SFD Report

Khandbari Municipality
Nepal

Final Report

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SFD Report Khandbari Municipality, Nepal, 2026

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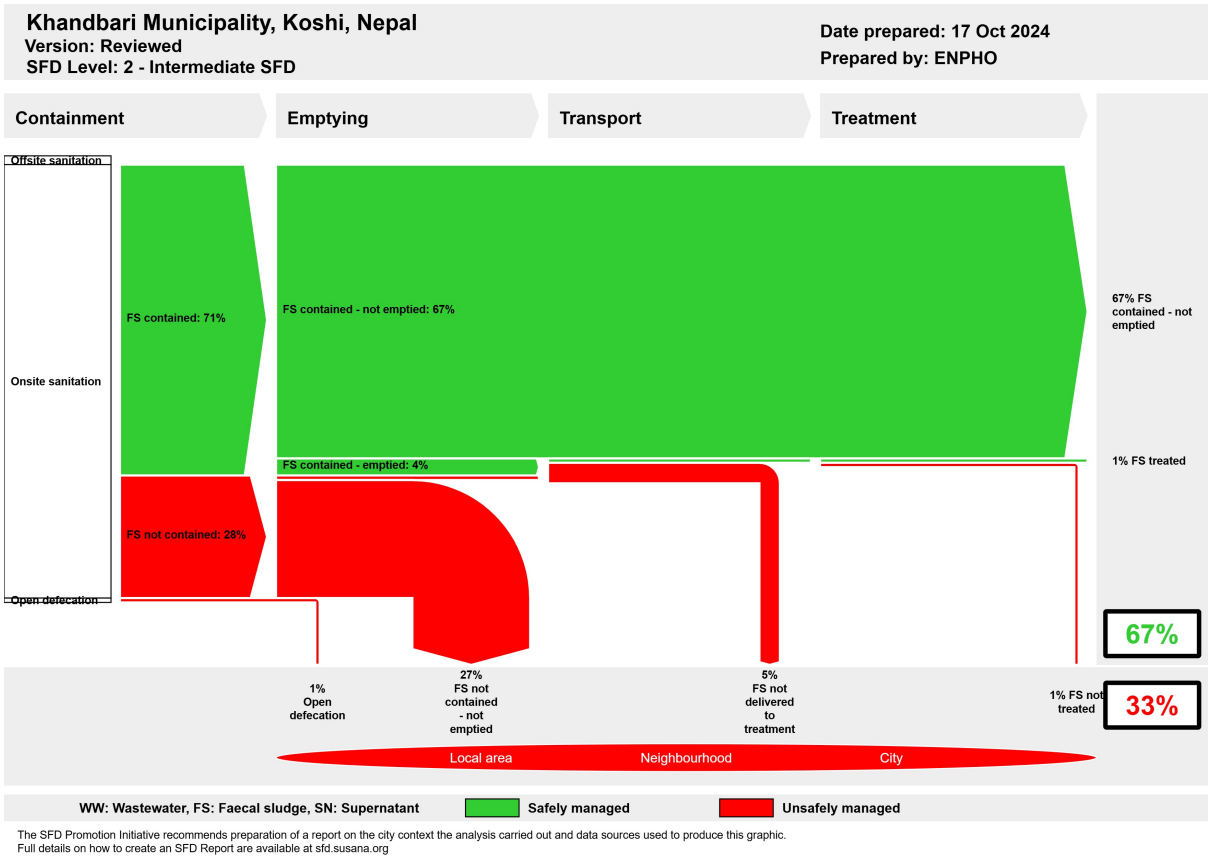
1. The SFD Graphic



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.
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2. Diagram information

SFD Level:

This SFD is a level 2 - Intermediate report.

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Khandbari Municipality

Municipal Association of Nepal (MuAN)

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3. General city information

Khandbari Municipality is situated in the Sankhuwasabha district, Koshi province of Nepal. It was established in 2014, by merging Manakamana, Pangma, Malta, Sitalpati Village Development Committees (VDCs) that spreads 122.78 square kilometers across 11 political wards.

According to the 2021 National Population and Housing Census, the population stood at 35,565 individuals residing in 9,309 households. Khandbari has a Tundra climate. The warmest month is May, the coldest month January, wettest month July, and driest month December. Geographically, the altitudes range from 278 meters to 2171 meters above sea level, with coordinates extends from 27°16'14" N to 27°27'44" N latitude and 87°14'27" E to 87°07'26" E longitude.

4. Service outcomes

This section provides a quick summary of the various sanitation technologies used across the municipality's sanitation value chain. All data in this section are from the household and institutional surveys conducted for this study (ENPHO, 2023). All the households had access to toilet and connected to onsite sanittaion technology.

Containment:

1% of sampled households do not have access to improved sanitation facilities. Those who have access rely on onsite sanitation system. A variety of sanitation technologies prevail: 21.5% of households utilize fully lined tanks, 0.5% utilize biogas digesters, 23% lined tanks with impermeable walls and open bottoms, and 54% had installed unlined pits. Institutional buildings had 60% fully lined tanks, 36% using lined tanks with impermeable walls and open bottom, and 4% relying on unlined pits.

Emptying and transportation:

Among sampled households, only 5.2% have emptied their containments atleast once after installation due to faecal sludge overflow. There are no any desludging services within municipality. 42.1% of containment has been emptied mechanically by desludging vehicles from the neighboring municipality, Mahakali, and Leguwa, Dhankuta District. 57.9% rely on manual emptying done by traditional sanitation workers.

Notably, only 4% of containments in institutions are emptied which are mechanically desludged highlighting a critical gap in maintenance practices in both household and institutional sanitation technology.

Treatment and Disposal:

The faecal sludge treatment plant, and mechanical desludging service is not available in the municipality. Mechanically desludged faecal sludge are disposed in forests and water bodies. Meanwhile, individuals engaged in manual emptying practice dig and dump practice, and direct use in farmland, escalating environmental and public health risks within the community.

Risk Assessment:

Most of the households, around 93.3% consumed spring source for drinking water, whereas 5.7% consumed the private taps at home, 0.5% used public taps, and 0.5% used jar water. The risk analysis was made in reference to the vertical and horizontal distance from containments to water sources.

The SFD graphic shows that 67% of the excreta or faecal sludge generated are safely managed while 33% are unsafely managed. The safely managed Faecal Sludge (FS) generated by 67% of the population is temporary as this FS is only contained. So, once the containment gets filled and the FS from the containment is emptied, the percentage of unsafely managed FS would increase.

5. Service delivery context

Access to safe 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 endorsed the Water Supply and Sanitation Act 2022 which has 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 need of people. Particularly, the National Sanitation and Hygiene Master Plan (NSHMP) 2011 has proved as an important strategic document for all stakeholders to develop uniform programs and implementation mechanism at all levels. It strengthens institutional set up with the formation of water and sanitation coordination committee at every tier of government to actively engage in sanitation campaigns. Currently, the municipality has no separate sanitation unit and no specific laws and policies towards the faecal sludge management.

6. Overview of stakeholders

Based on the regulatory framework for Faecal Sludge Management (FSM), the major stakeholders for effective and sustaining service delivery as presented in Table 1.

Table 1: Overview of Stakeholders.

Key Stakeholders	Institutions / Organizations
Public Institutions at Federal Government	Ministry of Water Supply
Public Institutions at Provincial Government	Ministry of Energy, Water resources and Water Supply

Public Institutions at Local Government	Khandbari Municipality, Khandbari WSUC
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 data were collected from proportionate stratification random sampling. Altogether, 370 households and 25 institutions were surveyed from 11 wards of the municipality. Primary data on emptying, transportation, and current sanitation practices in the municipality are validated from Key Informant Interviews (KIIs) with water service providers and other different sanitation and environmental stakeholder. The overall data and findings were shared with the stakeholders of the municipality and validated through a sharing program on 28th October, 2024.

8. Process of SFD development

Data on sanitation situation is collected through household and institutional surveys (ENPHO, 2023). Enumerators from the municipality were mobilized after providing orientation on sanitation technologies, objectives of the survey and proper use of mobile application, KOBOCOLLECT for collection of data for survey. Along with this, KIIs were conducted with officers of municipality to understand the situation practices across the service chain. Types of sanitation technologies used in different locations were mapped using ARCGIS. To produce the SFD graphic, initially a relationship between sanitation technology used in questionnaire survey and SFD PI methodology was made. Then, data were fed into SFD graphic generator to produce the SFD graphic.

9. List of data sources

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

- ENPHO. (2023). Sanitation Survey on Khandbari Municipality, Khandbari.
- NSO. (2022). National population and housing census 2021. Kathmandu: National Statisitics Office.

