SFD Report

Shaarada Municipality
Nepal

Final Report

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

Date of production: 24/11/2023

Last update: 16/01/2024

SFD Report Shaarada Municipality, Nepal, 2024

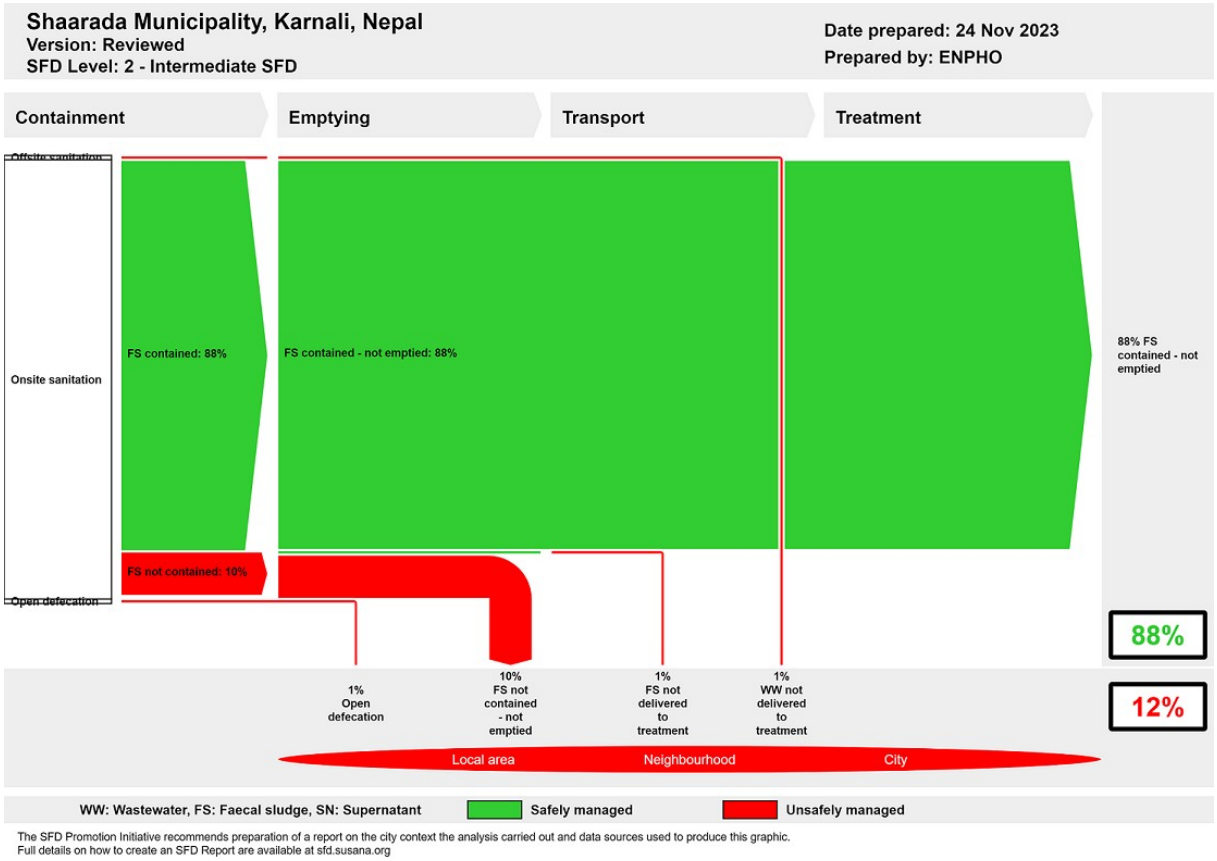
Produced by:

Anita Bhuju, ENPHO
Shreeya Khanal, ENPHO
Buddha Bajracharya, ENPHO
Rupak Shrestha, ENPHO
Asmita Shrestha, ENPHO
Sabuna Gamal, ENPHO

This Executive Summary and SFD Report are available from:

www.sfd.susana.org

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.
Full details on how to create an SFD Report are available at sfd.susana.org

2. Diagram information

SFD Level:

This SFD is level 2– Intermediate report.

Produced by:

Environment and Public Health Organization (ENPHO).

Collaborating partners:

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

Status:

Final SFD report.

Date of production: 24/11/2023

3. General city information

Shaarada Municipality is situated in Salyan District of Karnali Province in the western region of Nepal. It is divided into 15 wards and covers an area of 198.34 sq. km.

It was established on May 16, 2014 by merging 7 rural municipalities namely, Khalanga, Marke, Hiwalcha, Kajeri, SaijuwalTakura, Syanikhal and Dandagaun. It lies at 28°18'51" to 28°27'44"N latitude and 82°02'40" to 82°16'36"E longitude and at the altitude from 1,210 metres above sea level (masl) to 1,830 masl (Shaarada Municipality, 2023).

A population of 34,663 is residing on 8,898 households in the municipality (National Statistics Office, 2023) . It has an annual population growth rate of 0.28%. The municipality has a temperate climate (Cwb) with warm summers and dry winters. It has an average high temperature of 21.8°C and average low temperature of 8.9°C. It receives 1,110 mm rainfall per year (Climate-Data, 2021).

4. Service outcomes

The overview of different sanitation technologies across the sanitation value chain in the municipality is briefly explained in this section. All data in this section is from the household and institutional surveys conducted for this survey (ENPHO, 2023). Salyan District was declared Open Defecation Free (ODF) on July 1, 2016. But 1% of households do not have toilets, while 99% of households have the coverage of improved sanitation facility. The households without improved sanitation facility opt for open defecation.

Containment:

Among households with improved sanitation facilities, about 1% of households rely on an offsite sanitation system and 98% rely on onsite sanitation systems. The municipality does not have a sewer network and thus, the households with offsite sanitation systems have their toilets connected to an open/stormwater drain. Households with onsite sanitation systems have different sanitation technologies. About 9% of households have fully lined tanks, 54% have lined tanks with impermeable walls and open bottom, 1% have lined pits with semi-permeable walls and open bottom and 34% have unlined pits.

Similarly, all the institutional buildings have toilets. Among which, 21% of institutional buildings have fully lined tanks, 56% have lined tanks with semi-permeable walls and open bottom and 23% have unlined pits.

