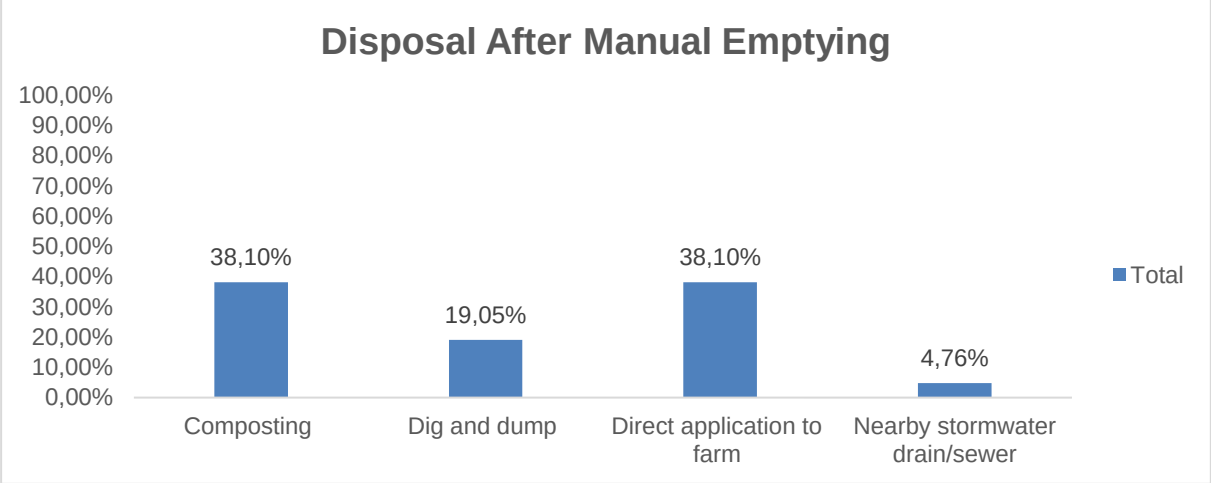

Figure 9: Disposal of Manually emptied faecal sludge (ENPHO, 2023).

2.1.5 Institutional Level Sanitation System

Altogether 35 institutions from commercial buildings, educational institutions, governmental and non-governmental offices, health care centres and hotels were assessed randomly. It was revealed that 34.29% of the buildings have connected their toilet to an offsite sanitation system whereas 65.71% of such buildings have connected their toilet to onsite sanitation technologies. The percentage of types of onsite sanitation technologies in these buildings are shown in Figure 10.

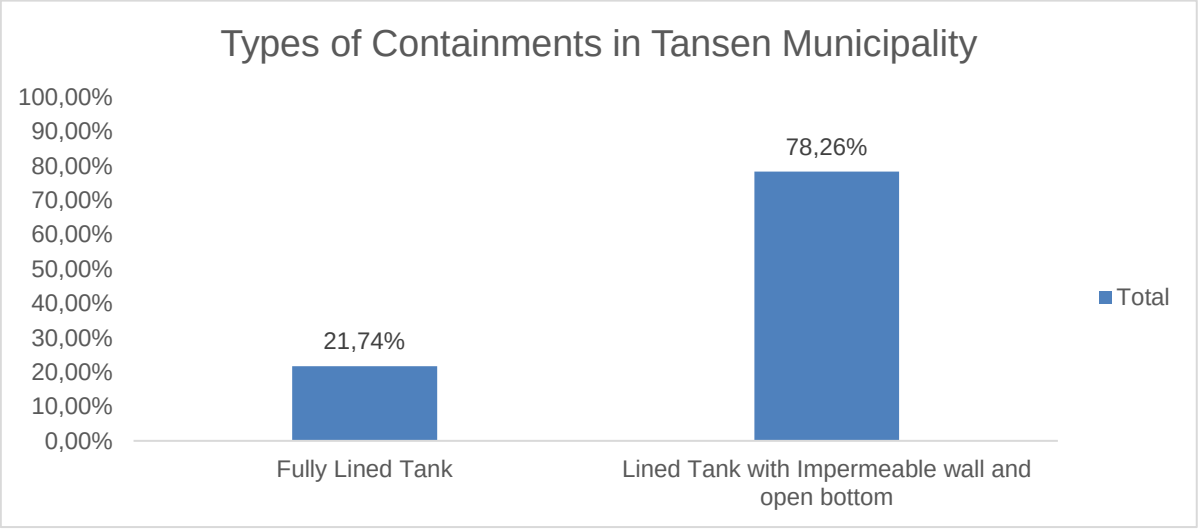

Figure 10: Types of containment in institutions of Tansen Municipality (ENPHO, 2023).

From the institutional survey, 4.35% of institutions in Tansen Municipality have emptied their containments and 95.65% of institutions have not emptied them because they have never been filled (ENPHO, 2023). Distribution of different types of onsite sanitation technologies of institutions in various wards of Tansen Municipality is shown in Figure 11.

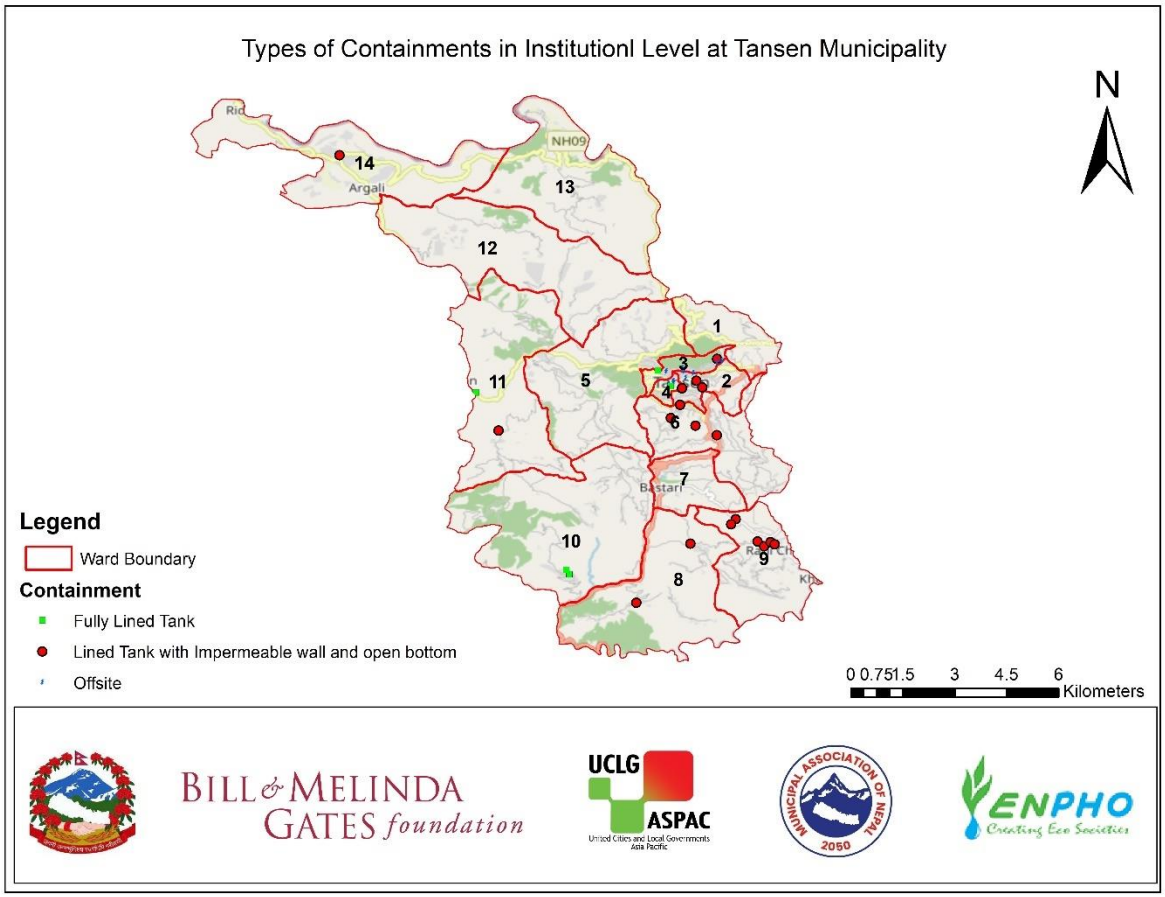

Figure 11: Types of onsite sanitation systems in institutions of Tansen Municipality.

2.1.6 Public Toilets

Tansen Municipality has only four public toilets available. One public toilet lies near Rishikesh Temple which was constructed in 2019 that consists of 2 compartments for male (6 urinals and 2 pan) and female (2 pan) (KII-3, 2023).

Public toilet 2 lies near municipality office. It was constructed in 2015 and consists of 2 compartments for male and female. The faecal sludge is collected in rectangular containments (KII-3, 2023).

Public toilet 3 lies near the bus park area which is one of the oldest public toilets in the municipality which was constructed in 1996. The public toilet was in operation before the COVID-19 in 2019. After the COVID-19, the public toilet could not run as previously due to construction of new one. The toilet consists of 2 compartments for both male and female with one pan available (KII-3, 2023).

Public toilet 4 lies near the museum which is mostly used by the visitors that consists of 2 separate compartments for male and female with one pan each. The construction of the public toilet was funded by the municipality (KII-3, 2023). Figure 12 shows the public toilets available in Tansen Municipality.