SFD Khandbari Municipality, Nepal, 2026

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Abbreviations

AEPC	Alternative Energy Promotion Centre
BMGF	Bill and Melinda Gates Foundation
DWSSM	Department of Water Supply and Sewerage Management
ENPHO	Environment and Public Health Organization
FS	Faecal Sludge
FSM	Faecal Sludge Management
GoN	Government of Nepal
HH	Household
IRF	Institutional and Regulatory Framework
KII	Key Informant Interview
KM	Kilometres
MDG	Millennium Development Goal
MICS	Multiple Indicator Cluster Survey
MuNASS-II	Municipalities Advocacy on Sanitation in South Asia – II
MoH	Ministry of Health
MoHP	Ministry of Health and Population
MoWS	Ministry of Water Supply
MuAN	Municipal Association of Nepal
NGO	Non-Governmental Organization
NPC	National Planning Commission
NWSSP	National Water Supply and Sanitation Policy
ODF	Open Defecation Free
PPP	Public Private Partnership
RWSSNP	Rural Water Supply and Sanitation National Policy
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
WHO	World Health Organization
WSUC	Water Supply and User's Committee
WW	Wastewater

1 City context

Khandbari Municipality is situated in the headquarters of Sankhuwasabha district, Koshi province. The municipality was formed by merging Manakamana, Pangma, Malta, Sitalpati Village Development Committees (VDCs) in 2014 A.D. It comprises 11 political wards spread across 122.78 square kilometres of geographical area (khandbari Municipality, 2079). Figure 1 shows the map of the municipality with its ward boundaries.

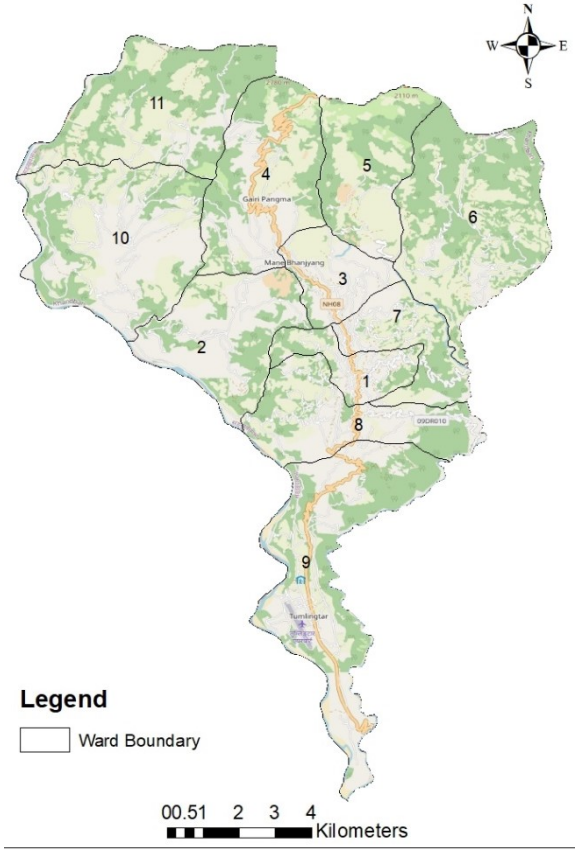

Figure 1: Map of Khandbari Municipality with ward boundaries.

1.1 Population

The municipality's population, according to the 2021 National Population and Housing Census was 35,565 individuals distributed across 9,309 households. The male and female populations were 17,356 and 18,209 respectively (NSO, 2021) . The municipality has experienced annual growth rate of 1.2% per annum, and a population density of 290/km² (City Population, Khandbari, 2021) .

1.2 Climate

Khandbari has a Tundra climate (Classification: Et). The district's yearly temperature is 29.52ºC (85.14ºF) and it is 7.52% higher than Nepal's averages. Khandbari typically receives about 133.11 millimeters (5.24 inches) of precipitation and has 123.66 rainy days (33.88% of the time) annually. The warmest month is May, coldest month January, wettest month July, and driest month December (weathersandclimate, Weather and climate, 2024).

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Oct	Dec	Year
Record high °C (°F)	31.94 (89.49)	34.93 (94.87)	43.91 (111.04)	45.91 (114.64)	45.91 (114.64)	43.91 (111.04)	40.92 (105.66)	40.92 (105.66)	39.92 (103.86)	37.92 (100.26)	35.93 (96.67)	31.94 (89.49)	45.91 (114.64)
Average high °C (°F)	24.67 (76.41)	28.24 (82.83)	34.23 (93.61)	38.43 (101.17)	38.79 (101.82)	37.66 (99.79)	34.22 (93.6)	34.62 (94.32)	33.56 (92.41)	32.3 (90.14)	30.17 (86.31)	26.3 (79.34)	32.76 (90.97)
Daily mean °C (°F)	20.6 (69.08)	24.02 (75.24)	30.28 (86.5)	34.78 (94.6)	35.37 (95.67)	34.76 (94.57)	32.17 (89.91)	32.43 (90.37)	31.19 (88.14)	29.26 (84.67)	26.69 (80.04)	22.69 (72.84)	29.52 (85.14)
Average low °C (°F)	14.2 (57.56)	16.49 (61.68)	21.45 (70.61)	25.81 (78.46)	27.34 (81.21)	28.36 (83.05)	27.7 (81.86)	27.75 (81.95)	26.47 (79.65)	23.59 (74.46)	20.33 (68.59)	16.75 (62.15)	23.02 (73.44)
Record low °C (°F)	5.99 (42.78)	9.98 (49.96)	14.97 (58.95)	20.96 (69.73)	21.96 (71.53)	22.95 (73.31)	21.96 (71.53)	23.95 (75.11)	16.97 (62.55)	17.96 (64.33)	13.97 (57.15)	10.98 (51.76)	5.99 (42.78)
Average precipitation mm (inches)	8.51 (0.34)	16.0 (0.63)	11.33 (0.45)	35.77 (1.41)	109.15 (4.3)	216.04 (8.51)	473.24 (18.63)	344.21 (13.55)	304.75 (12.0)	70.29 (2.77)	4.88 (0.19)	3.17 (0.12)	133.11 (5.24)
Average precipitation days (≥ 1.0 mm)	1.82	2.27	2.54	6.81	14.42	19.23	24.59	21.78	20.05	7.44	1.91	0.82	10.31
Average relative humidity (%)	53.26	47.72	32.52	34.51	48.81	60.1	71.75	70.4	71.94	65.7	53.0	49.82	54.96
Mean monthly sunshine hours	8.53	8.56	10.85	12.72	13.33	13.18	12.35	12.34	10.63	11.18	9.69	8.58	11.0

Source: weatherandclimate, 2021

Figure 2: Weather Summary of Khandbari Municipality.

1.3 Topography

The municipality lies at the Northen belt of the country at altitude of 278 meters to 2171 meters above mean sea level. Geographically it extends from 27°16'14" N to 27°27'44" N latitude and 87°14'27" E to 87°07'26" E longitude at Nepal's hill region (khandbari Municipality, 2079) . It is bordered by Sabhapokhari Rural Municipality and Panchkhapan Municpality in the east, Shadananda Municipality of Bhojpur district in the west, Silichong and Chichila Rural Municipality in the north and Chainpur and Bhojpur Districts in the South (khandbari Municipality, 2079).

2 Service Outcomes

2.1 Overview

On September 30, 2019, the Government of Nepal declared the nation free of open defecation, marking universal access to improved sanitation facilities nationwide (MoWS, 2017). However, the sanitation situation in many places remains unsatisfactory. To assess the sanitation status across the entire sanitation service chain, a household survey was conducted in 370 sampled households using a proportionate sampling across the 11 wards of Khandbari Municipality (further details are presented in section 4). Data on sanitation situations were collected through household and institutional surveys (ENPHO, 2023). The results obtained after the triangulation and validation of the data with all the data sources including literature reviews, and Key Informant Interviews (KIIs) is presented in this section.

2.1.1 Sanitation Systems in household buildings

The National Population and Housing Census, 2021 indicated that 0.93% of the households in the municipality lacks access to basic sanitation facilities (NSO, 2021). Meanwhile, findings from this survey revealed 1% of sampled households in the municipality do not have access to improved sanitation facilities. An improved sanitation facility is defined as one that hygienically separates human excreta from human contact. Improved sanitation facilities include flush or pour flush to piped sewer systems, septic tanks, or pit latrines, ventilated improved pit latrines, pit latrines with slabs and composting toilets (MICS, 2019).

In the municipality, those who had access to improved sanitation facilities rely on onsite sanitation system. Any sanitation technology or system involving the collection and storage of excreta (referred to as faecal sludge) on the plot where it is generated is known as onsite sanitation (Susana, 2018). In the municipality, none of the households have a well-designed septic tank. Instead, fully lined tanks with a single or double chamber were constructed in 21.5% of households, and 0.5% have built biogas. Additionally, 23% of households installed lined tanks with impermeable walls and an open bottom, while 54% built unlined pits. Table 1 illustrates the various types of onsite sanitation technologies used in the municipality and the corresponding proportion of households utilizing each.

Table 1: Sanitation system illustrating different onsite sanitation technologies installed at households in Khandbari Municipality (ENPHO, 2023).