Apart from the household sanitation survey, public toilets were also surveyed to understand station status in the municipality.

Three public toilets in the municipality were observed for the study where the toilet located at Duldhara was not in operation but the remaining two are functional. The toilet located at Khalanga is constructed by Rural Water Supply and Sanitation Fund Development Committee and toilet at Shreenagar is constructed by Khalanga Shitalpati Water and Sanitation Users Committee. Both toilets have separate male and female compartments. Every day, about 70 people use these toilets. The restrooms are mostly used by local shopkeepers, travellers, and public bus passengers. The users are charged Rs. 5 (USD 0.03) for urination and Rs. 10 (USD 0.08) for defecation in the toilet at Khalanga while Rs. 10 (USD 0.08) is charged for both urination and defecation in the toilet at Shreenagar.

Emptying and Transport:

In the municipality, among the sanitation systems with onsite sanitation system, only 1% of households and 5% of institutional buildings have emptied their containment. Manual emptying is practised at households whereas mechanical emptying is practised at institutions. However, the municipality does not have any kind of desludging services.

Treatment and Disposal/Reuse:

Here, both manually and mechanically emptied Faecal Sludge (FS) is disposed of into farmlands or unsafely composted. Therefore, all the emptied FS is disposed of unsafely into an open environment.

Approximately 88% of households have piped drinking water supply services in the municipality. Among other service providers, Khalanga Shitalpati Water and Sanitation Users' Organization provides drinking water services in ward 1 to ward 6 of the municipality. It has distributed 2,165 taps at households and institutions. While 9% of households must collect water from spring sources and 3% rely on groundwater for drinking water supply.

Water contamination at source is possible for aquifers. The vulnerability of an aquifer depends on lateral spacing between sanitation systems and the groundwater sources. Here, 100% of the population using both lined tanks with impermeable walls and open bottom, and lined pit with semi-permeable walls and open bottom possesses the significant risk to groundwater pollution.

Overall, the SFD graphic shows that excreta generated from 88% of the population are safely managed while 12% of the population are unsafely managed. The safely managed FS generated from 88% of population is temporary as the FS has not been emptied. With the current practice of faecal sludge management (FSM), the proportion of safely managed FS will become unsafely managed once the containments start filling up.

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.

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).

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 Water Resources and Energy Development
Public Institutions at Local Government	Shaarada Municipality
Non-governmental Organizations	Environment and Public Health Organization (ENPHO)
Private Sector	Water and Sanitation User Committees
Development Partners, Donors	MuAN, BMGF, UCLG ASPAC

7. Process of SFD development

Data on sanitation situation were collected through household and institutional surveys (ENPHO, 2023) . For the survey, local enumerators from the municipality were oriented on sanitation technologies and proper use of mobile application (KOBOCOLLECT). The Key Informant Interviews (KIIs) were conducted with WASH focal person of the municipality, Water and Sanitation Users' Committee and caretakers of public toilets. 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 Promotive Initiative (SFD PI) methodology was made. Then, data were fed into SFD graphic generator to produce the SFD graphic.

8. Credibility of data

The major data were collected from random household sampling. Altogether, 368 households and 43 institutions were surveyed from fifteen wards of Shaarada Municipality. Primary data on emptying, transportation and current sanitation practices in the municipality were validated from KIIs with municipality representatives, public toilet management, and water service providers. The overall data and findings were shared with the stakeholders of the municipality and validated through a sharing program.

9. List of data sources

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

- Climate-Data, 2021. Climate-Data. [Online] Available at: https://en.climate-data.org/asia/nepal/mid-western-development-region/salyan-khalanga-1025332/
- ENPHO, 2023. Sanitation Situation Assessment of Shaarada Municipality. Unpublished, s.l.: s.n.
- MoWS, 2020. Open Defecation Free Nepal: Narration of the Journey, Kathmandu: Secretariat of National Sanitation and Hygiene Coordination Committee, Nepal.
- National Statistics Office, 2023. National Population and Housing Census 2021 National Report, Kathmandu: National Statistics Office.
- Shaarada Municipality, 2023. Shaarada Municipality. [Online] Available at: https://shaaradamun.gov.np/en

SFD Shaarada Municipality, Nepal, 2024

Produced by:

Anita Bhuju, ENPHO
Shreeya Khanal, ENPHO
Buddha Bajracharya, ENPHO
Rupak Shrestha, ENPHO
Asmita Shrestha, ENPHO
Sabuna Gamal, ENPHO

This Executive Summary and the SFD Report are available from: www.sfd.susana.org

Table of Content

List of Tables

List of Figures

Abbreviations

DWIEDO	Drinking Water, Irrigation and Energy Development Office
DWSSM	Department of Water Supply and Sewerage Management
DUDBC	Department of Urban Development and Building Construction
ENPHO	Environment and Public Health Organization
EPA	Environment Protection Act
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSTP	Faecal Sludge Treatment Plant
GoN	Government of Nepal
HH	Household
IRF	Institutional and Regulatory Framework
KII	Key Informant Interview
KM	Kilometre
masl	meter above sea level
MDG	Millennium Development Goal
mm	Millimetre
MoWS	Ministry of Water Supply
MuAN	Municipal Association of Nepal
NPC	National Planning Commission
NSHMP	National Sanitation and Hygiene Master Plan
NWSSP	National Water Supply and Sanitation Policy
ODF	Open Defecation Free
PPP	Public Private Partnership
RWSSNP	Rural Water Supply and Sanitation National Policy
SDG	Sustainable Development Goal
SDP	Sector Development Plan
SFD	Shit Flow Diagram
SFD PI	Shit Flow Diagram Promotion Initiative
SN	Supernatant
SuSanA	Sustainable Sanitation Alliance
UCLG ASPAC	United Cities and Local Governments Asia Pacific
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WSUC	Water and Sanitation Users Committee
WW	Wastewater
WWTP	Wastewater Treatment Plant

1 City context

Shaarada Municipality is situated in Salyan District of Karnali Province in the western region of Nepal. It was officially established on May 16, 2014. It was formed by merging 7 rural municipalities namely, Khalanga, Marke, Hiwalcha, Kajeri, SaijuwalTakura, Syanikhal and Dandagaun. It is divided into 15 wards. It shares its boundary with Chhatreshwori Rural Municipality and Bagchaur Municipality on the east, Bangad Kupinde Municipality on the west, Siddha Kumakh Rural Municipality on the north and Chhatreshowri, Tribeni and Kalimati Rural Municipalities on the south (Shaarada Municipality, 2023). Figure 1 shows the ward boundary map of Shaarada Municipality.