Figure 12: Public Toilets available at various location of Tansen Municipality.

2.1.7 Risk of Ground Water Pollution

The risk of groundwater pollution was assessed based on the source of drinking water, secondary data on water quality and the vulnerability of the aquifer with regard to lateral spacing between sanitation system and groundwater sources.

2.1.8 Source of Drinking Water and Water Production

a) Water Supply:

Tansen Drinking Water Users Committee has been providing piped drinking water in Tansen since 1994. It has been providing drinking water in ward 1, 2, 3, 4, 5, 6, 7 and 11 of the municipality. Currently, the system consists of five major spring sources: Bhuki, Sisne, Banjha, Holangdi and Teendhara. Additionally, the system is connected to one sump well at Kaligandaki River which is 7 km away from Tansen to meet the water demand of the municipality. The water is then transferred to the treatment site which is located at Baugha Gumba. The system consists of a conventional treatment plant with a pressure filter and a chlorination unit. Then, the water is pumped in numerous stages.

At present, Tansen Water Users Committee is serving drinking water to 4,173 households. The water is collected in 3 major reservoir tanks with a capacity of 400 m^3 and 500 m^3 (tanks located at Batase Danda) and one 100 m^3 tank located at Basantapur. Figure 13 shows the distribution of the piped drinking water supply system in Tansen Municipality.

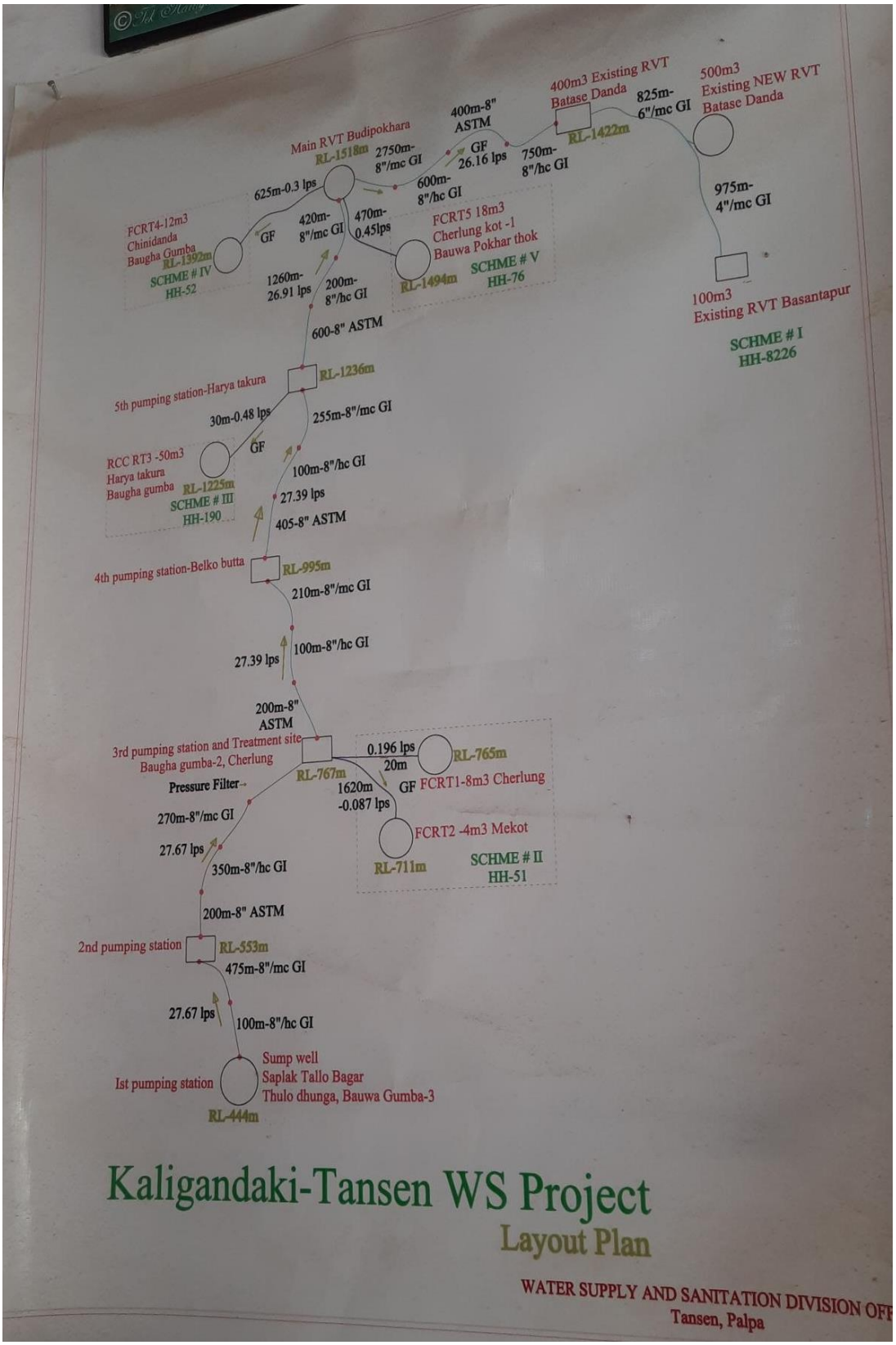

Figure 13: Layout plan for the distribution of water supply in different wards of Tansen Municipality.

However, most households in the municipality rely on private tap water for drinking water supply. 68.52% of the households in the municipality depend on private tap water sources for drinking and other daily activities. The remaining households depend on groundwater and public taps for drinking purposes. Figure 14 shows the various sources of drinking water supply in the municipality.

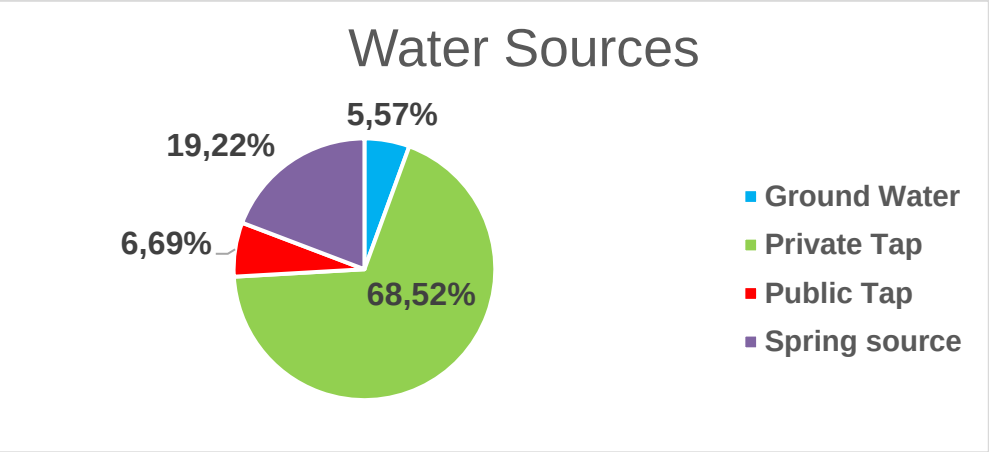

Figure 14: Sources of Drinking water supply in the Municipality.

b) The vulnerability of the aquifer and lateral spacing between sanitation system and groundwater source

The term aquifer pollution vulnerability is intended to represent the varying level of natural protection afforded by the contaminant attenuation capacity of the unsaturated zone or semi-confining beds above an aquifer, because of physicochemical processes (filtration, biodegradation, hydrolysis, adsorption, neutralization, volatilization, and dispersion)—all of which vary with their texture, structure, clay content, organic matter, pH, redox and carbonate equilibria. Groundwater vulnerability is specific to containment type and pollution scenarios (Andreo, 2013) Here, among the various types of onsite sanitation technologies, lined tanks with impermeable walls and open bottom and lined pits are more prone to contribute to aquifer pollution as the nature of such containments impose more containment load from the land surface to groundwater.

A key determinant of risk variation is the soil and geological setting. Especially for consolidated hard rock sediments with poor soil cover and shallow water tables, the risk is higher. According to WHO criteria, if the travel time of pollutant to groundwater source is less than 25 days, there is significant risk to contamination; low risk, if the travel time is between 25 and 50 days; and very low risk if the travel time is greater than 50 days (Krishnan, 2011). The size of pores in the soil determines the infiltration rate. In the sandy loam soil, the permeability is approximately 2.5 cm per hour. Thus, between 25 and 50 days the pollutant could travel to the depth of approximately 30 metres (98.67 feet) in sandy loam soil. Hence, the people using open bottom tanks and consuming water from the hand pumps with the depth up to 98.67 feet (30 m) and horizontal distance of the pump within 25 feet (7.62 m) from the source of pollutants are assumed at significant risk to groundwater pollution.

Figure 15 demonstrates the depth of hand pumps and horizontal distance of it with the containment type lined tank with impermeable walls and open bottom. Here, the total percentage of households using lined tanks with impermeable walls and open bottom is 44% (T1A4C10 + T2A4C10). Among these, 5% of households depend on groundwater. So, the percentage of these households with significant risk to consumption of contaminated groundwater is 62.5% out of 5% which accounts for 3% (i.e., T2A4C10 = 44% x 3% = 1%) is at risk of consumption of groundwater pollution from their containment whereas the remaining low risk is 43% (i.e., total T1A4C10 = 43%).