Types of containment	Construction material used in the wall of the containment	Construction material used in the bottom of the containment	Number of Chambers	Number of containments	%	Recategorized as SFD	%
Biogas Digester	NA	NA	NA	NA	0.5%	Fully lined tank	22%
Fully Lined tank	Cemented brick/stone walls or concrete walls	PCC or plaster	One or two	NA	21.5%		
Lined tank with impermeable walls and open bottom	Cemented brick/stone walls or concrete walls	Soiling or nothing	One or two or more than two	NA	23%	Lined tank with impermeable walls and open bottom	23%
Unlined Pit	Mud mortar stone or brick wall	Soiling or nothing	NA	NA	54%	Unlined Pit	54%
Open defecation	NA	NA	NA	NA	1%	Open defecation	1%
						Total	**100%**

Biogas: A biogas digester, an effective energy conversion technology, treats household-generated faecal sludge through anaerobic digestion. This process reduces sludge size, eliminates harmful pathogens, and yields biogas and nutrient-rich slurry, biologically stable to use as a soil conditioner (Linda Strande, 2014). The Alternative Energy Promotion Centre (AEPC) has promoted biogas technology in 77 districts of Nepal, contributing to improved health and sanitation (AEPC, 2018). In the municipality, 0.5% of households had biogas digesters. When creating a SFD graphic, biogas is reclassified as SFD containment, considering it as a fully lined tank.

Fully Lined Tank: A fully lined tank is a rectangular tank with impermeable walls and a base, engineered to prevent leakage or seepage of faecal sludge into the surrounding environment. This design ensures the safe storage of faecal sludge, protecting against groundwater contamination (Linda Strande, 2014). In the municipality, 21.5% of households had fully lined tanks.

Lined Tank with Impermeable Walls and Open Bottom: This rectangular onsite technology involves constructing tanks with impermeable walls and a permeable base, allowing the infiltration of effluents that could potentially contaminate groundwater (Peal, et al., 2020). In the municipality, 23% of households installed this type of containment.

Unlined Pit: An unlined pit is a pit appropriately designed, constructed, and maintained, featuring permeable walls and a base for liquid infiltration. However, it poses a concern as the walls are made of materials like mud mortar stone/brick or dry stone, and the base with soiling or nothing, making it permeable resulting in the risk of groundwater contamination.

54% of the households in the municipality used this. This practice significantly increases the risk of contamination of ground water sources. The different types of containment is shown in Figure 3.

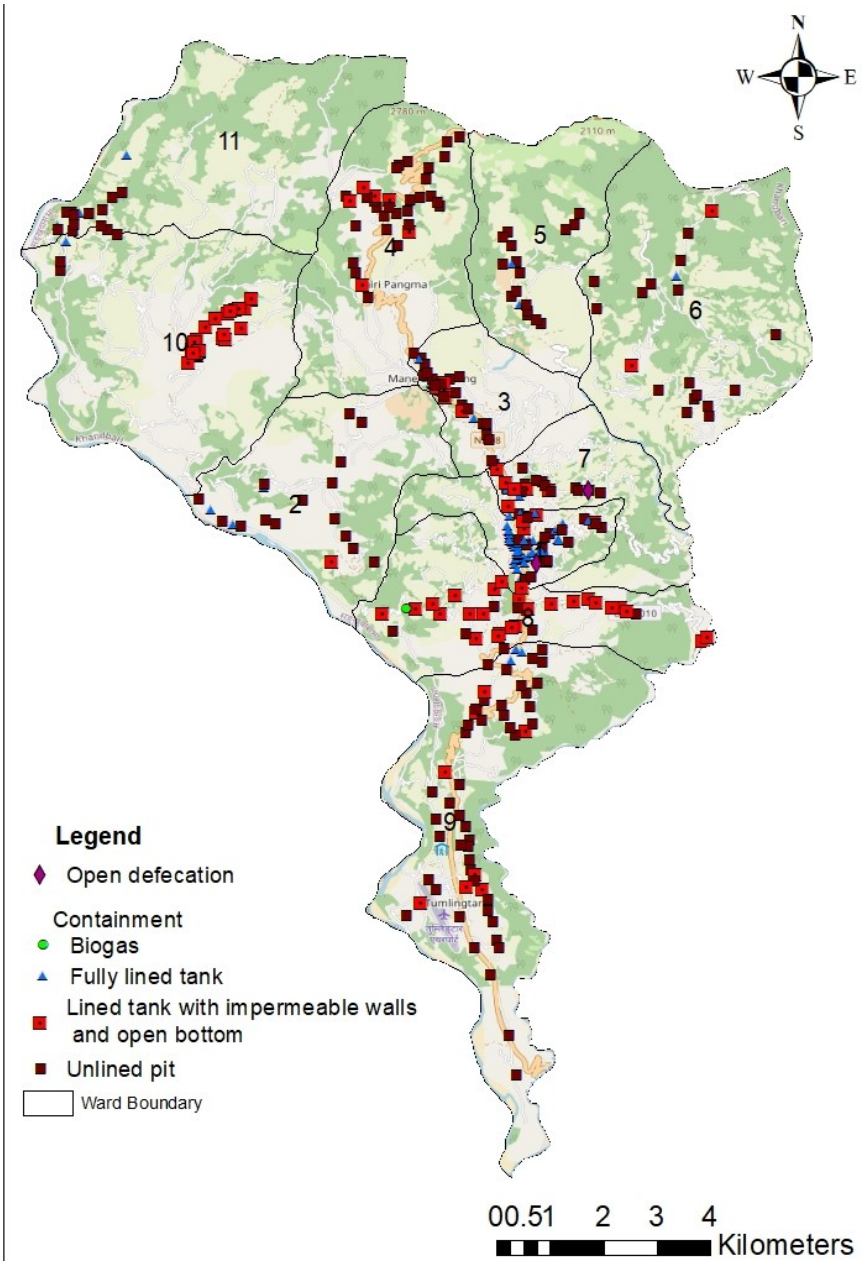

Figure 3: Map locating different types of containment in Khandbari Municipality.

2.1.2 Sanitation System in Institutional Buildings

All the surveyed 25 institutions had access to a safely managed sanitation system in the municipality. 5 educational institutes, 11 government and non-government offices, 5 health care centres and 3 hotels with lodging facilities and 1 commercial building were surveyed.

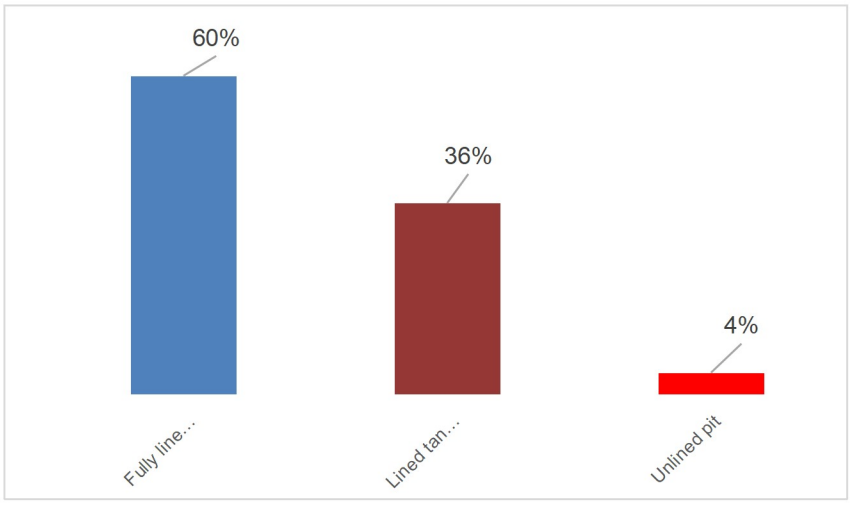

Figure 4: Containments used in institutional buildings.

The findings showed 60% of institutional buildings had made fully lined tanks, 36% had lined tanks with impermeable walls and open bottom, and 4% had unlined pits. The proportion of different types of sanitation technologies are shown in figure 4. Only 4% of the institutions were emptied using mechanical desludging vehicles (Figure 4).

2.1.3 Public Toilets

As per KII, there are 4 public toilets built in different areas whose descriptions are provided below:

Public toilet in ward 9: There is 1 public toilet in hatbazaar area of ward 9 (Figure 5-right picture), and 1 in near to Tumlingtar Airport (Figure 5-left picture). The public toilet is constructed by municipality but is currently operated by caretakers. One in hatbazaaar area mainly opens during the hatbazaar, while the one near Tumlingtaar Airport remains open. The sanitary condition of the toilets was good and had proper maintenance.



Figure 5: Public toilet in Tumlingtar Airport (Left) and Hatbazaar Area (Right).

Public toilet in hatbazaar area, ward 1

There is 1 public toilet near the market area in ward 1. The toilet had separate compartments for male and female, but not all the compartments were open during the study period. The caretakers have been assigned to oversee these facilities, collecting a minimal charge for service use, and to ensure the maintenance and cleanliness of the toilets. The sanitary condition of the toilets was good (Figure 6).



Figure 6: Public toilet near hatbazaar area, ward 1.