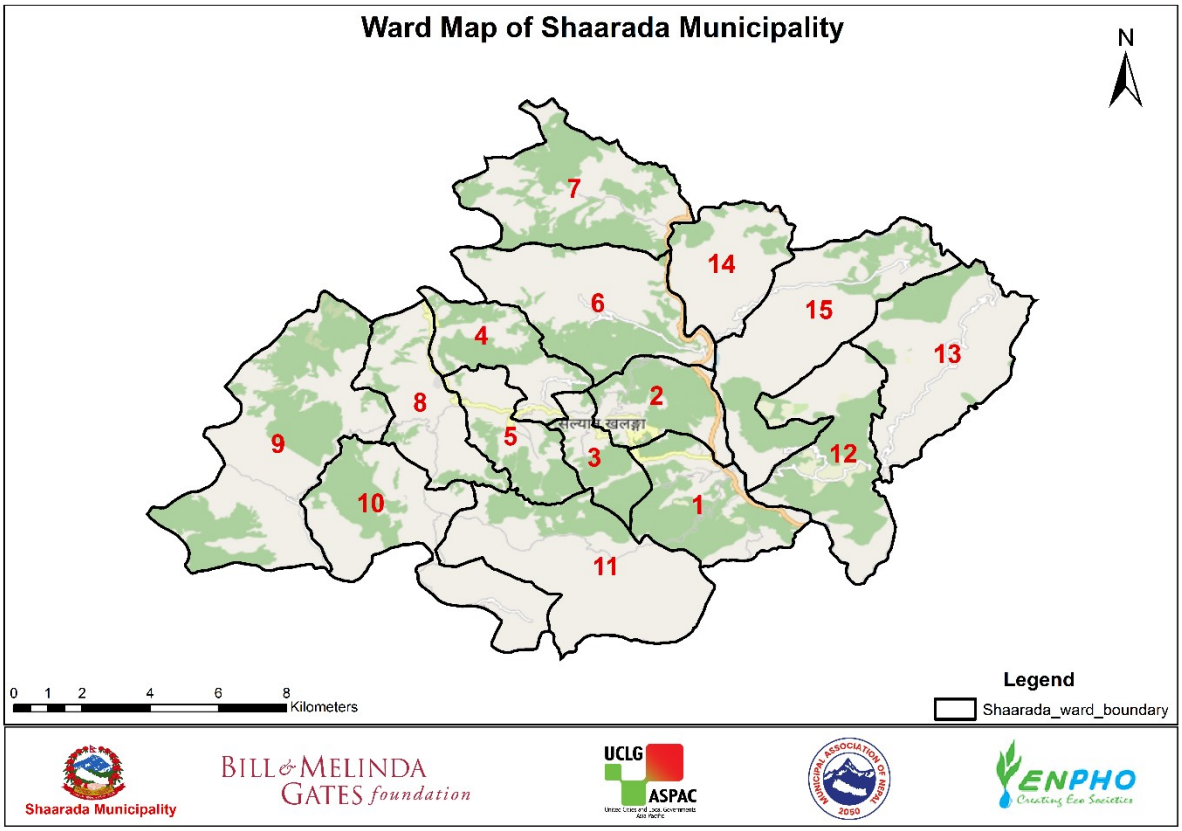


Figure 1: Ward boundary map of Shaarada Municipality.

1.1 Population

As per the national population and housing census conducted in 2021, Shaarada Municipality has a total population of 34,663 with 16,388 male and 18,275 female population. It has altogether 8,898 households (National Statistics Office, 2023). The annual population growth rate of Shaarada Municipality is 0.28% (Shaarada Municipality, 2023).

1.2 Topography and Geography

Shaarada Municipality lies at 28°18'51" to 28°27'44"N latitude and 82°02'40" to 82°16'36"E longitude. It ranges at the altitude of 1,210 metres above sea level (masl) to 1,830 masl. It covers a total area of 198.34 sq. km. in the western region of Nepal. The municipality lies in the Siwalik and Mahabharat range based on the physiographic division of Nepal (Shaarada Municipality, 2023). Thus, it has the mixture of topography based on the range. The highest

composition of Phyllites, Schist, Quartize and Limestone is found in the Mahabharat range, sandstone, mudstone, shale and conglomerate is found in the Siwalik range and alluvial sediments i.e. sand, silt and clay along-with coarse gravels is found in low lands nearby the rivers in the municipality (Upreti, 1999).

1.3 Climate

Köppen–Geiger classification is one of the most used systems for climatic categorization. This classification is a widely used method for portraying climates worldwide, based on monthly air temperature and precipitation. The climatic condition of Shaarada Municipality falls on temperate climate (Cwb) based on Köppen–Geiger classification. This climatic condition has warm summers and dry winters (Karki, et al., 2015) . The municipality has minimum temperature of 14°C to maximum of 31°C in summer while minimum of 3°C to maximum of 28°C in winter (Shaarada Municipality, 2023). The warmest month of the year is June with an average temperature of 21.8°C and coldest month is January with average temperature of 8.9°C. The annual average temperature of the municipality is 16.6°C. It receives an average 1110 mm rainfall annually. The most rainfall occurs in July and the least in November (Climate-Data, 2021) . Figure 2 shows the graph of the monthly average for precipitation and temperature of Shaarada Municipality.