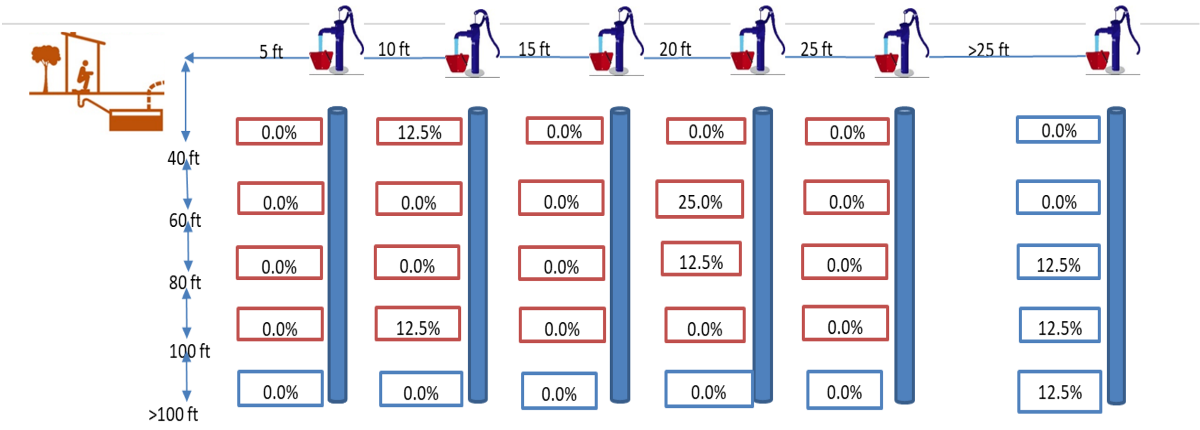

Figure 15: Depth of hand pumps and lateral spacing of it with containment type of a lined tank with impermeable walls and open bottom (ENPHO, 2023).

Figure 16 demonstrates the depth of hand pumps and horizontal distance of it with the containment type lined pit with semi-permeable walls and open bottom. Here the total percentage of households using lined pits with semi-permeable walls and open bottom is 7% (T1A5C10 + T2A5C10). Among these, 8% of households depend on groundwater. So, the percentage of these households with significant risk to consumption of contaminated groundwater is 100% out of 8% (i.e., T2A5C10 = 8% x 7% = 0.56% ~ 1%) is at risk of consumption of groundwater pollution from their containment whereas the remaining 6% are at low risk (i.e., total T1A5C10 = 6%).

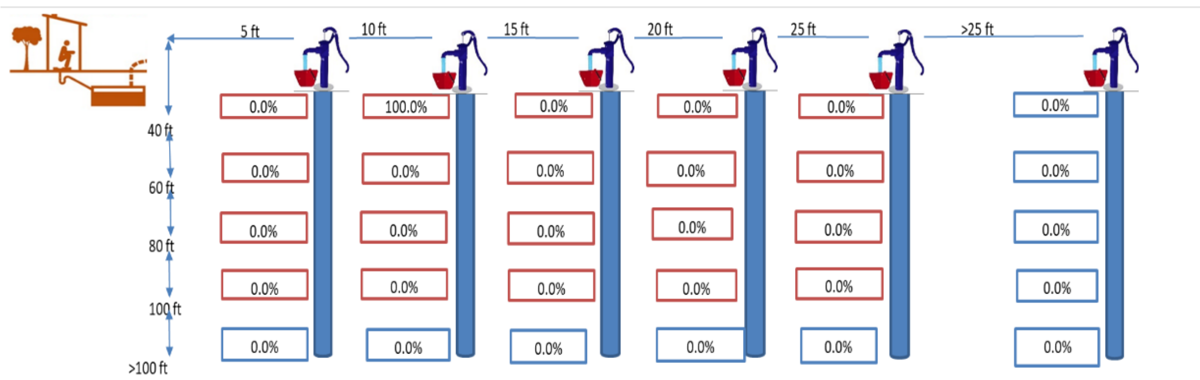

Figure 16: Depth of hand pumps and lateral spacing of it with containment type of a lined pit with semi-permeable walls and open bottom (ENPHO, 2023).

2.2 SFD Selection Grid

Types of sanitation technology selected in the SFD selection grid in the municipality are shown in Figure 17. The vertical column in the left side of the SFD selection grid has a list of technologies to which the toilet is connected to and open defecation in case of households without toilet. Similarly, horizontal row at the top of the selection grid shows options for connection for outlet or overflow discharge from toilet.

The types of household containments in the municipality are re-categorized to match the containments defined by Shit Flow Diagram Promotion Initiative (SFD PI). The anaerobic biogas digester used to treat household organic waste is also utilized by households to store and treat their faecal sludge. For the purpose of generating the SFD graphic, the biogas digester is modelled as a fully lined tank. Similarly, single pits constructed by assembling pre-cast concrete rings one above another are classified as lined pits with semipermeable walls and open bottom.

Thus, different types of sanitation systems and their outlet are selected in the selection grid and the proportion of the population using such types of systems is calculated in the SFD graphic generation process.

List A: Where does the toilet discharge to? (i.e. what type of containment technology, if any?)	List B: What is the containment technology connected to? (i.e. where does the outlet or overflow discharge to, if anything?)									
	to centralised combined sewer	to centralised foul/separate sewer	to decentralised combined sewer	to decentralised foul/separate sewer	to soakpit	to open drain or storm sewer	to water body	to open ground	to 'don't know where'	no outlet or overflow
No onsite container. Toilet discharges directly to destination given in List B			T1A1C3		Significant risk of GW pollution Low risk of GW pollution					Not Applicable
Septic tank					Significant risk of GW pollution Low risk of GW pollution					
Fully lined tank (sealed)					Significant risk of GW pollution Low risk of GW pollution			T1A3C8		T1A3C10
Lined tank with impermeable walls and open bottom	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution			T1A4C8		T2A4C10 T1A4C10
Lined pit with semi-permeable walls and open bottom	Not Applicable									T2A5C10 T1A5C10
Unlined pit										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied but abandoned when full and covered with soil										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil										
Toilet failed, damaged, collapsed or flooded										
Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded										
No toilet. Open defecation	Not Applicable									Not Applicable

Figure 17: SFD selection grid for Tansen Municipality.

Brief explanation of terms used to indicate different frames selected in the SFD selection grid in Figure 17 is explained in Table 5.

Table 5: Explanation of terms used to indicate different frame selected in the SFD selection grid in Figure 17.

T1A1C3	This is a fully functioning toilet discharging directly to a correctly designed, properly constructed, fully functioning decentralized combined sewer. The excreta are raw, untreated and hazardous.
T1A3C8	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta are potentially more toxic than the excreta in a septic tank). Since the tank is fitted with a supernatant/effluent overflow connected to open ground the excreta in this system are considered NOT contained.
T1A3C10	A correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. Since the tank is not fitted with a supernatant/effluent overflow this system is considered contained.
T1A4C8	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. Since the tank is fitted with a supernatant/effluent overflow connected to open ground, the excreta in this system are considered NOT contained.
T1A4C10 (Low Risk)	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. However, since the tank is not fitted with a supernatant/effluent overflow this system is considered contained.
T2A4C10 (High Risk)	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. The tank is NOT fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered NOT contained.
T1A5C10 (Low Risk)	A correctly designed, properly constructed and well-maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is not fitted with a supernatant/effluent overflow, so this system is considered contained.
T2A5C10 (High Risk)	This is a correctly designed, properly constructed and well-maintained pit with semipermeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is NOT fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered NOT contained.

2.2.1 SFD Matrix

The SFD matrix is the second step to generate the SFD graphic. The SFD matrix shows the proportion of people using each type of system and the proportion of each system from which FS and supernatant is emptied, transported and treated. A detailed instruction on how to calculate the proportion of the contents of each type of onsite container which is faecal sludge was used. As stated on the SFD PI, the default "100%" value is used for onsite containers which are connected to soak pits, water bodies or to open ground. This will model the contents

as 100% of faecal sludge and a proportion of this may be emptied periodically. The remaining not emptied fraction is made up of one or more of the following: faecal sludge which remains in the container, supernatant (when discharging to water bodies or to open ground), and infiltrate. The value for onsite containers that are connected to a sewer network or to open drains is used as “50%” which means half of the contents are modelled as FS and a proportion of this may be emptied periodically. The remaining not emptied fraction will comprise faecal sludge which remains in the container and, in the case of open-bottomed tanks, infiltrate. The other half of the contents is modelled as supernatant discharging into the sewer network or to open drains. The formula obtained from SFD PI used for FS proportion calculation is shown below:

$$\frac{(Onsite\ container\ connected\ to\ soak\ pit, no\ outlet, water\ bodies\ or\ open\ ground) * 100 + (Onsite\ container\ connected\ to\ sewer\ network\ or\ open\ drain) * 50}{Onsite\ Container}$$

Here, data for each selected sanitation system on the SFD Matrix is entered. The proportion of the contents of each type of onsite container (either septic tanks; or fully lined tanks (sealed); or lined tanks with impermeable walls and open bottom and all types of pits), is shown in column Population (Pop) of Figure 17. Since the municipality does not have proper sewer networks or a wastewater or FS treatment plant, the proportion of wastewater delivered to the treatment plant is 0%. Similarly, W5c is the proportion of wastewater treated in the treatment plant, which is also 0%.