Public toilet near Manakamana temple premises

There is one public toilet constructed near Manakamana Temple Ffigure 7). The toilet was built by municipality. The facility includes separate sections for males, and females with toilet connected to rectangular holding tank. The toilet is made open for the people visiting the Manakamana temple.



Figure 7: Public toilet near Manakamana temple premises.

2.1.4 Emptying and Transportation Services

Emptying of containment

Emptying is one of the major components of the sanitation service chain. Regular emptying of the containment prevents sludge overflow and blockages (Strande, 2014) . Of the total sampled households with containment, only 5.2% have emptied their containment (excluding biogas containment) atleast once after installation due to faecal sludge overflow.

Currently, there are no desludging services available in the municipality, neither private nor municipal. About 42.1% of the emptied containment was mechanically emptied, desludging vehicles from the neighboring place-Leguwa and Dhankuta district provide on-demand services in Khandbari Municipality. The remaining 57.9% of containments were manually emptied using traditional sanitation workers.

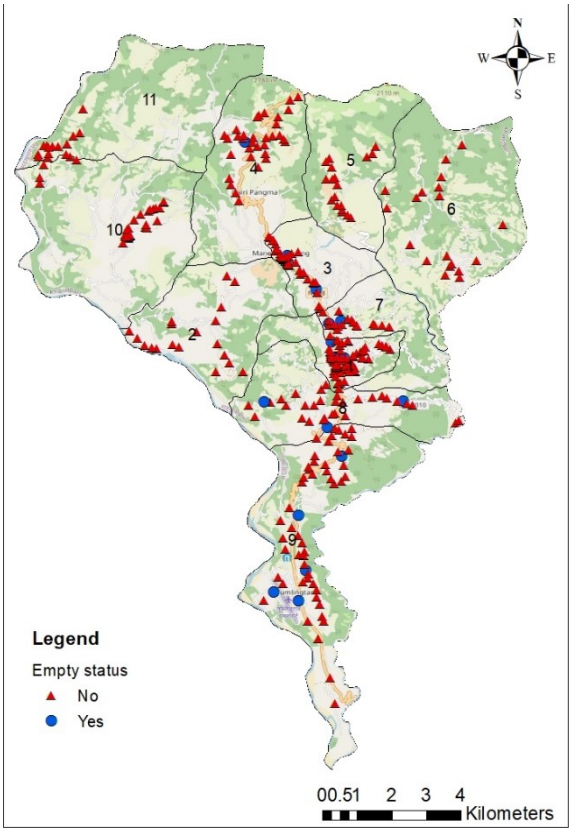

Figure 8: Status of containment emptying in households.

2.1.5 Treatment and Disposal/Reuse of Faecal Sludge

In the municipality, faecal sludge treatment plant is not available. Mechanically desludged faecal sludge is disposed of in forests and water bodies (KII-1, 2023). Meanwhile, individuals who practiced manual emptying adopt the practice of digging new pits and abandoning the old ones, while few practice the direct application of it in farmland. This method can not be considered safe as it possesses direct risks to the environment and public health. This perpetuates the cycle of unsafe faecal sludge disposal and exacerbates environmental and public health risks.

2.1.6 Risk assessment of drinking water source contamination from open bottom containment

The risk of contamination was assessed based on the source of drinking water, secondary data on water quality and lateral spacing between sanitation technologies and water sources.

a. Sources of Drinking Water

As per the findings of this survey, 5.7% consumed the water from private taps, and 0.5% relied on public taps. The majority, 93.3%, consumed spring source for drinking purposes (Figure-9), while 0.5% uses Jar water. Key informant interviews (KII-2, 2023) findings indicated that Khandbari Water Sanitation Users Committee provide piped drinking water supply in 2,220 households mainly in ward 1, 3, 7, 8 and 9. There are other different small WSUC that distribute water to small number of households (KII-2, 2023). The findings showed that although there is a private tap at home people prefer consuming spring source water. Some of the pictures of spring source found in community are shown in Figure 9.



Figure 9: Source of spring water seen in locality.

In accordance with the World Health Organization's (WHO) guidelines for drinking water quality, the presence of E. coli serves as an indicator of potential faecal contamination. As per the National Drinking Water Quality Standard of 2022, drinking water should be free of *E. coli*, indicated by a count of 0 colony-forming units (CFU) per 100 millilitres of water (World Health Organization WHO, 2024) . Furthermore, the proximity between spring sources and open-bottom containment is a critical factor in assessing contamination risk. Spring sources located above residential areas are deemed to pose a lower risk of contaminating drinking water compared to those situated below residential areas.

2.2 SFD Selection Grid

The SFD grid consists of different containment technology used in list A and its connection in list B. Sanitation technologies selected in the SFD grid in Khandbari Municipality are shown in Figure 10. The vertical column on the left side of the SFD selection grid has a list of technologies to which the toilet is connected to, and households without toilet resorting to open defecation. Similarly, horizontal row at the top of the selection grid shows options for connection made for the outlet or overflow of discharge from the toilet.

As per the containment definition by Shit Flow Diagram Promotive Initiative (SFD PI), various containments are kept into different SFD categories. For example, biogas is reclassified as a

fully lined tank, given that the walls and bottom of the biogas structure are water-sealed and share similar features with a fully lined tank. However, fully lined tanks, lined tanks with impermeable walls and open bottom and unlined pits do not require reclassification and remain unchanged. After the reclassification of these containments, the types of sanitation technologies and their connections are chosen in the SFD selection grid, as illustrated in Figure 10.

List A: Where does the toilet discharge to? (i.e. what type of containment technology, if any?)	List B: What is the containment technology connected to? (i.e. where does the outlet or overflow discharge to, if anything?)									
	to centralised combined sewer	to centralised foul/separate sewer	to decentralised combined sewer	to decentralised foul/separate sewer	to soakpit	to open drain or storm sewer	to water body	to open ground	to 'don't know where'	no outlet or overflow
No onsite container. Toilet discharges directly to destination given in List B					Significant risk of GW pollution Low risk of GW pollution					Not Applicable
Septic tank					Significant risk of GW pollution Low risk of GW pollution					
Fully lined tank (sealed)					Significant risk of GW pollution Low risk of GW pollution					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					T2A4C10 T1A4C10
Lined pit with semi-permeable walls and open bottom	Not Applicable									Significant risk of GW pollution Low risk of GW pollution
Unlined pit										T2A6C10 T1A6C10
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							T1B11 C7 TO C9		Not Applicable

Figure 10: SFD selection grid for Khandbari Municipality.

A brief explanation of terms used to indicate different frames selected in the SFD selection grid is explained in Table 2.

Table 2: Explanation of terms used to indicate frame selected in the SFD selection grid.

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.
T1A4C10	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	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.

T1A6C10	This is a correctly designed, properly constructed and well-maintained unlined pit with permeable walls and base, through which infiltration can occur. The tank is NOT fitted with a supernatant/effluent overflow, so this system is considered contained.
T2A6C10	This is properly constructed and well-maintained unlined pit with permeable walls and 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;
T1B11C7 to C9	With no toilet, users defecate in water bodies, on open ground and to don't know where; consequently, the excreta is not contained.

2.3 SFD matrix

2.3.1 Proportion of faecal sludge from types of sanitation technologies

In the second step of developing an SFD graphic, the proportion of faecal sludge (FS) in each type of sanitation technology is calculated. Following detailed instructions in SFD PI, a default "100%" value is applied when onsite containers are connected to soak pits, water bodies, or open ground, representing the entire contents as faecal sludge, with a portion being periodically emptied.

For onsite containers connected to a sewer network or open drains, a "50%" value is used, indicating that half the contents are modelled as faecal sludge, with periodic emptying. The remaining fraction contains faecal sludge in the container and infiltrates (for open-bottomed tanks), while the other half is modelled as supernatant discharging into the sewer network or open drains. The formula for calculating FS proportion is provided below:

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

The calculated FS proportion in each type of sanitation technologies are:

i. The proportion of FS in septic tanks is 0% as there are no containments used.
ii. The proportion of FS in fully lined tanks is calculated as 100% as there are no connections made to an open drain; the tank maintains a 100% FS proportion.
iii. The FS proportion from lined tanks with open bottoms and all types of pits is 100%, as there are no connections of lined tanks with impermeable walls and open bottoms to open drains.

After determining the proportion of FS in each type of sanitation technology, the corresponding population proportions from the selected technologies in the SFD selection grid are set. Figure 11 illustrates the SFD matrix of the municipality.

Khandbari, Koshi, Nepal, 17 Oct 2024. SFD Level: 2 - Intermediate SFD
Population: 35565
Proportion of tanks: septic tanks: 0%, fully lined tanks: 100%, lined, open bottom tanks: 10(

Containment				
System type	Population	FS emptying	FS transport	FS treatment
	Pop	F3	F4	F5
System label and description	Proportion of population using this type of system (p)	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated
T1A3C10 Fully lined tank (sealed), no outlet or overflow	22.0	8.0	14.0	95.0
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	16.0	3.0	0.0	0.0
T1A6C10 Unlined pit, no outlet or overflow	33.0	5.0	0.0	0.0
T1B11 C7 TO C9 Open defecation	1.0			
T2A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	7.0	0.0	0.0	0.0
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	21.0	5.0	0.0	0.0

Figure 11: SFD Matrix of Khandbari Municipality.