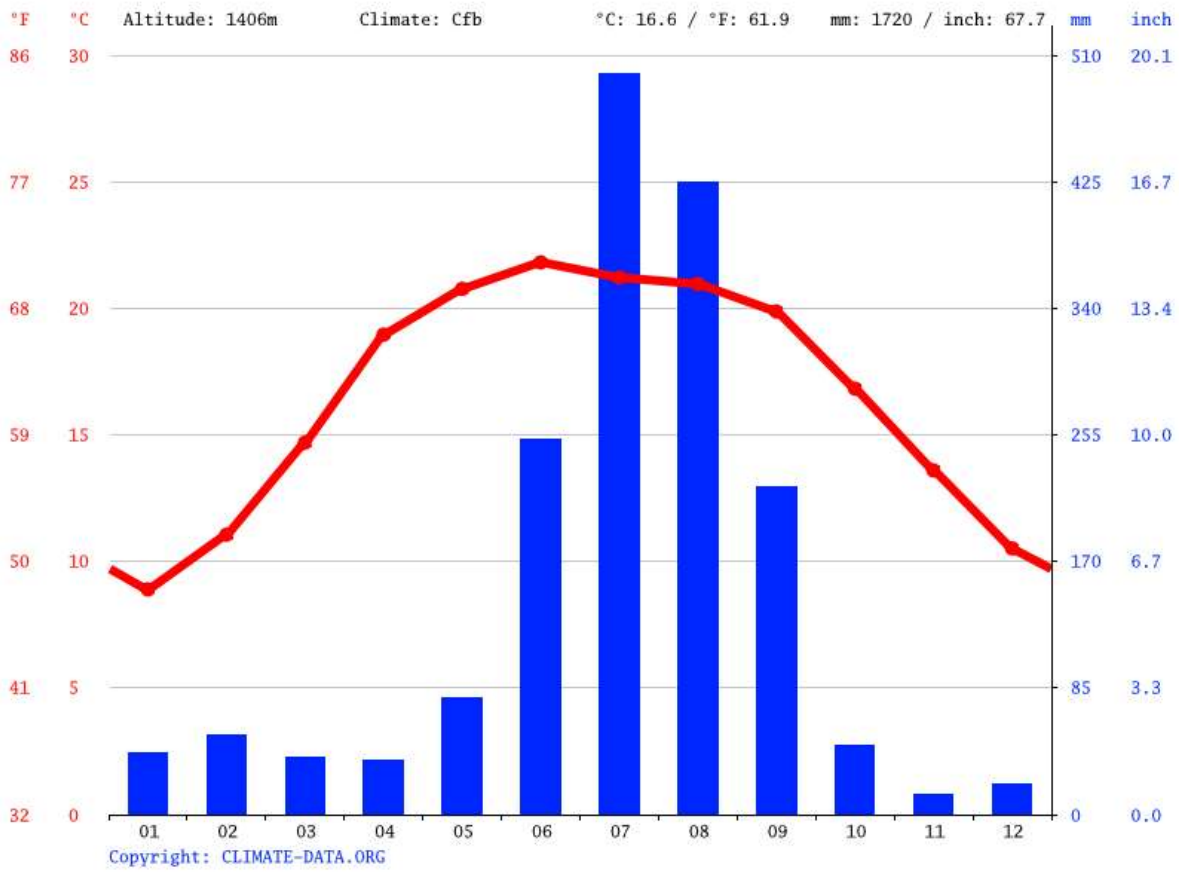


Figure 2: A graph showing the monthly average for precipitation and temperature of Shaarada Municipality.

2 Service Outcomes

2.1 Overview

Data on sanitation situation were collected through household and institutional surveys (ENPHO, 2023). A total of 368 households were sampled from 8,898 households distributed in 15 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 secondary data, Key Informant Interviews (KIIs) and a validation workshop is presented in this section.

Sanitation is defined as infrastructures, facilities or services provided for safe management of human excreta emanating from toilet while handling, storage, and treatment onsite or offsite conveying it safely to the end use or disposal to protect human health and environment (Affam & Ezechi, 2021).

2.1.1 Sanitation System in Household Buildings

Salyan District was declared Open Defecation Free (ODF) on July 1, 2016 (MoWS, 2020). The status of ODF indicates accessibility to basic sanitation on each household (HH). In Shaarada Municipality, still 1% of the households do not have toilets and practice open defecation. The households practising open defecation goes to an open ground. Figure 3 shows the place of an open defecation.

Figure 3: A place for an open defecation.

The remaining 99% of the households have improved sanitation facilities either with offsite or onsite sanitation systems. 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. 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) . In the municipality, 1% of the households have offsite sanitation systems whereas 98% of households have onsite sanitation systems. Figure 4 presents the location map of households with status of access to improved sanitation.