The proportion of FS emptied and delivered to treatment plant is shown column F4 and F5 respectively. The FS emptied from the containments is dumped untreated openly in farmlands or water bodies. Thus, values for variables F4 and F5 for all onsite sanitation systems are set to 0%. However, FS from anaerobic biogas digesters, classified as fully lined tanks (system T1A3C10) is considered as transported (F4 = 42%) and treated with a treatment efficiency estimated at 95% (F5 = 95%). Figure 18 shows the SFD matrix of Tansen Municipality.

Tansen Municipality, Lumbini Province, Nepal, 6 Jul 2023. SFD Level: 2 - Intermediate SFD
Population: 50792
Proportion of tanks: septic tanks: 0%, fully lined tanks: 100%, lined, open bottom tanks: 100%

Containment						
System type	Population	WW transport	WW treatment	FS emptying	FS transport	FS treatment
	Pop	W4b	W5b	F3	F4	F5
System label and description	Proportion of population using this type of system (p)	Proportion of wastewater in sewer system, which is delivered to decentralised treatment plants	Proportion of wastewater delivered to decentralised treatment plants, which is treated	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated
T1A1C3 Toilet discharges directly to a decentralised combined sewer	32.0	0.0	0.0			
T1A3C10 Fully lined tank (sealed), no outlet or overflow	10.0			45.0	42.0	95.0
T1A3C8 Fully lined tank (sealed) connected to open ground	3.0			8.0	0.0	0.0
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	43.0			8.0	0.0	0.0
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	4.0			19.0	0.0	0.0
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	6.0			33.0	0.0	0.0
T2A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	1.0			0.0	0.0	0.0
T2A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	1.0			0.0	0.0	0.0

Figure 18: SFD Matrix of Tansen Municipality.

2.2.2 SFD Matrix Explanation

The sanitation technologies and the corresponding percentage of the population using such technologies are shown in Figure 18 (SFD Matrix). These values are derived from the household survey (ENPHO, 2023).

2.2.3 A proportion of FS emptied and transported.

The proportion of faecal sludge emptied (F3) is calculated based on the percentage containment emptied (ENPHO, 2023) and amount of FS emptied during the process (KII-4, 2023). The information on FS emptied from containment is obtained from Key Informant Interviews (KIIs) with desludging service providers. As stated by the desludging service provider, the portion of liquid in the FS is high which can be easily pumped out by the desludging vehicle. So, almost 90% of the FS content in the containment is removed during emptying. Hence, actual proportion of FS emptied from each containment is calculated as:

$$FS\ proportion\ emptied\ from\ containment = percentage\ of\ containment\ emptied \times proportion\ of\ FS\ emptied$$

The proportion of FS emptied from different types of sanitation technologies are shown in Table 6.

Table 6: Sanitation Technologies and Proportion of Faecal Sludge Emptied (ENPHO, 2023[(1)]; KII-4, 2023[(2)]).

S.N.	Sanitation Technologies	SFD Reference Variable	Percentage of Emptied Containment (1)	Proportion of FS emptied during emptying (2)	F3
1	Toilet discharges directly to a decentralized combined sewer	T1A1C3	0%	90%	0%
2	Fully lined tank (sealed), no outlet or overflow	T1A3C10	50.10%	90%	45%
3	Fully lined tank (sealed) connected to open ground	T1A3C8	9.33%	90%	8%
4	Lined tank with impermeable walls and open bottom, connected to open ground	T1A4C8	21%	90%	19%
5	Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	9.07%	90%	8%
6	Lined pit with semi-permeable walls and open bottom, no outlet or overflow	T1A5C10	37.17%	90%	33%
7	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A4C10	0%	90%	0%
8	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A5C10	0%	90%	0%

2.3 Summary of Assumptions:

Offsite sanitation System:

- ✓ The sewer network serves 32% of the households. The wastewater of the sewer network is being disposed of into the river as the municipality does not have a treatment plant (KII-1, 2023). Thus, values for variables W4b and W5b are both set to 0%.

Onsite Sanitation System:

- ✓ The proportion of FS in septic tank was set to 0%, the proportion of FS in fully lined tanks was set to 100% and the proportion of FS in lined tanks with impermeable walls and open bottom and all types of pits was set to 100% according to the relative proportions of the systems in the municipality, as per the guidance given in the Frequently Asked Question (FAQs) in the sustainable Sanitation Alliance (SuSanA) website.
- ✓ Variables F3, F4 and F5 for all onsite sanitation systems were derived from the household survey and cross-checked with KIIs conducted.
- ✓ The municipality does not have any form of treatment plant to treat faecal sludge. Also, the people using single pits reclassified as lined pits with semi-permeable walls and open bottoms are not using them properly. The FS emptied from the containments is dumped openly in farmland or water bodies. Thus, values for variables F4 and F5 for all sanitation systems are set to 0%. However, FS from anaerobic biogas digesters, classified as fully lined tanks (system T1A3C10), is considered as transported (F4 = 42%) and treated with a treatment efficiency estimated at 95% (F5 = 95%).

2.4 SFD Graphic

Figure 19 shows the SFD graphic for Tansen Municipality. In the graphic, the percentage of Faecal Sludge (FS) and wastewater (WW) indicated by colour green represent safely managed or stored excreta (51%) whereas the percentage in colour red represents unsafely stored or managed excreta (49%).

FS contained, i.e., FS kept in a container which is safe from human contact, in onsite sanitation, either emptied or not is safe. The FS contained - not emptied is also FS stored in tanks and pits which are in safe distance from sources of drinking water. Further, FS not contained is FS kept in containment which possess risk to human health through groundwater contamination. The lack of a Wastewater Treatment Plant (WWTP) or Faecal Sludge Treatment Plant (FSTP) in the Municipality leads to disposal of FS in farmlands and water bodies.

The faecal sludge that is safely managed is further segregated as 49% of FS which is safely collected in the containment which has not been emptied. This 49% of safely managed FS should be considered as only temporary, as most of the pits and tanks have not yet filled up and the FS generated remains ‘not emptied’. Therefore, these systems will require emptying services in the short and medium term as they fill up. The remaining 2% corresponds to FS safely treated and managed in the biodigesters.

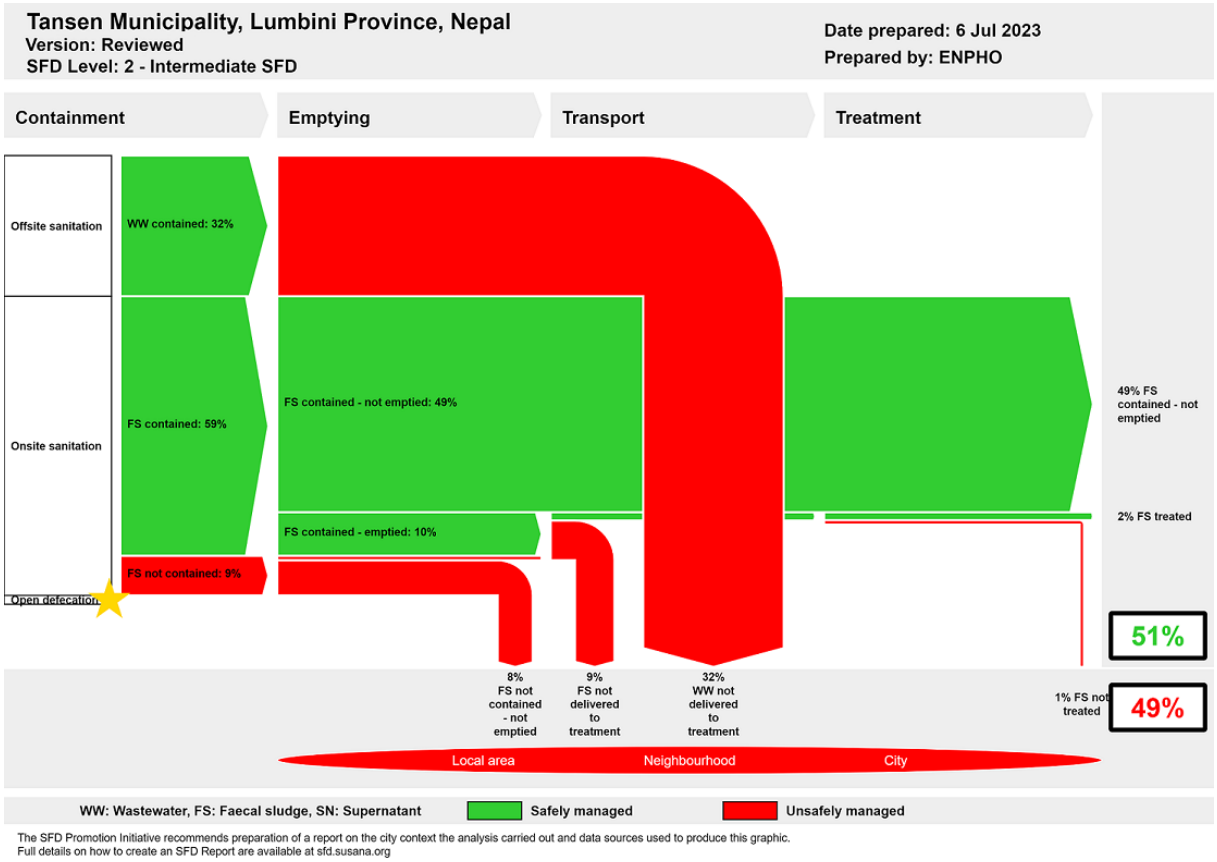

Figure 19: SFD graphic of Tansen Municipality.