2.3.2 Proportion of faecal sludge emptied (F3)

The column labelled "Population (Pop)" in Figure 11 displays the proportion of contents for each type of onsite container (fully lined tanks (sealed), lined tanks with impermeable walls and open bottom, and unlined pit). The variable F3 represents the proportion of contents in each type of onsite container that undergoes at least one emptying after construction. The calculation of the proportion of faecal sludge emptied (F3) is based on the percentage of containment emptied (ENPHO, 2023) and the amount of faecal sludge (FS) emptied during the process.

According to findings from household surveys and Key Informant Interviews (KII-1, 2023), approximately 90% of the FS in the containment is emptied. This is attributed to most containments getting filled due to groundwater intrusion, resulting in a high liquid content that can be easily pumped out by desludging vehicles. However, an average of 10% of the FS in the containment, characterized by high thickness and poor water solubility, remains un-

removed during emptying. The calculation of the emptied proportion of FS is adjusted accordingly as follows (Table 3).

$$Actual\ Proportion\ of\ FS\ emptied\ (F3) = percentage\ of\ containment\ emptied \times proportion\ of\ FS\ removed\ during\ emptying$$

Table 3: Sanitation technologies and proportion of emptied faecal sludge (ENPHO, 2023[1]; KII_1, 2023[2]).

SN	Sanitation Technologies	SFD Reference Variable	Percentage of Emptied Containment (1)	Emptied Proportion of FS during emptying (2)	Actual Proportion of Emptied FS (F3)
1	Fully lined tank (sealed), no outlet or overflow	T1A3C10	9%	90%	8%
3	Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	4%	90%	3%
4	Unlined pit, no outlet or overflow	T1A6C10	6%	90%	5%
5	Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution (High Risk)	T2A6C10	6%	90%	5%

2.3.3 Proportion of FS emptied which is delivered to treatment plant (F4 and F5)

The municipality does not have any treatment plant for faecal sludge treatment. Operational biogas digester is classified as treated (F5). In the provided SFD matrix, 22% of fully lined tanks, including 0.5% with functioning household biogas digesters, are considered treated with 95% efficiency (F5=95%).

2.4 Summary of assumptions

Onsite Sanitation Systems:

- ✓ The proportion of FS in septic tanks 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, as per the guidance provided by SuSanA.
- ✓ Variables F3, F4 and F5 for all onsite sanitation systems were derived from the household survey and cross-checked with KIIs conducted.
- ✓ The emptied FS from fully lined tanks connected to no outlet (system T1A3C10) is 8% (F3 = 8%) out of which 14% is delivered to treatment and 95% is treated in the FSTP (F4 = 14% and F5 = 95%).
- ✓ The emptied FS from lined tanks with impermeable walls and open bottom, no outlet or overflow (system T1A4C10) is 3% (F3 = 3%) but no FS is delivered to treatment nor treated in the FSTP (F4 = 0% and F5 = 0%).
- ✓ The emptied FS from lined tanks with impermeable walls and open bottom, no outlet or overflow where there is significant risk of groundwater pollution (system T2A4C10) is 7% (F3 = 7%) but no FS is delivered to treatment nor treated in the FSTP (F4 = 0% and F5 = 0%).
- ✓

- ✓ The emptied FS from unlined pits, no outlet or overflow (system T1A6C10) is 5% (F3 = 5%) but no FS is delivered to treatment nor treated (F4 = 0% and F5 = 0%).
- ✓ The emptied FS from unlined pits, no outlet or overflow (system T2A6C10) where there is significant risk of groundwater pollution is 5% (F3 = 5%) but no FS is delivered to treatment nor tretated (F4 = 0% and F5 = 0%).

2.5 SFD Graphic

Figure 12 presents diagrammatic representations of the excreta flow within Khandbari Municipality. The color scheme signifies the nature of sanitation systems, with green indicating safely managed systems and red denoting unsafely managed ones. FS, generated by 67% of the population are safely managed (Green). Initially, 71% of FS was safely contained. However, this proportion drops to 67% after emptying which can be considered safe until emptying. Out of the remaining 4% of FS which are contained and emptied, only 1% of FS undergoes proper treatment, primarily from population using biogas digester. This highlights that FS remains safe depending upon the nature of the emptying mechanism and availability of treatment facilities.

Additionally, FS generated by 33% of the population is unsafely managed (Red). It includes 1% of FS not treated and 27% of FS which is neither contained nor emptied. Moreover, 5% of FS are delivered untreated into the environment, possessing risks of pollution and 1% of the population still practices open defecation exacerbating sanitation challenges.

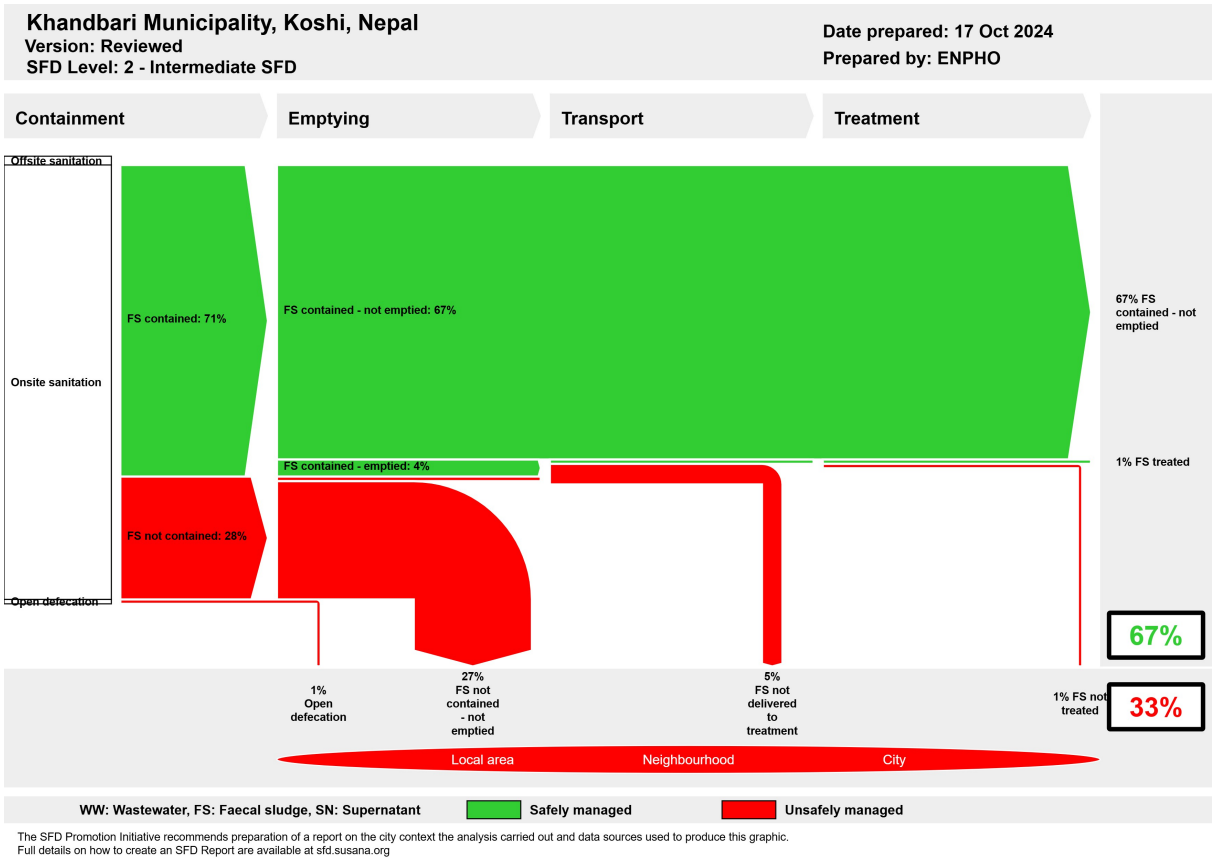

Figure 12: SFD Graphic of Khandbari Municipality.

2.5.1 Onsite Sanitation

All the households in Khandbari Municipality utilize onsite sanitation technologies. Among them, FS from 71% of the population is appropriately stored in technically effective containment, as depicted by "FS contained" in the SFD graphic. FS from the remaining 28% of the population is stored in unsafe containment, represented as "FS not contained".

FS contained

The term 'FS contained' refers to faecal sludge within an onsite sanitation technology that ensures a safe level of protection from excreta, limiting pathogen transmission to the user or the public. These containments, such as tanks or pits, are correctly designed, properly constructed, fully functioning, and pose little to no risk of polluting groundwater used for drinking (Susana, 2018). FS generated by 71% of the population is contained. The value of FS contained (71%) is derived from the summation of the percentage of the population using the following containment systems: fully lined tank without outlet or overflow (T1A3C10), lined tank with impermeable walls and open bottom without outlet or overflow (T1A4C10), and unlined pit, no outlet or overflow (T1A6C10).