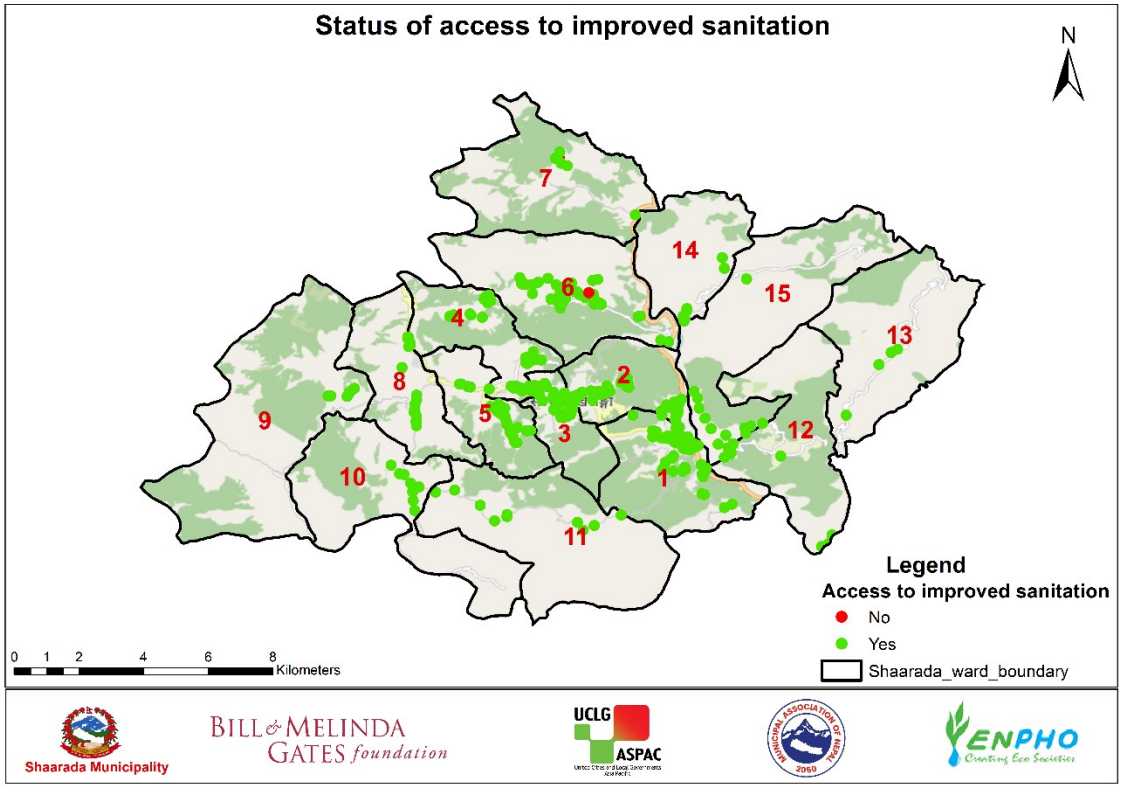


Figure 4: Location map of households with status of access to improved sanitation.

Types of Offsite Sanitation Systems

Shaarada Municipality does not have a sewerage network, still 1% of the households have offsite sanitation systems. Here, households that have connected their toilet to an open/stormwater drain is considered as offsite sanitation system. It is taken as toilet with no onsite container for the SFD graphic. The drain is constructed for the transport of stormwater from roads and the buildings to minimize flooding in the city. The outlet of the drain is in nearby river (KII-1, 2023) . Therefore, Faecal Sludge (FS) and wastewater transported through open drain is disposed of directly to water bodies. Figure 5 shows the outlet of an open/stormwater drain to a river.

Figure 5: The outlet of an open/stormwater drain into a river.

Types of Onsite Sanitation Systems

In the municipality, 98% of the households have onsite sanitation systems. Table 1 shows the types of onsite sanitation technologies and percentage of households using it at Shaarada Municipality.

Table 1: Types of onsite sanitation technologies at households of Shaarada Municipality.

Containment	Wall construction materials	Bottom of containment	Chamber	Number	Connected to	%
Fully lined Tank	Concrete walls or Cemented brick/stone walls	PCC or plastered	One or Two	NA	Soak pit Sewer Open drain/open ground No outlet/overflow	9%
Lined tank with impermeable walls and open bottom	Concrete walls or Cemented brick/stone walls	Soiling or Nothing	One/ two/ More than two	NA	Soak pit Sewer Open drain/open ground No outlet/overflow	54%
Single pit	Concrete rings piled one after other	Soiling or Nothing	NA	One	NA	1%
Unlined pit	Mud mortar brick wall/Mud mortar cement wall/No lining/Dry stone wall	Nothing	NA	NA	NA	34%

Fully lined tank is a rectangular tank with impermeable walls and base to safely store FS. It does not have outlet for the discharge of effluent (Strande, et al., 2014). 9% of households have fully lined tanks.

Lined tank with impermeable walls and open bottom is a rectangular onsite technology where the walls of the tank are lined and sealed, and a permeable base. The facility allows infiltration of effluents which could contaminate groundwater (Peal, et al., 2020). 54% of households have these types of containments in the municipality. Figure 6 shows pictures of a lined tank with impermeable walls and open bottom in the Shaarada Municipality.

Figure 6: Lined tank with impermeable walls and open bottom in the Shaarada Municipality.

Single Pit is a circular onsite technology made from concrete rings. There is no lining between rings, and it allows infiltration of effluents from walls and as well as bottom of the pit. No outlet or overflow for effluent is observed in this type of containment (SuSanA, 2018). 1% of households have single pits in the municipality. Figure 7 shows pictures of a single pit found in the municipality.

Figure 7: Single pit found in the Shaarada Municipality.

Unlined Pit is a dug pit in the ground. It has no lining in walls and a permeable base. It allows infiltration of effluents from walls as well as bottom of the pit (SuSanA, 2018). 34% of households have unlined pits.

Table 2 shows the types of sanitation technologies recategorized according to the SFD PI.

Table 2: Types of sanitation technologies recategorized according to the Shit Flow Diagram Promotion Initiative (SFD PI).

Sanitation System	Percentage
No toilet/Open defecation (T1B11 C7 TO C9)	1%
No onsite container (T1A1C6)	1%
Onsite Sanitation System	
Fully lined tank (T1A3C8 and T1A3C10)	9%
Lined tank with impermeable walls and open bottom (T1A4C8, T1A4C10 and T2A4C10)	54%
Lined pit with semi-permeable walls and open bottom (T1A5C10)	1%
Unlined pit (T1A6C10 and T2A6C10)	34%
Grand Total	**100%**

According to Shit Flow Diagram Promotion Initiative (SFD PI) methodology, single pits and twin pits are categorized under lined pits with semi-permeable walls and open bottom. As the municipality does not have twin pits, 1% of the households have lined pits with semi-permeable walls and open bottom.

Figure 8 shows location map of households with different types of containment at Shaarada Municipality.

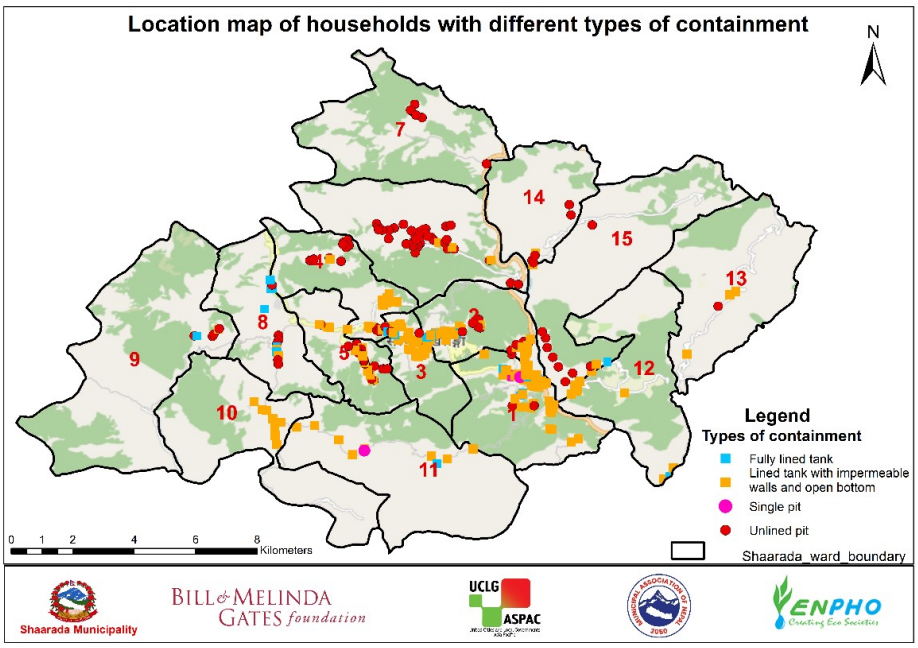


Figure 8: Location map of household with different types of containment.