The unsafely managed excreta are divided into: WW not delivered to treatment (32%), FS emptied but not delivered to treatment (9%) which is unsafely disposed of into the environment and FS not contained - not emptied (8%), having a risk of groundwater contamination through seepage. A further 1% corresponds to FS not treated from the biodigesters.

Lack of FSTP in the Municipality leads to disposal of FS in farmland and water bodies. Considering the SFD graphic, FS management is a concern for the municipality even through FS which is safely collected but emptied will eventually be emptied in future and will require safe management.

Offsite Sanitation

Nepal Multiple Indicator Survey (MICS) reported that among the total households in Nepal, 10.7% of households has a toilet connected to sewer network and, in Lumbini province, it is only 1% (CBS, 2020) whereas in Tansen Municipality, it is 32%.

Onsite Sanitation

67.69% of the population in the municipality relies on the onsite sanitation system. Among them, 59% are using technically effective containments that safely store faeces and 9% with unsafe containment. Tansen Municipality does not have any treatment plant or land separated for disposal of FS, which was confirmed by the information collected during a KII with the municipal officer (KII-1, 2023). The majority of FS emptied is delivered to open land or

farmlands for unsafe disposal. The description on the fate of FS from the onsite sanitation systems as shown in the SFD graphic is explained in Table 7.

Table 7: Description of the percentages of the SFD graphic (Susana, 2018).

Variables	Description	Percent
WW Contained	Toilet discharges directly to a decentralized combined sewer.	32%
FS contained	Faecal sludge that is contained within an onsite sanitation technology which is technically effective.	59%
FS not contained	Faecal sludge that is stored in an unsafe onsite sanitation technology.	9%
FS contained – not emptied	FS that is contained within an onsite sanitation technology and not removed where there is no significant risk to groundwater pollution. These containments are fully lined tanks (sealed), no outlet or overflow (T1A3C10), fully lined tanks with impermeable walls and open bottom without outlet or overflow (T1A4C10) and lined pits with semi-permeable walls and open bottom, no outlet or overflow (T1A5C10).	49%
FS contained – emptied	FS that is contained in onsite sanitation technology and emptied either mechanically or manually.	10%
FS not contained – not emptied.	FS that is not contained within an onsite sanitation technology and not removed which may either remain in the containment or infiltrate to ground polluting groundwater.	8%
FS not delivered to treatment	FS emptied from an onsite sanitation system is either FS contained or not but is not delivered to the treatment plant.	9%
WW not delivered to treatment	All wastewater from toilets going directly to water bodies.	32%
FS not treated	FS emptied from an onsite sanitation system, delivered to treatment but not treated.	1%

Open Defecation

Nepal Multiple Indicator Survey (MICS) reported that among the total households in Nepal, 5% of households still practices open defecation and only in Lumbini Province it is 4% (CBS, 2020). The sanitation situation assessment conducted by ENPHO in 2023 showed that 100% of surveyed households in the municipality have access to basic sanitation coverage. (ENPHO, 2023).

3 Service delivery context

3.1 Policy, legislation, and regulation

The constitution of Nepal 2015 has established right to access to clean drinking water and citizen as fundamental right. In Article 35 (4) related to right to health recognizes citizen's rights to access to clean drinking water and sanitation. In addition, Right to Clean Environment, Article 30 (1) recognizes that every person shall have the right to live in a healthy and clean environment (GoN 2015). To respect and promote the right of citizens to wards accessing clean drinking water and sanitation services, the government has promulgated and amended necessary laws. The most relevant legislation for promotion of safe sanitation services is discussed here.

Local Government Operation Act, 2017

Local Governance Operation Act 2017 has promulgated to implement the rights of local government and promote co-operation, co-existence, and co-ordination among federal, provincial, and local government. The act defined roles and responsibility of municipalities along with provision and procedure for approving laws and regulations at local level. Regarding the management of sanitation, the act entitles local government to conduct awareness campaigns, design and implement sanitation programs at the local level.

Environment Protection Act, 2019

Environment protection act 2019 is promulgated to prevent and control pollution from different development activities. It defines "Pollution" as the activities that significantly degrade, damage the environment, or harm the beneficial or useful purpose of the environment, by changing the environment directly or indirectly because of wastes, chemical, heat, noise, electrical, electro-magnetic wave, or radioactive ray. It provides the mechanism for appointing environmental inspector to control pollution by federal, provincial and local government.

Water Supply and Sanitation Act, 2022

The act was promulgated to ensure the fundamental right of citizens to easy access on clean and quality drinking water, sanitation services and management of sewerage and wastewater. It defines sewerage and wastewater management as construction of sewer networks and treatment plants to preserve sources of water. It has entitled federal, provincial, and local level for the operation and management of water and sanitation services. The act also explicitly defines the responsibility of every citizen to preserve, conserve and maintain the sources of water and use responsibly.

Environment Friendly Local Governance Framework 2013

The environment-friendly local governance framework 2013 has been issued to add value to environment-friendly local development concept encouraging environmental protection through local bodies. The framework has set basic and advanced indicators for households, settlement, ward, village, municipality, and district levels for declaration of environment friendly. The use of water sealed toilets in households as basic indicators for sanitation and health. Provision of toilet with safety tank and use as advanced indicators for sanitation. Provision of gender, children and disabled friendly public toilets in parks, petrol pumps and main market as basic indicator for municipal level. Advance indicators such as drainage discharged only after being processed through biological or engineering technique. While it

has failed to identify the necessity of faecal sludge treatment plants as it has assumed safety tank in the households is sufficient for treating faecal sludge.

Institutional and Regulatory Framework for Faecal Sludge Management, 2017

Ministry of Water Supply through its Department of Water Supply and Sewerage Management (DWSSM) articulated and endorsed Institutional and Regulatory Framework (IRF) for Faecal Sludge Management in Urban Areas of Nepal in 2017. The main objective of the IRF is to define the specific roles and responsibilities of key institutions for the effective management and regulation of Faecal Sludge Management (FSM). The framework primarily envisioned featuring FSM in the national policy and issuing policy directives into local government to incorporate FSM in their urban planning along with strengthening and enhancing the capacity of the local government to deliver effective services. A local government has been endowed with overall responsibility to plan, implement, and regulate the FSM services within its jurisdiction. The provision of the ability to engage the private sector and other relevant stakeholders such as the Water and Sanitation Users Committee (WSUC) in the framework reflects a participatory approach that would help in sustaining the interventions.

Total Sanitation Guideline, 2017

Total Sanitation Guideline was promulgated by the Ministry of Water Supply in April 2017 after the successful implementation of the National Sanitation and Hygiene Master Plan (NSHMP) 2011. It provides guidelines for sustaining ODF outcomes and initiating post-ODF activities through an integrated water, sanitation and hygiene plan at municipalities and districts. The guideline redefined sanitation as management of services and facilities to safely dispose of/reuse faecal sludge, collection and treatment of solid waste and wastewater to establish a hygienic environment and promote public health. Indicators are set to guide total sanitation movement with an arrangement for resource management, monitoring and evaluation, capacity building.

3.2 Policies

Historically, the National Sanitation Policy (1994) was the guideline for the planning and implementation of sanitation programs. The policy had promoted sanitation issues together with issues on water supply in rural communities. Also, Rural Water Supply and Sanitation National Policy (RWSSNP) 2004, has set a new target to provide safe, reliable, and affordable water supply with basic sanitation facilities. The policy focused on delivering quality services on water and sanitation to the marginalized and vulnerable groups. However, it was unable to address the complex operational issue of urban water supply and sanitation service delivery (DWSSM, 2009).Thus, National Urban Water Supply and Sanitation Sector Policy (NUWSSSP) was formulated and enforced in 2009. It focused on achieving coherent, consistent, and uniform approaches of development in urban areas with the involvement of different agencies and institutions. Both these policies were limited to addressing emerging issues and challenges in the rural and urban areas. Thus, the National Water Supply and Sanitation Policy (NWSSP) was formulated in 2014 by GON to address the emerging challenges and issues with the adoption of new approaches and resolve the inconsistency in RWSSNP and NUWSSSP.

The goal of the NWSSP was to reduce urban and rural poverty by ensuring equitable socio-economic development, improving health and the quality of life of the people and protection of environment through the provision of sustainable water supply and sanitation services. It adopted innovative technologies and knowledge emerged in the sector. Remarkably, it was the first official document that recognized discharge of untreated wastewater and dumping of septic sludge heavily polluted the surface water sources in urban areas.

Nepal is a signatory of the historical resolution of 2010 United Nations General Assembly on the Human Right to Water and Sanitation (UNGA, 2010). Nepal committed to Millennium Development Goals (MDGs) for 2000- 2015. The goal was accomplished through declaration of the country as free from open defecation on 30th September 2019. National Sanitation and Hygiene Master Plan, 2011 was developed for coordinated planning and implementation of National Sanitation Campaign. The campaign strengthened institutional setup tier of government in a participatory approach. In an alignment total sanitation campaign was initiated formally to sustain ODF. The guideline set various indicators to assess the sustainability of sanitation services. Remarkably, it extended sanitation definition as management of services and facilities to safely dispose of/reuse faecal sludge, collection and treatment of solid waste and wastewater to establish the hygienic environment and promote public health (NPC, 2017).