FS not Contained

The term 'FS not contained' refers to faecal sludge within an onsite sanitation technology that does not ensure a safe level of protection from excreta, with a likely risk of pathogen transmission. These containments, such as tanks or pits, are incorrectly designed, poorly constructed, poorly functioning, and/or pose a 'significant' risk of polluting groundwater used for drinking (Susana, 2018). FS generated by 28% of the population is not contained. It is obtained from the summation of the percentage of the population using the following containments: lined tank with impermeable walls and open bottom without outlet (T2A4C10) and unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution (T2A6C10).

FS contained - not Emptied

It is faecal sludge that is contained within an onsite sanitation technology but not removed which may persist within the container or infiltrate into the ground, depending on the type of sanitation technology in use (Susana, 2018). The value of 67% is obtained from the proportion of the population using sanitation systems where the FS is contained and have not emptied their containment. However, it should be considered safe, 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.

FS contained - Emptied

It is faecal sludge which is removed from an onsite sanitation technology where it is contained and can be emptied, utilizing either mechanical or manual emptying equipment. The value of 4% is obtained from the proportion of population using sanitation systems where the FS is contained and have emptied their containment.

FS not contained - not Emptied

It is faecal sludge that is not contained within onsite sanitation technology and not removed. It may persist within the container or infiltrate into the ground, depending on the type of

sanitation technology in use. The value of 27% is obtained from the proportion of the population using sanitation systems where the FS is not contained and not emptied.

FS not delivered to treatment

The proportion of FS not delivered to treatment, i.e. 5%, is the summation of FS contained - emptied and FS not contained - emptied. Since there is no FSTP, FS are not delivered to treatment plants.

2.5.2 Open Defecation

It is a situation where no toilet is in use, and people resort to open defecation in fields, forests, bushes, bodies of water, or other open spaces. Despite municipality having ODF status, 1% of the population still defecate openly or use neighbors toilet or public toilet.

3 Service delivery context description

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 the 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 inspectors 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 septic tanks 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 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 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.

3.1.1. Policy

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. Participatory approach, community leadership project development, optimization of local resources and installation of locally appropriate technologies were major principles in the policy. (DWSSM, 2004) However, it was unable to address the complex operational issue of urban water supply and sanitation service delivery. (DWSSM, 2009) Thus, the 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. 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. Nepal was declared ODF nation on September 23, 2019, (MoWS, 2017) however, the target of 90% households with toilets connected to sewer system or proper FSM is yet to be achieved.

There has been no specific policy made on sanitation and faecal sludge management. However, activities related to solid waste management are being carried out by municipality.

3.1.2. 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 Government

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 policies, plans and programs. It supports, facilitates, and coordinates with federal, provincial, and local governments for developing policy plans 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 13.

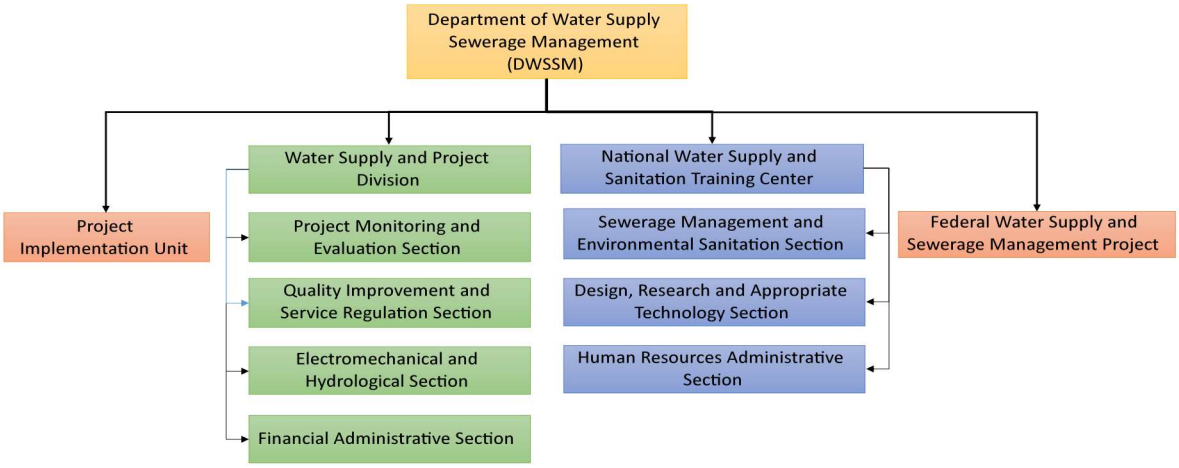

Figure 13: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).

At Provincial Government

Ministry of Water Supply, Irrigation and Energy: Ministry of water supply, Irrigation and Energy in Koshi province is major executing body for planning, developing, and implementing water supply and sanitation programs. Planning and implementation of water supply and sanitation infrastructure in 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 terai region, 3,000 to 5,000 in hilly region and 500 to 1,000 in Himalayan region.

At Local Government

Municipal council: There is no specific sanitation section in the municipality. However, the sanitation related works are being looked by the social development section.

3.1.3. Service provision

Urban Water Supply and Sanitation Policy 2009 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).

3.1.4. 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 4. However, FSM specific standards have yet to be developed and implemented.

Table 4: 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 grey water	✓	✓	✓
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	✓	✓	✓

4 Stakeholder Engagement

4.1 Key Informant Interviews (KIIs)

During the study, Key Informant Interviews (KIIs) were conducted to gather insights from different key stakeholders working in the sanitation sector of Khandbari Municipality. The objective was to obtain a comprehensive understanding of current sanitation service practices. Mr. Khem Prasad Niraula, Social Development Officer was interviewed specifically regarding sanitation service practices, covering technical, institutional, and financial aspects. Additional interviews were conducted with different stakeholders as mentioned below (Table 5).

Table 5: List of Key Informant Interviewed personnel.

S.N.	Name	Designation	Organization/ Company	Purpose of KII	Date
1.	Khem Prasad Niraula (KII-1)	Social development Officer	Khandbari Municipality	Sanitation status, Ongoing projects on Sanitation, Policies, and plan for Sanitation development	28th October, 2024
2.	Mahendra Shrestha (KII-2)	Manager	Khandbari WSUC	Water supply services	28th October, 2024

4.2 Household Survey

Household survey was conducted in all wards of the municipality through mobilization of local enumerators selected by the municipality. The enumerators were given two days orientation about sanitation technologies and methods for conducting the household survey. The household survey was conducted using the mobile application “KOBOCOLLECT” after orientation. SFD team member went on field visits in households to encourage enumerators and observe household sanitation status. Mr. Mahesh Thapaliya, Mayor of the municipality, provided encouragement and motivated the enumerators before the survey. The pictures below depict the group photo featuring the SFD team members along with the enumerators (Figure 14).



Figure 14: Glimpses of SFD orientation to enumerators in municipal hall (left) and practicing in field (right).

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= n_o/(1+ (n_o-1)/N), where,

Z	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 n_h= (N_h/N)*n, where N_h is a total population in each stratum. Thus, a total of 370 households were sampled from 9309 households distributed in 11 wards with proportionate stratification random sampling. The household samples surveyed in the municipality is shown in Figure 15.

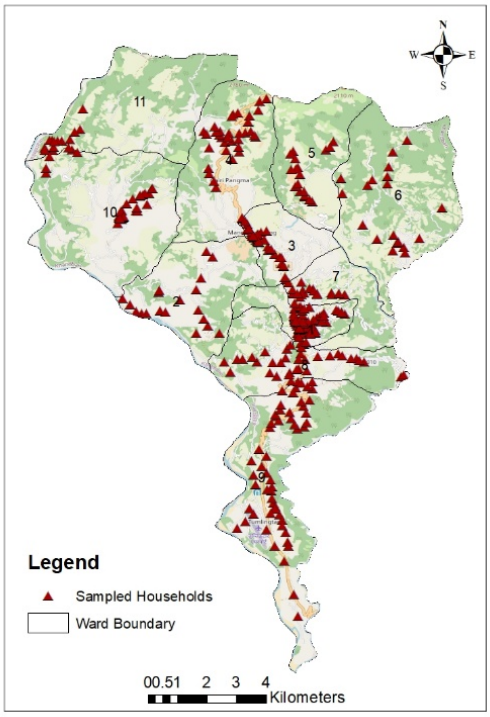

Figure 15: Distribution of sampling points in different wards of Khandbari Municipality.

4.3 Direct Observation

Various sanitation technologies in the households in all the wards were observed and visual references were kept. Additionally, observation of the water sanitation users committee, and public toilet status was also done.