2.1.2 Sanitation Systems in Institutional Buildings

Altogether 43 institutional buildings were surveyed. The sanitation data of institutional buildings were obtained from different types of institutions. Table 3 shows the types and number of surveyed institutions.

Table 3: Type and number of surveyed institutions.

Type of Institution	Number of Surveyed Institutions
Educational Institution	17
Government /Non-government Office	18
Health care centre	8
Grand Total	**43**

All the institutional buildings in the municipality have toilets with 100% onsite sanitation systems. About 21% of the buildings have fully lined tanks, 56% have lined tanks with impermeable walls and open bottom and 23% have unlined pits. The data show that only 21% of the institutional buildings have safer FS collecting containments whereas 79% of the institutional buildings have improperly built containments that possesses risk to groundwater contamination. Figure 9 shows the location map of institutional buildings with different types of containments in Shaarada Municipality.

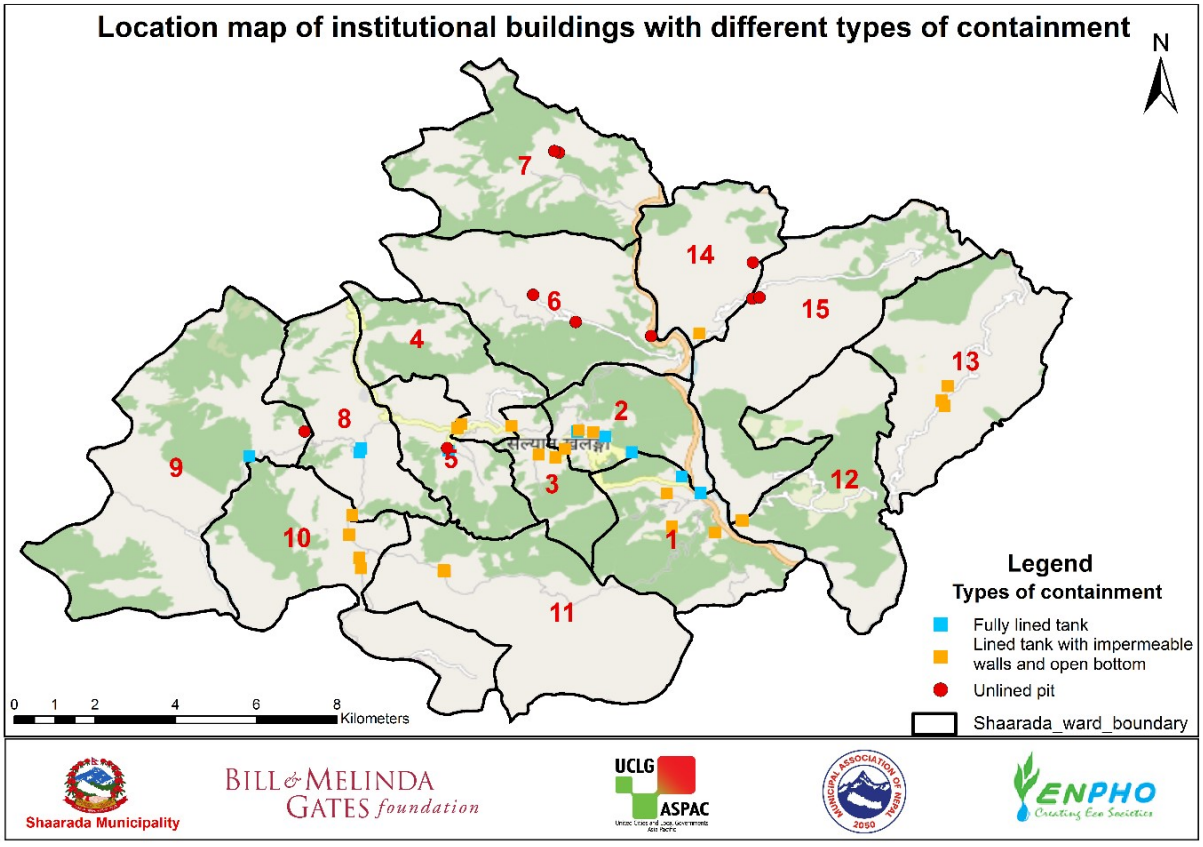


Figure 9: Location map of institutional buildings with different types of containment in Shaarada Municipality.

2.1.3 Public Toilets

There are three public toilets in the Shaarada Municipality. All of them were observed for the study. Among these, a toilet located Duldhara in ward 5 was not in operation. The information about public toilets obtained during KII and observation are fed in this report.

Public toilet at *Khalanga*

The toilet located at *Khalanga* in ward 1 was constructed by Rural Water Supply and Sanitation Fund Development Committee under Ministry of Water Supply (MoWS). It is being managed by a caretaker. It has separate male, female and disable friendly compartments. It serves 10 users at a time with 5 urinals and 2 pans in male compartment, 2 pans in female compartment and 1 pan in disable friendly compartment. The local shopkeepers, travellers and public bus passengers are the service recipients of this toilet. About 15 to 20 users uses the toilet per day. The users are charged Rs. 5 (USD 0.03). for urination and Rs. 10 (USD 0.08) for defecation.