Similarly, Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (SDP 2016-2030) was formulated in 2016 for sector convergence, institutional and legal reforms, capacity development and establishing coordination and harmonization in the sector. The SDP classified service system and delineated roles and responsibilities for effective and sustainable service delivery. The SDP highlighted that majority of households rely on onsite sanitation system (70%) that requires effective treatment of faecal sludge. However, there is lack of concrete policies, guidelines, and indicators on faecal Sludge Management in the sector for effective planning, implementation, and service delivery.

3.2.1 Institutional roles

Federal, provincial, and local government are entitled for implementation of water and sanitation programs to ensure the rights on access to safe water and sanitation.

At Federal Level

National Planning Commission: At the federal government, the National Planning Commission is the specialized and apex advisory body for formulating a national vision, developing policy, periodic plans, and sectoral policies. The NPC assesses resource needs, identifies sources of funding, and allocates budget. It serves as a central agency for monitoring and evaluating development policy, plans and programs. It supports, facilitates and coordinates with federal, provincial, and local government for developing policy plan and implementation.

Ministry of Water Supply: Ministry of Water Supply is the lead ministry responsible for planning, implementation, regulation, and monitoring and evaluation of sanitation programs in the country (GoN, 2015). Under the MoWS, Department of Water Supply and Sewerage Management (DWSSM) plan and implement water and sanitation projects funded by foreign donors or inter provincial projects or serves at least 15,000, 5,000 and 1,000 people in terai,

hilly and mountain region respectively (GoN, 2015). The organizational structure of DWSSM is shown in Figure 20.

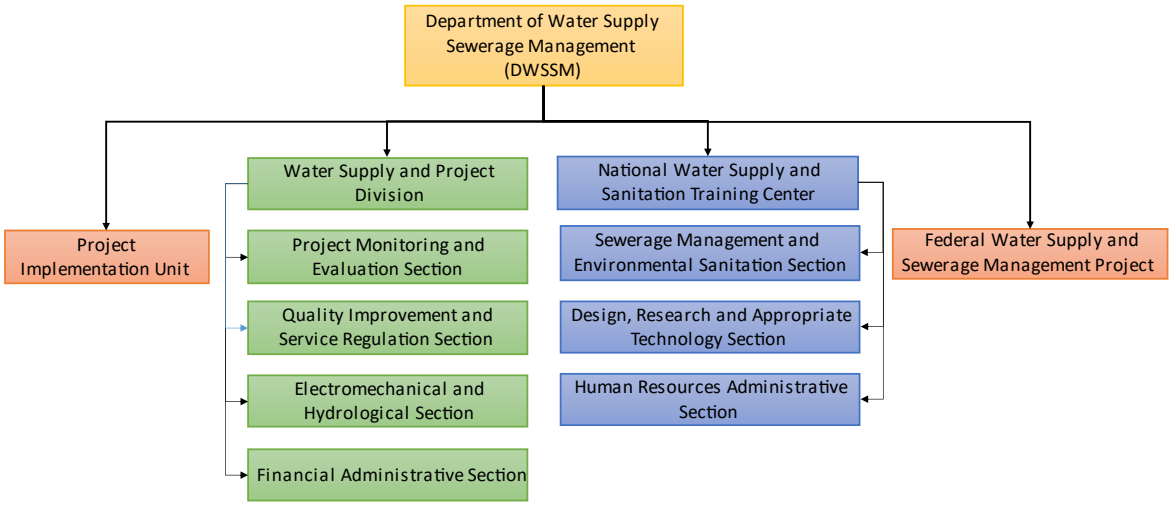

Figure 20: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).

At Provincial Level

Ministry of Physical Infrastructure: Ministry of physical infrastructure of provincial government in Madesh Province is major executing body in the province. Planning and implementation of water supply and sanitation infrastructure is the province is executed through Water supply and Sanitation Divisional Office (WSSDO). WSSDO implements the water and sanitation programs meeting the following criteria:

i. Inter local government projects.

ii. Beneficiaries between 5,000 to 15,000 in the terai region, 3,000 to 5,000 in hilly region and 500 to 1,000 in Himalayan region.

3.2.2 Service Provision

Urban Water Supply and Sanitation Policy 2009 has emphasized the Public-Private Partnership (PPP) in water supply and sanitation to improve service delivery (MoPIT, 2009). Also, the Public-Private Partnership Policy, 2015 encourages private sector investment in the development and operation of public infrastructure services for comprehensive socioeconomic development. The policy has aimed to remedy challenges such as structuring of projects, land acquisition, coordination and approval, payments to private sectors and approval for environment impact (MoF, 2015).

3.2.3 Service Standards

The sanitation service standards have set by Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (2016-2030). It classifies sanitation services as high, medium, and basic based on sanitation facilities in place. The sanitation service levels with indicators are

shown in Table 8. However, FSM specific standards have yet to be developed and implemented.

Table 8: Sanitation Service Level and its Components.

S.N.	Service Components	Service Level		
		High	Medium	Basic
1	Health and Hygiene Education	✓	✓	✓
2	Household Latrine	✓	✓	✓
3	Public and School Toilets	✓	✓	✓
4	Septic tank sludge collection, transport, treatment, and disposal	✓	✓	✓
5	Surface drains for collection, transmission, and disposal of greywater	✓	✓	✓
6	Small-bore sewer collection for toilet and septic tank effluent, low-cost treatment and disposal		✓	
7	Sanitary sewers for wastewater collection, transmission, non-conventional treatment, and disposal	✓		
8	Sanitary sewers for wastewater collection, the transmission of conventional treatment and disposal	✓		
9	Limited solid waste collection and safe disposal	✓	✓	✓

3.3 Planning

3.3.1 Service Targets

The plans and programs for development in Nepal is guided by a national development framework formulated by the national planning commission in coordination with sectoral ministries. The ministry of finance allocates budgets and releases them to executing agencies and coordinates with development partners to address resource gaps. Nepal is committed to the SDGs which has been reaffirmed in key documents such as the current 15th development plan and the 25-year long-term vision 2100 that internalizes the sustainable development goals (NPC, 2020).

The SDGs codes are assigned for all national development programs through the Medium-Term Expenditure Framework (MTEF). The MTEF sets out three-year spending plans of the national and provincial governments which aims to ensure that budgets reflect social and economic priorities and give substance to reconstruction and development commitments (NPC, 2020). Further, Nepal has prepared the SDG status and roadmap to localize the SDG indicators with baselines and targets for 2030. Nepal has set the following target and indicator focused on sanitation based on global SDGs as shown in Table 9.

Table 9: National SDG target and indicator on sanitation.

National SDG Target and Indicator	2015	2019	2022	2025	2030

Target 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations						
6.2.1 Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water						
1	Households using improved sanitation facilities which are not shared (%)	60	69.3	78.7	85.7	95
2	Proportion of population using latrine (%)	67.6	75.7	83.8	90	98
3	Sanitation coverage (%)	82	86.5	89.9	93.3	99
4	Urban households with toilets connected to sewer systems/ proper FSM (%)	30	46	62	74	90

4 Stakeholder Engagement

4.1 Key Informant Interviews (KIIs)

KIIs and objective sharing of the study were conducted with the major stakeholders of sanitation sector of the municipality. Interviews were performed with Mr. Santosh Lal Shrestha and Mr. Durga Bahadur Thapa, Mayor and Senior Officer of Tansen Municipality for the planning and the activity that is going on sanitation sector and Mr. Purna Bajracharya, Chairperson of Tansen Drinking Water Uses Committee. Table 10 shows the KIIs with the Municipal officers, Water Users Committee and Public Toilet Operators (Figure 21).

Table 10: List of Key Informant Interviewed Personnel.

S.N.	Name	Designation	Organization	Purpose of KII	Date
1.	Santosh Lal Shrestha, Durga Bahadur Thapa, Shiva Sharma, Prakash Gaire (KII-1)	Mayor, Senior Officer, Engineer and Officer	Tansen Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	14th May 2023
2.	Dr. Purna Bajracharya (KII-2)	Chairperson	Tansen Drinking Water Users Committee,	Supply and demand of water, water sources, groundwater contamination risk	14th May 2023
3.	Surya Reshm, Rupakala Bishwokarma, Pumpa Gandarva. (KII-3)	Operators	Public Toilet	Quantitative and management data on public toilet and public toilet operation	14th May 2023
4.	Yam Bahadur Thapa (KII-4)	Chairperson	Private Desludger	Emptying practices, finances, requirement, disposal and treatment	14th August 2023

Figure 21: KII with Municipal officers of Tansen Municipality.

4.2 Household Survey

A household survey was conducted in all wards of the municipality through mobilization of enumerators selected by the municipality. The enumerators were given two days orientation about sanitation and methods for conducting the household survey. The household survey was conducted using the mobile application "KOBOCOLLECT" after orientation. The SFD team members along with the municipal focal person went on field visits in households to encourage enumerators and observe the household sanitation status.

4.2.1 Determining Sample Size

The number of households to be sampled in the municipality was determined by using Cochran (1963:75) sample size formula $no = \frac{z2pq}{e2}$ and its finite population correction for the proportion n= no/(1+ (no-1)/N).