4.4 Sharing and Validation of Data

The Shit Flow Diagram Sharing and Validation workshop was conducted in the municipality to share the findings of the sanitation situation survey and receive suggestions from municipal stakeholders. Altogether, 24 participants including the mayor, deputy mayor, CAO, ward chairpersons and other members from the municipal executive council, sectoral staff etc. actively participated in the workshop and provided valuable suggestions. The list of participants with their designation is attached to Appendix 2 (Figure 16).



Figure 16: Discussion on SFD by stakeholder of the municipality in validation sharing program.

5 Acknowledgements

We would like to acknowledge the organizations involved in the Municipalities Advocacy on Sanitation in South Asia – II (MuNASS-II) project for their collaboration and coordination, namely the United Cities and Local Governments Asia-Pacific (UCLG ASPAC) as the executing agency and the Municipal Association of Nepal (MuAN) as the implementing agency, for their coordination with the municipality.

We extend our sincere appreciation to the individuals who provided invaluable support and guidance during the study: Mr. Maheshwor Thapaliya, Mayor, Mrs. Shova Bajracharya, Deputy Mayor of Khandbari Municipality, for continuous support in the study. We would also like to thank Mr. Dipak Mani Ghimire, Chief Administrative Officer of the municipality, and Mr. Khem Prasad Niraula, from Social Development section, for facilitating the enumerators and continuous support throughout the study.

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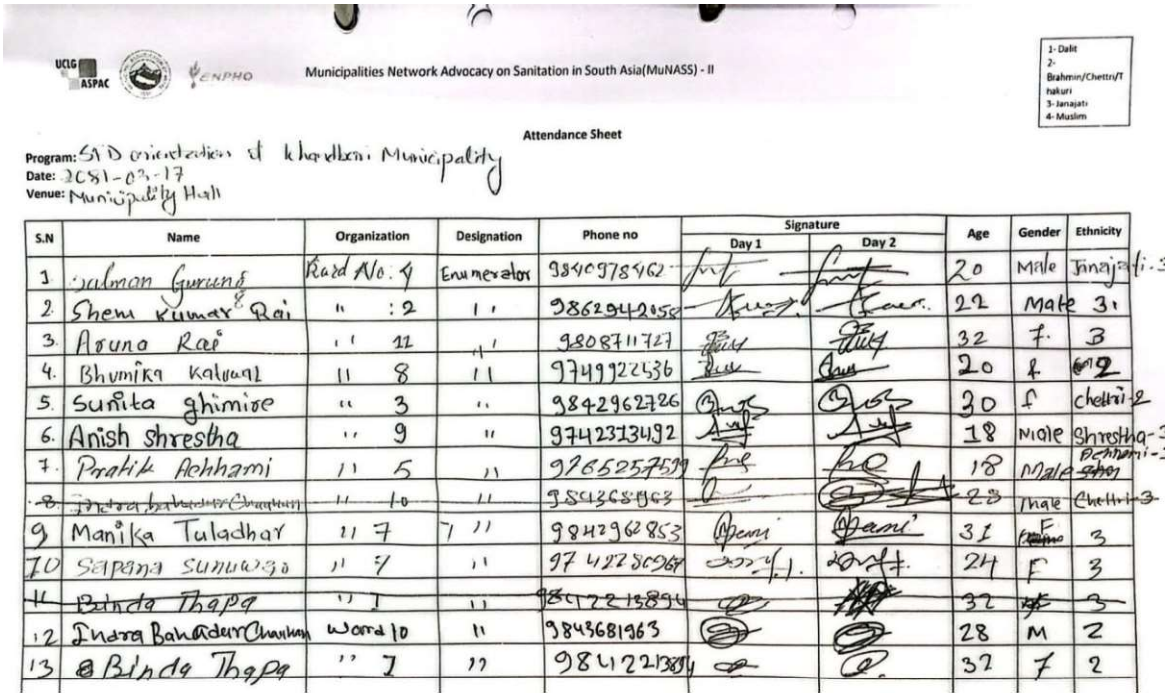
7 Appendix

Appendix 1: Roles and Responsibility of Various Tiers of Governments Delineated in Drafted SDP 2016 – 2030

System Classification		Minimum Key HR Required	Regulation & Surveillance	Financing & Construction	Ownership of System	Service Delivery	
Size	Sanitation					Provision	Production
Small	Onsite sanitation	Water Supply and Sanitation Technician (WSST)	Federal and or Provincial Government	User+/ community+/ other			
Medium	Septage Management	Sub-engineer	Federal and or Provincial Government	Provincial+/ Local Govt+/ Community+/ Private Sector		Local Govt	Users committee/ Utility manager
Large	Septage or FSM Management	WASH Engineer + finance & admin staff	Federal and or Provincial Government	Provincial+/ Local Govt+/ Community+/ Private Sector		Local Govt	Utility Manager
Mega	Septage/ FSM Management	WASH Engineer + finance & admin staff	Federal and or Provincial Government	Provincial+/ Local Govt+/ Community+/ Private Sector		Local Govt	Utility Manager

Appendix 2: List of enumerators in SFD orientation



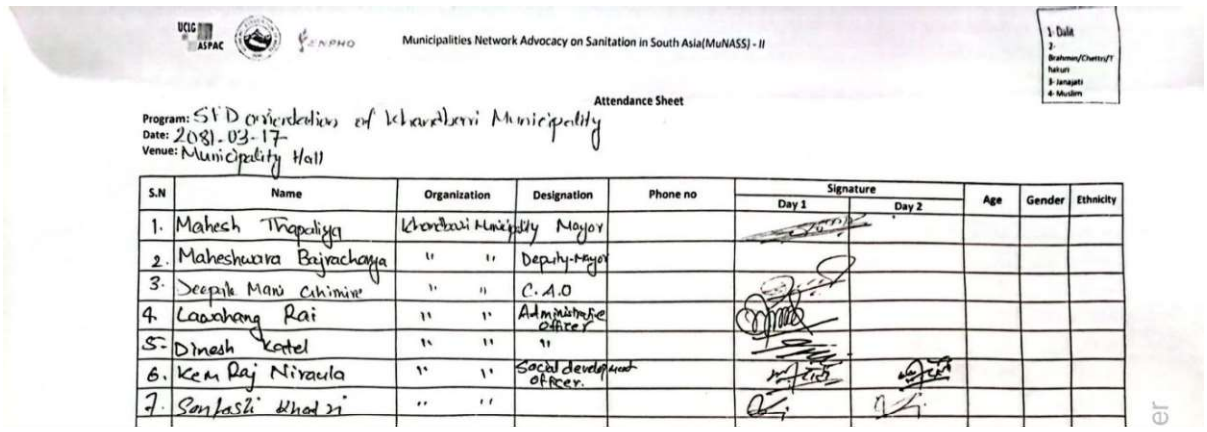
Municipalities Network Advocacy on Sanitation in South Asia(MuNASS) - II

1- Dalit
2- Brahmin/Chettri/Thakuri
3- Janajati
4- Muslim

Attendance Sheet

Program: SFD orientation of Khandbari Municipality
Date: 2081-03-17
Venue: Municipality Hall

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Age	Gender	Ethnicity
1	Salman Gurung	Ward No. 4	Enumerator	9841978462			20	Male	Janajati
2	Shem Kumar Rai	" :2	"	9862942058			22	Male	3
3	Aruna Rai	" 12	"	9808711727			32	F	3
4	Bhumika Kafle	" 8	"	9749922536			20	F	2
5	Sunita Ghimire	" 3	"	9842962726			30	F	Chettri-2
6	Anish Shrestha	" 9	"	9742313492			18	Male	Shrestha-3
7	Pratik Adhikari	" 5	"	9765257539			18	Male	Brahmin-1
8	~~Indra Bahadur Chaulagain~~	" 10	"	9843685963			28	Male	Chettri-3
9	Manika Tuladhar	" 7	"	9842962853			31	F	3
10	Sapana Sunuwar	" 5	"	9742758964			24	F	3
11	~~Bindu Thapa~~	" 1	"	~~9841221389~~			~~32~~	~~F~~	3
12	Indra Bahadur Chaulagain	Ward 10	"	9843681963			28	M	2
13	Bindu Thapa	" 1	"	9841221389			32	F	2