The outlet of the toilet is connected to a containment. The containment is rectangular in shape with the tank capacity of about 8,000 litres. Moreover, the containment has not been emptied yet. Water used in the toilet is supplied from a 1,000 litres overhead tank on the taps of each compartment. The toilet compartments have proper ventilation and is cleaned regularly. Also, it has handwashing facility inside the toilet compartments (KII-4, 2023) . Figures 10 and 11 show the picture of public toilet at *Khalanga* and its status.

Figure 10: Public toilet located at *Khalanga.*

Figure 11: Status of public toilet at *Khalanga.*

Public toilet at *Shreenagar*

The toilet located at *Shreenagar* Bus Park in ward 2 was constructed by Khalanga Shitalpati Water and Sanitation Users Committee under third small town water supply project. It has separate male and female compartments. It serves 11 users at a time with 3 pans and 3 urinals in male compartment and 2 urinals and 3 pans in female compartment. The local shopkeepers and public bus passengers are the service recipients of the toilet. About 30 to 50 users uses the toilet per day. The users are charged Rs. 10 (USD 0.08) for urination and defecation.

The outlet of the toilet is connected to a containment. The containment is rectangular in shape with the tank capacity of about 6,000 litres. Moreover, the containment has not been emptied yet. Water is supplied from a 1,000 litres overhead tank on the taps in each compartment. Both compartments have a basin placed in the compartment lobby for handwashing facility. The toilet compartments have proper ventilation and is cleaned regularly (KII-4, 2023). The caretaker is responsible for the overall cleaning of toilet. Figures 12 and 13 shows the picture of public toilet at *Shreenagar* and its status.

Figure 12: Public toilet located at *Shreenagar*.

Figure 13: Status of public toilet at *Shreenagar*.

2.1.4 Emptying and Transport

Emptying is one of the key elements of sanitation service chain. It basically assures the proper operation of containment. Regular emptying of the containment prevents sludge overflow and blockages (Strande, et al., 2014) . Moreover, emptying of containment is determined by the number of users, duration of years and types, and size of containment.

Among the households with onsite sanitation systems, only 1% of the households have emptied their containment whereas 99% have not emptied yet. Similarly, about 5% of the institutional buildings have emptied their containments. In comparison to households, more institutional buildings have emptied their containments. Only, the containment types, unlined pits have been emptied at households whereas the containment types, fully lined tanks and lined tanks with impermeable walls and open bottom have been emptied at institutional buildings. Figure 14 shows emptying status of different types of containment at households.

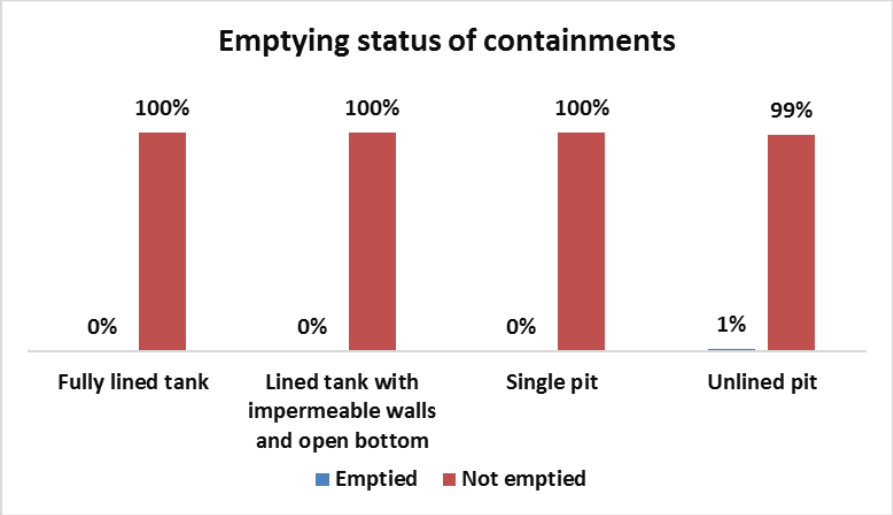


Figure 14: Status of emptying of different types of containment.

Only manual emptying is practised at households whereas only mechanical emptying is practised at institutional buildings in the municipality. However, the municipality does not have any desludging services (KII-1, 2023).

2.1.5 Treatment and Disposal/Reuse

Shaarada Municipality does not have a Faecal Sludge Treatment Plant (FSTP). Here, both manually and mechanically emptied FS is disposed into farmlands or composted (KII-1, 2023). Thus, in the municipality, all the emptied FS is disposed of unsafely and untreated in an open environment.

2.1.6 Risk Assessment of Groundwater Pollution

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

a. Sources of drinking water and water production

In the Shaarada Municipality, approximately 88% of households have piped drinking water supply services. Organizations like Khalanga Shitalpati Water and Sanitation Users'

Organization, Hiwalcha Water and Sanitation Users' Committee (WSUC), Kharibang Village WSUC, Shreenagar WSUC are among the drinking water service providers in the municipality. These service providers extract water from spring sources such as rivers and streams, to supply at households and institutions (KII-1, 2023). In addition to it, about 9% of the households directly collect water from spring sources whereas 3% of households rely on groundwater for drinking water supply. However, spring sources remains the major source of drinking water in the municipality as the service providers also extract water from spring sources. Figure 15 shows the drinking water accessibility in the municipality.