Where,

Z^2	1.96	At the confidence level of 95%
p	0.5	Assuming that about 50% of the population should have some sanitation characteristics that need to be studied (this was set at 50% since this percentage would yield the maximum sample size as the percentage of the population practising some form of sanitation is not known at the intervention sites).

q	1-p	
e	+/-5%	Level of precision or sampling error.
N		A total number of population (households in the municipality).

This is followed by proportionate stratification random sampling such that each ward in the municipality is considered as one stratum. The sample sized required in each ward is calculated as

nh= (Nh/N)*n, where Nh is the total population in each stratum.

Thus, a total of 359 households were sampled from 14,782 households distributed in 14 wards with proportionate stratification random sampling which is shown in Figure 22.

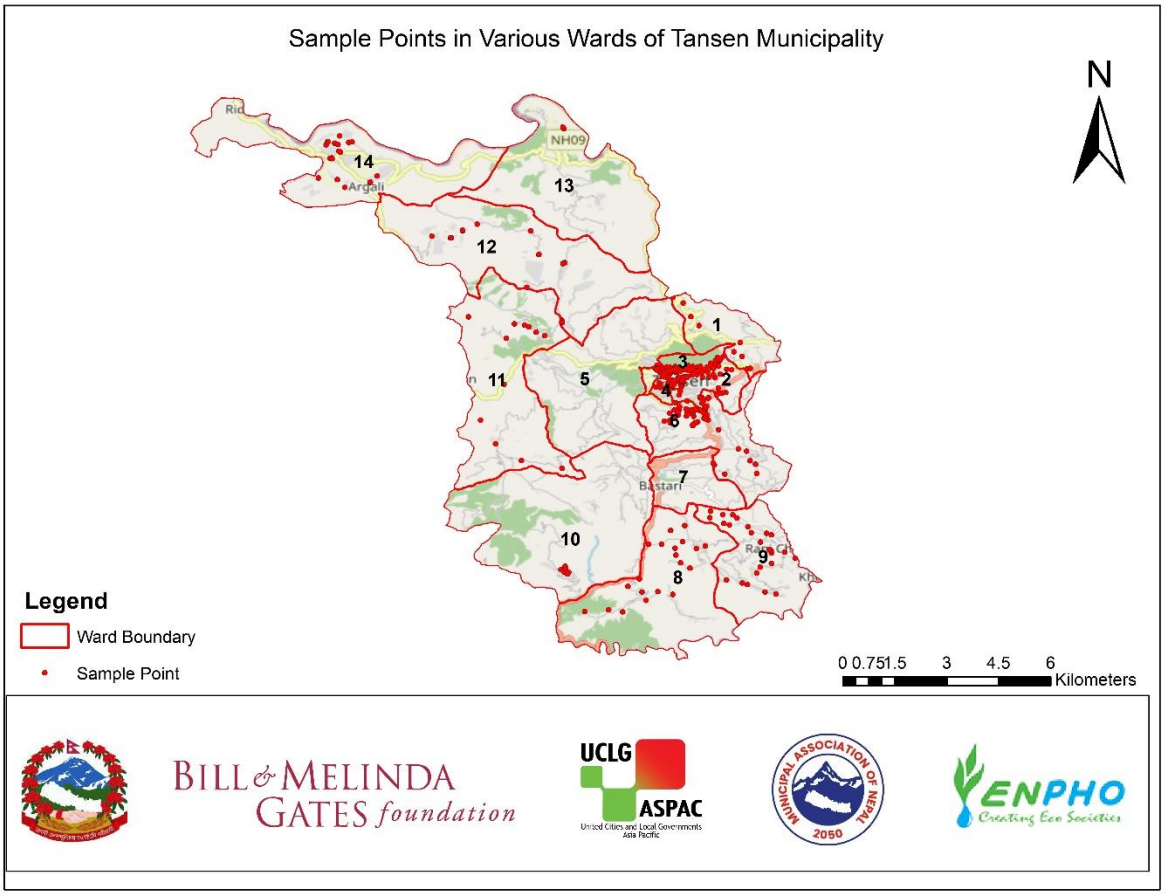

Figure 22: Distribution of sampling points in different wards of Tansen Municipality.

4.2.2 Direct Observation

Various sanitation technologies in the households in all the wards were observed and visual references were kept in Figure 23. Also, observations of the toilet, water source, containments and transportation of faecal sludge were carried out.

Figure 23: Direct observation Survey in the Municipality.

4.3 Sharing and Validation of Data

The sharing and validation of findings on sanitation status were conducted in the municipality hall in participation of Mayor, Deputy Mayor, Chief Administrative Officer (CAO), Ward Chairpersons, Municipal Officers, General members of the municipal council and other relevant stakeholders. The participants agreed upon the findings of this study that showed the current sanitation status of the municipality (Figure 24).

Figure 24: Sharing and Validation at Tansen Municipality.

5 Acknowledgements

We would like to acknowledge United Cities Local Government – Asia Pacific (UCLG ASPAC) for funding the Municipalities Advocacy on Sanitation in South Asia – II (MuNASS-II) and Municipal Association of Nepal (MuAN) for coordination with the Municipality.

We offer our sincere gratitude to Mr. Santosh Lal Shrestha, Mayor, Mrs. Pratisha Sinjali, Deputy Mayor, Mr. Jeevan Gyawali, Chief Administrative Officer of Tansen Municipality. We would also like to thank Mr. Prakash Gaire and Shiva Sharma, IT officer and Engineer of Tansen Municipality for their remarkable support during the study.

We would like appreciate Dr. Roshan Raj Shrestha, Deputy Director of Bill and Melinda Gates Foundation (BMGF), Dr. Bernadia Irawati Tjandradewi, Secretary General, and Mr. Satish Jung Shah, Knowledge Management ASPAC. Similarly, we are very much obliged to Mr. Ashok Kumar Byanju Shrestha, President and Mr. Kalanidhi Devkota, Executive Director, Mr. Muskan Shrestha, Sanitation Advocacy Specialist, MuAN for their gracious support during the study.

We are very grateful to Ms. Bhawana Sharma, Executive Director and Mr. Rajendra Shrestha, Program Director in Environment and Public Health Organization (ENPHO) for tremendous support and guidance during the whole process of the study. Together, we would like to thank all ENPHO colleagues for their support in the development of questionnaire for the survey and uploading data in KOBOCOLLECT tool.

We are grateful to the enumerators, Mr. Ganesh Karki, Mr. Seman Jung Thapa, Mr. Bibek Timalsina, Mr. Ashok Bhattarai, Mrs. Laxmi Bista, Mrs. Jyoti Chauhan, Mrs. Bimala Dawadee, Mrs. Susmita Paudel Chhetri, Mrs. Gita Bashyal, Mr. Tuk Bahadur Rana, Mrs. Anuska Ligal, Mrs. Laxmi Baudel, Mr. Dhiraj Bhattari.

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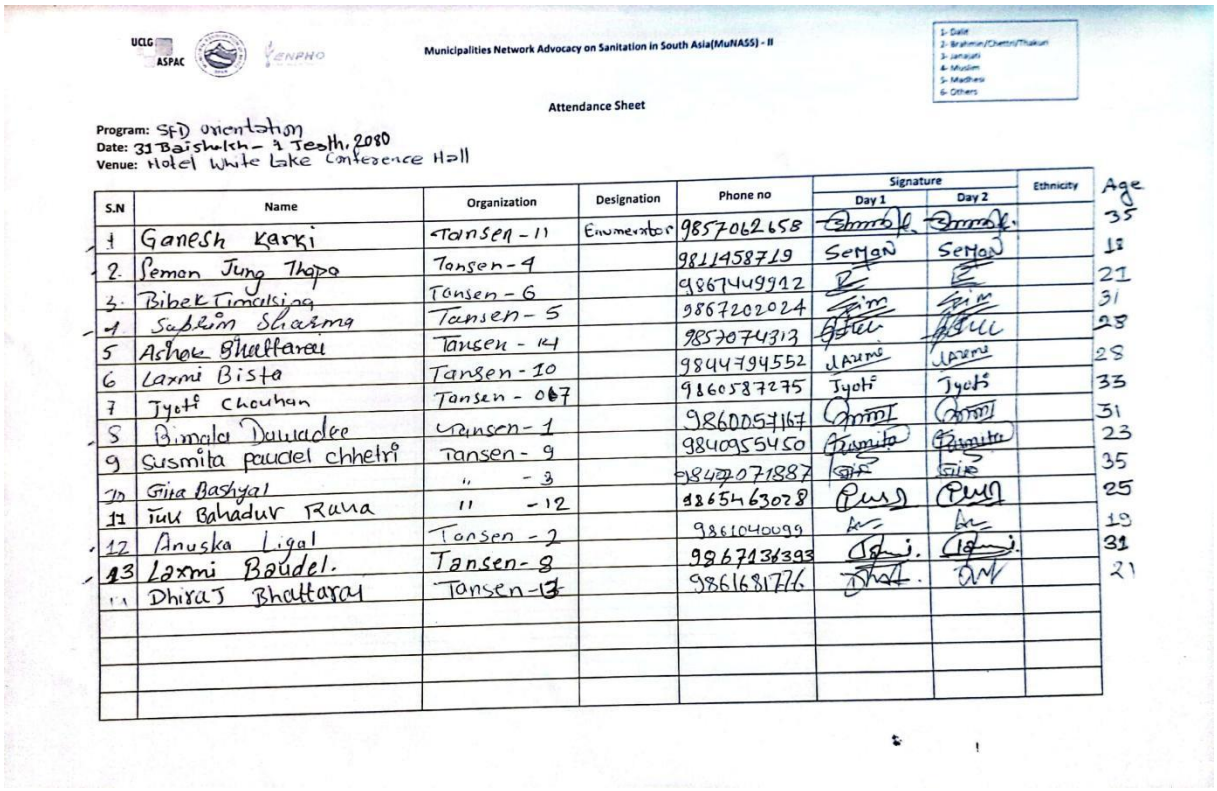
7 Appendix