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

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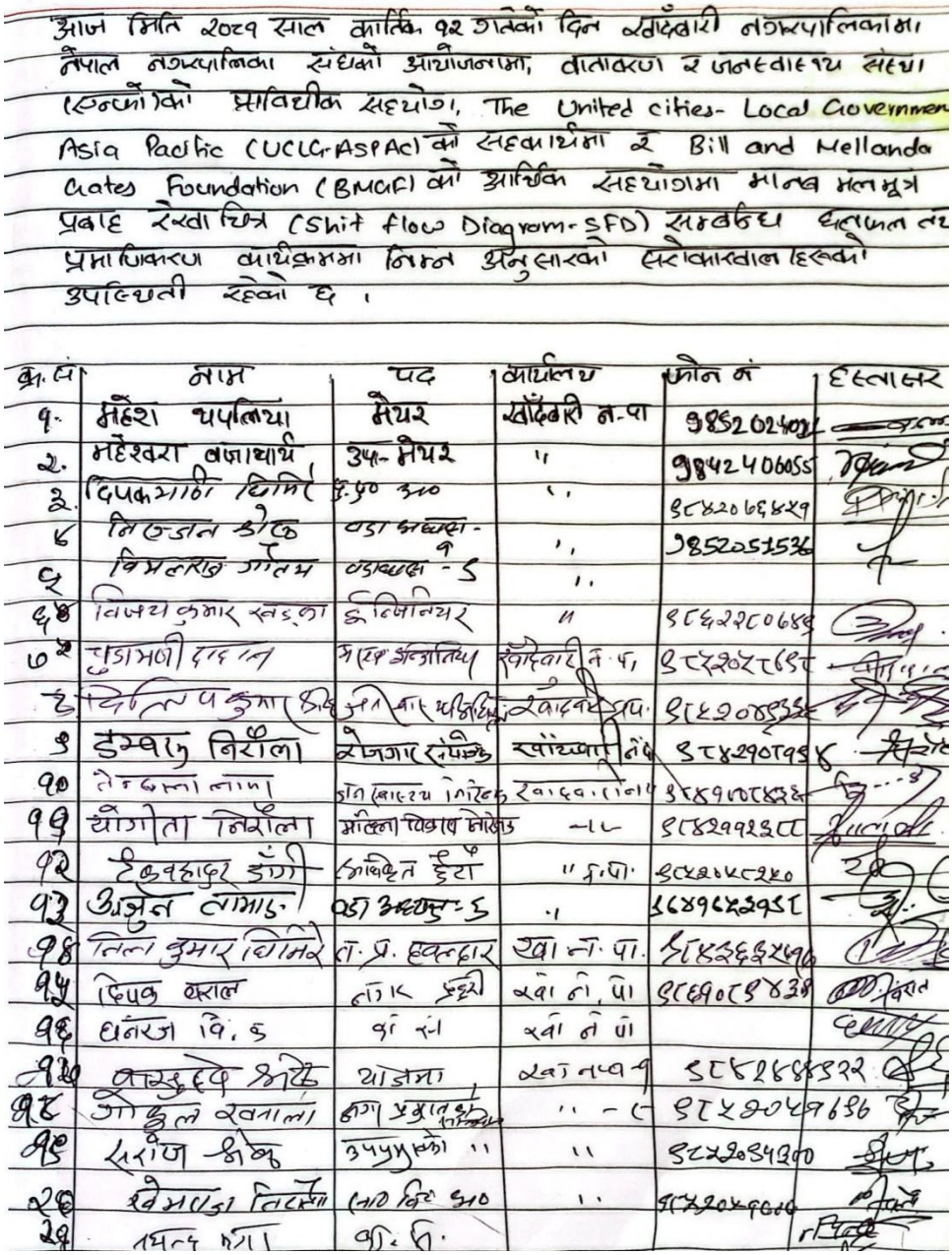
Attendance Sheet

Program: SFD orientation of Khandbari Municipality
Date: 2081-03-17
Venue: Municipality Hall

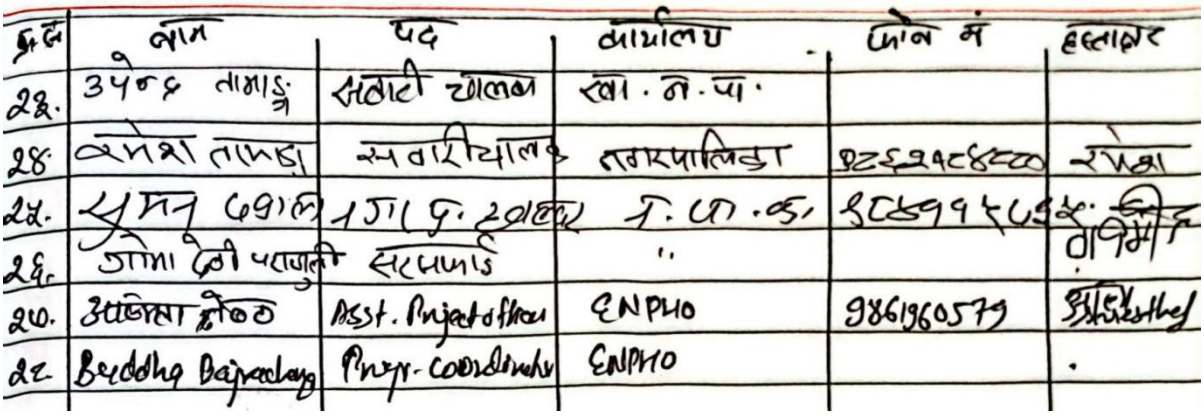
S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Age	Gender	Ethnicity
1.	Mahesh Thapaliya	Khandbari Municipality	Mayor						
2.	Maheshwara Bajracharya	" "	Deputy-Mayor						
3.	Deepika Mani Ghimire	" "	C.A.O						
4.	Laxmang Rai	" "	Administrative officer						
5.	Dinesh Katel	" "	"						
6.	Kem Raj Niraula	" "	Social development officer.						
7.	Sanjaya Khadka	" "							

Appendix 3: List of Participants present in Sharing and Validation meeting of SFD



आज मिति २०८१ साल फाल्गुन १२ गतेको दिन खाँदबारी नगरपालिकामा नेपाल नगरपालिका संघको आयोजनामा, वातावरण र जलवायु संघ। (ICLEI)को प्राविधिक सहयोग, The United cities- Local Governmen Asia Pacific (UCLG-ASPAC) को सहकार्यमा र Bill and Melanda Gates Foundation (BMGF) को आर्थिक सहयोगमा मानव मलमूत्र प्रवाह रेखाचित्र (Shit flow Diagram- SFD) सम्बन्धि अभिमुखीकरण कार्यक्रममा निम्न अनुसारको सहभागीहरुको उपस्थिती रहेको छ ।

क्र.सं	नाम	पद	कार्यालय	फोन नं	हस्ताक्षर
१.	महेश चपलिया	मेयर	खाँदबारी न.पा	9852024032	
२.	महेश्वरा बजाचार्य	उप-मेयर	"	9842406055	
३.	दिपकमार्ग दिमिरे	इ.प्र.अ	"	९८४२०६४४२९	
४	निरुजन डोके	वडा अध्यक्ष-	"	9852051536	
५	विमलराज गौतम	वडाध्यक्ष - ५	"		
६	विजय कुमार खड्का	इन्जिनियर	"	९८६२२८०६४९	
७	चुडामणी दाहाल	सहायक अधिकृत	खाँदबारी न.पा.	९८५२०५८७९८	
८	विष्णु प्रसाद [illegible]	[illegible]	[illegible]	९८५२०४९३५५	
९	डम्बरु निरौला	रोजगार संयोजक	खाँदबारी न.पा	९८४२९०८१९५	
१०	तेजबहादुर लामा	प्रशासन अधिकृत	खाँदबारी न.पा	९८४१०८८३६८	
११	योगीता निरौला	महिला विकास अधिकृत	-"-	९८४२११३८८	
१२	ईन्द्रबहादुर इंगी	कार्यवाहक इन्चार्ज	" इ.प.अ.	९८५३०५८२४०	
१३	अर्जुन लामाछ	वडा अध्यक्ष-५	"	९८४१८५२९५८	
१४	तिला कुमार दिमिरे	ना.प्र. हवलदार	खा.न.पा.	९८४३६६४५१०	
१५	दिपक बराल	लाइट इन्ची	खा.न.पा.	९८६१०८१४३४	
१६	धनन्जय वि.क	फा.सं	खा.न.पा.		
१७	बासुदेव भोटे	योजना	खा.न.पा.	९८४१४४४३२२	
१८	गोकुल रवताला	हाजा प्रशासन	" - C	९८५२०५५१४६	
१९	धरांज शेरु	उपप्रमुख	"	९८५२०३५३४०	
२०	रमेशजंग तिर्सेना	नाप किं ओ	"	९८५२०५८९८०	
२१	[illegible]	[illegible]			



क्र.सं.	नाम	पद	कार्यालय	फोन नं	हस्ताक्षर
२३.	उपेन्द्र तामाङ्ग	सवारी चालक	खा. न. पा.		
२४.	रमेश तामाङ्ग	सवारीचालक	नगरपालिका	९८६२१८४८८०	रमेश
२५.	सुमन दयाल	नगर प्र. स्वाध्याय	न. पा. क.	९८४११५८५५	[illegible]
२६.	गोमा देवी पराजुली	सरसफाई	"		[illegible]
२७.	अजिता श्रेष्ठ	Asst. Project officer	ENPHO	9861960579	[illegible]
२८	Buddha Bajracharya	Prog. coordinator	ENPHO		.

Appendix 4: Glimpses of KII with different stakeholders





SFD Khandbari Municipality, Nepal, 2026

Produced by:

Asmita Shrestha, ENPHO

Buddha Bajracharya, ENPHO

Anita Bhuju, ENPHO

Jagam Shrestha, ENPHO

Rupak Shrestha, ENPHO

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