7.1 Appendix 1: List of Participants of Orientation on Survey for Shit Flow Diagram



UCLG ASPAC | ENPHO

Municipalities Network Advocacy on Sanitation in South Asia(MuNASS) - II

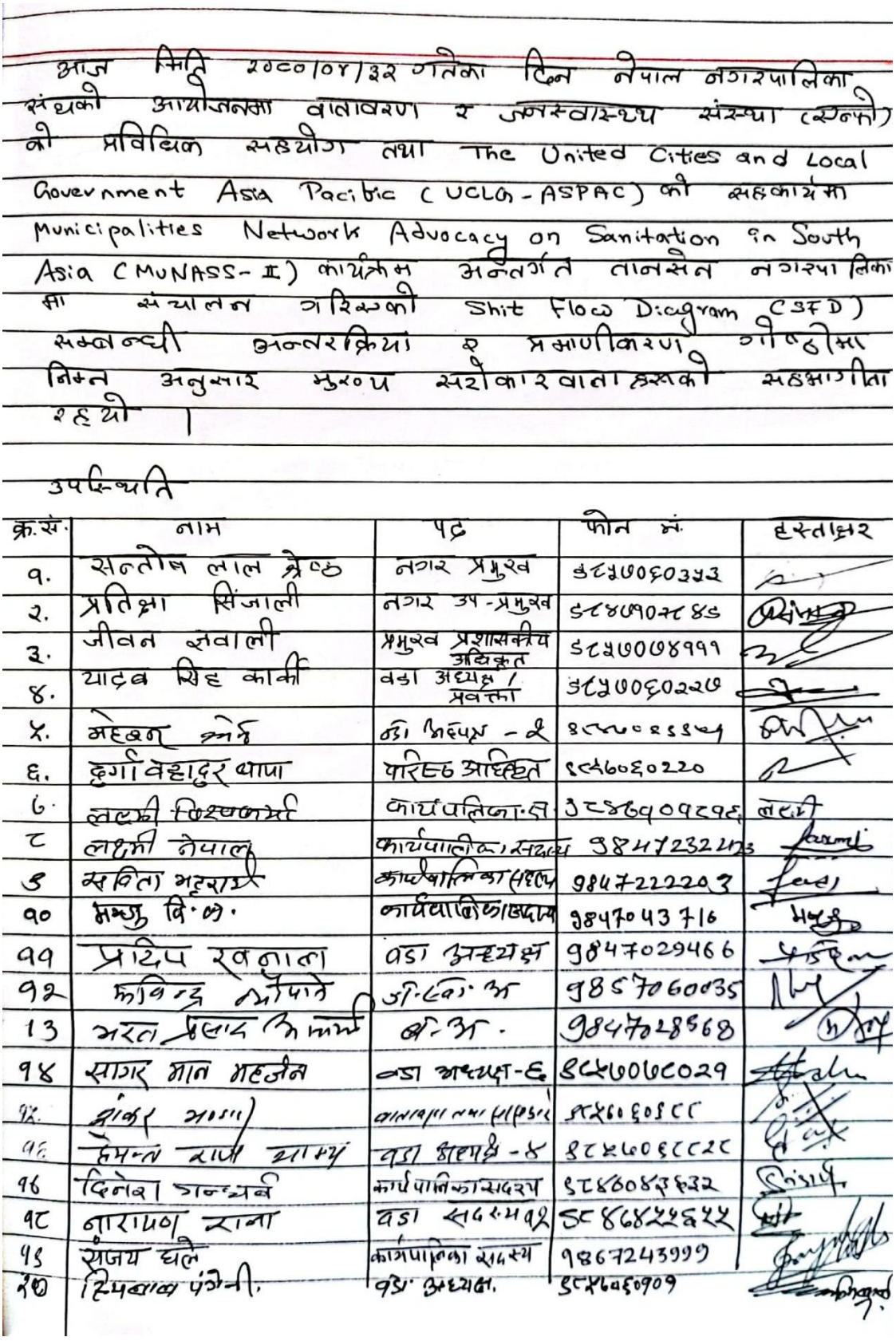
1- Dalit
2- Brahmin/Chettri/Thakuri
3- Janajati
4- Muslim
5- Madhesi
6- Others

Attendance Sheet

Program: SFD orientation
Date: 31 Baishakh – 1 Jesth, 2080
Venue: Hotel White Lake Conference Hall

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Ethnicity	Age
1	Ganesh Karki	Tansen - 11	Enumerator	9857062658				35
2.	Semon Jung Thapa	Tansen - 4		9811458719	Semon	Semon		18
3.	Bibek Timalsina	Tansen - 6		9867449912				21
4	Sabin Sharma	Tansen - 5		9867202024				31
5	Ashok Bhattarai	Tansen - 14		9857074313				28
6	Laxmi Bista	Tansen - 10		9844794552	Laxmi	Laxmi		25
7	Jyoti Chouhan	Tansen - 067		9860587275	Jyoti	Jyoti		33
8	Bimala Dawadee	Tansen - 1		9860057167				31
9	Susmita paudel chhetri	Tansen - 9		9840955450	Susmita	Susmita		23
10	Gita Bashyal	" - 3		9847071887				35
11	Tul Bahadur Rana	" - 12		9865463078				25
12	Anuska Ligal	Tansen - 2		9861040099				19
13	Laxmi Baudel.	Tansen - 8		9867136393				31
14	Dhiraj Bhattarai	Tansen - 17		9861681776				21

7.2 Appendix 2: List of Participants in Sharing and Validation Workshop



आज मिति २०८०।०४।३२ गतेका दिन नेपाल नगरपालिका संघको आयोजनामा वातावरण र जनस्वास्थ्य संस्था (एनफो) को प्राविधिक सहयोग तथा The United Cities and Local Government Asia Pacific (UCLG-ASPAC) को सहकार्यमा Municipalities Network Advocacy on Sanitation in South Asia (MuNASS-II) कार्यक्रम अन्तर्गत तानसेन नगरपालिका मा संचालन गरिनको Shit Flow Diagram (SFD) सम्बन्धी अन्तरक्रिया र प्रमाणीकरण गोष्ठीमा निम्न अनुसार सुरुप सरोकारवालाहरुको सहभागीता रहेको ।

उपस्थिति

क्र.सं.	नाम	पद	फोन नं.	हस्ताक्षर
१.	सन्तोष लाल श्रेष्ठ	नगर प्रमुख	९८४७०६०३४३	
२.	प्रतिक्षा सिंजाली	नगर उप-प्रमुख	९८४७१०४८४९	
३.	जीवन रुवाली	प्रमुख प्रशासकीय अधिकृत	९८४७०७४९९९	
४.	यादव सिंह कार्की	वडा अध्यक्ष / प्रवक्ता	९८४७०६०२२७	
५.	मेहबुब अन्सारी	वडा सदस्य - २	९८४७०१९९७५	
६.	दुर्गा बहादुर थापा	पारिस्थ अधिकृत	९८४६०६०२२०	
७.	लक्ष्मी चिरञ्जीवी	कार्यपालिका-सदस्य	९८४७५०९८५६	
८	लक्ष्मी नेपाल	कार्यपालिका सदस्य	९८४७२३२५५३	
९	सविता भट्टराई	कार्यपालिका सदस्य	९८४७२२२२०३	
१०	मन्जु वि.क.	कार्यपालिका सदस्य	९८४७०४३७१६	
११	प्रदिप रुवाला	वडा अध्यक्ष	९८४७०२९४६६	
१२	गोविन्द पौडाले	जि.स.स.	९८५७०६००३५	
१३	भरत प्रसाद [illegible]	वडा अ.	९८४७०२८५६८	
१४	सागर मान महर्जन	वडा अध्यक्ष-६	९८४७०७८०२९	
१५	[illegible]	[illegible]	[illegible]	
१६	हेमन्त राज शाह्य	वडा सदस्य-४	९८४७०६८८२८	
१७	दिनेश गन्धर्व	कार्यपालिका सदस्य	९८४७०४३६३२	
१८	नारायण राना	वडा सदस्य	९८४८४२५६२५	
१९	संजय घले	कार्यपालिका सदस्य	९८४७२४३९९९	
२०	हिमचाक पंगेनी	वडा अध्यक्ष	९८४७६०९०९	

क्र.सं.	नाम	पद	फोन नं. / मो. नं.	हस्ताक्षर
२१				
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२८	बाबुराम श्रेष्ठ	'' '' - २	९८६३०८०६२९	[signature]
२९	सान्तो घिमिरे			[signature]
३०	[illegible] टकनाल	ने.अ. (ले.प्र.सा. शाखा)	[illegible]	[signature]
३१	अनिता भुजु		९८४५३४८१५७	[signature]
३२	रूपक श्रेष्ठ		9849463840	[signature]

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