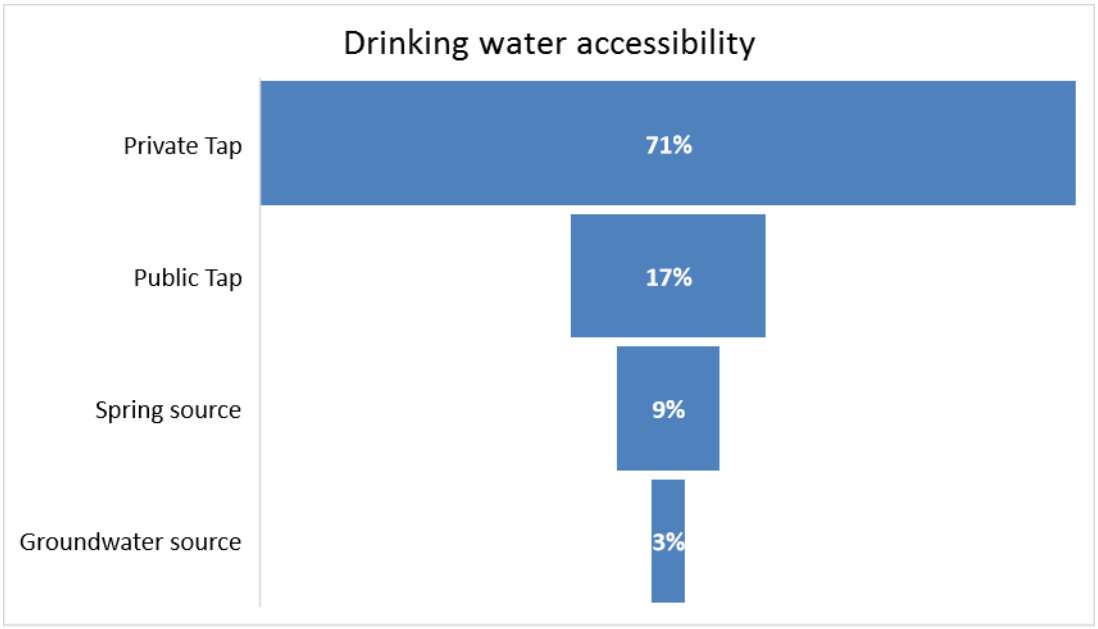


Figure 15: Drinking water accessibility in Shaarada Municipality.

Different water service providers serve in different areas of the municipality. Among others, Khalanga Shitalpati Water and Sanitation Users' Organization serves in ward 1 to ward 6 of the municipality. It has connected 2,165 taps to supply drinking water in the service areas. It extracts water from spring sources; Shaarada and Jorkhu Rivers. Water lifted from the rivers is collected in 3 reservoir tanks with capacities of 300 m^3, 250 m^3 and 200 m^3. The reservoir tanks are fitted with auto chlorine dosing systems for treatment of collected water. Thus, chlorinated water is supplied to households and institutions (KII-3, 2023).

In the municipality, most households have piped drinking water supply services which are mostly treated. Still, 12% of households depends on direct water sources for drinking water supply that are in the risk of contamination.

b. The vulnerability of aquifer and lateral spacing between sanitation systems and groundwater sources

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 (Foster, et al., 2013) . Among other anthropogenic activities, improperly designed and

constructed and unmanaged sanitation technologies also contribute to the groundwater contamination (EPA, 2015). In addition to it, the key factor to risk of groundwater pollution is the soil type and geological structure. According to WHO, 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. The size of pores in the soil determines the infiltration rate (Krishnan, 2011).

The geology of Shaarada Municipality consists of metamorphic and sedimentary rocks in high lands along with alluvial sediments i.e. sand, silt and clay along-with coarse gravels (Upreti, 1999) in the lowlands especially at riverbanks. Thus, in context of lowlands in the municipality, the pollutant could travel to the depth of approximately 18 metres (57.6 feet) between 25 and 50 days, in the soil type and possesses risk of groundwater pollution. Hence, the people using open bottom tanks or pits and consuming water from the handpumps with the depth up to 80 feet (18.28 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 16 shows the depth of handpumps and horizontal distance of it from source of pollutant by lined tanks with impermeable wall and open bottom. It shows that 100% of the households (2% of the overall population, where 2% is the percentage of population using lined tanks with impermeable walls and open bottom with no outlet or overflow and groundwater as drinking water source) using this type of containment possess significant risk to groundwater contamination.

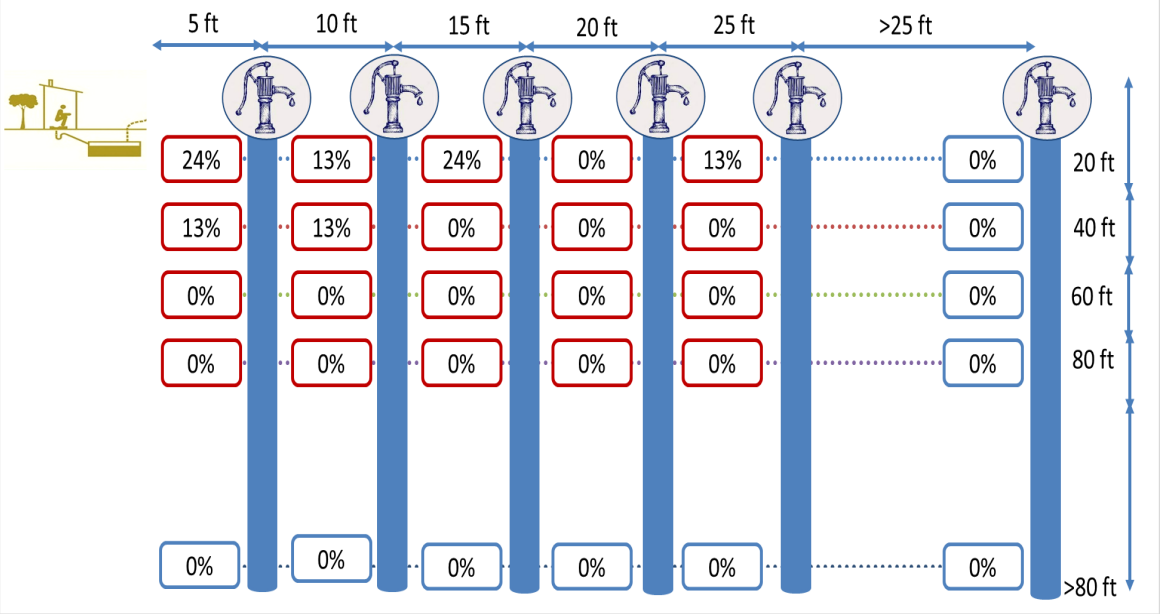


Figure 16: Depth of hand pumps and lateral spacing of it with containment type lined tank with impermeable walls and open bottom.

Figure 17 shows the depth of hand pumps and horizontal distance of it with the containment type lined pit with semi-permeable walls and open bottom and unlined pit. It shows that 100% of the households (1% of the overall population, where 1% is the percentage of population using lined pits with semi- permeable walls and open bottom with no outlet or overflow and using groundwater as drinking water source) using these types of containments possess significant risk to groundwater contamination.

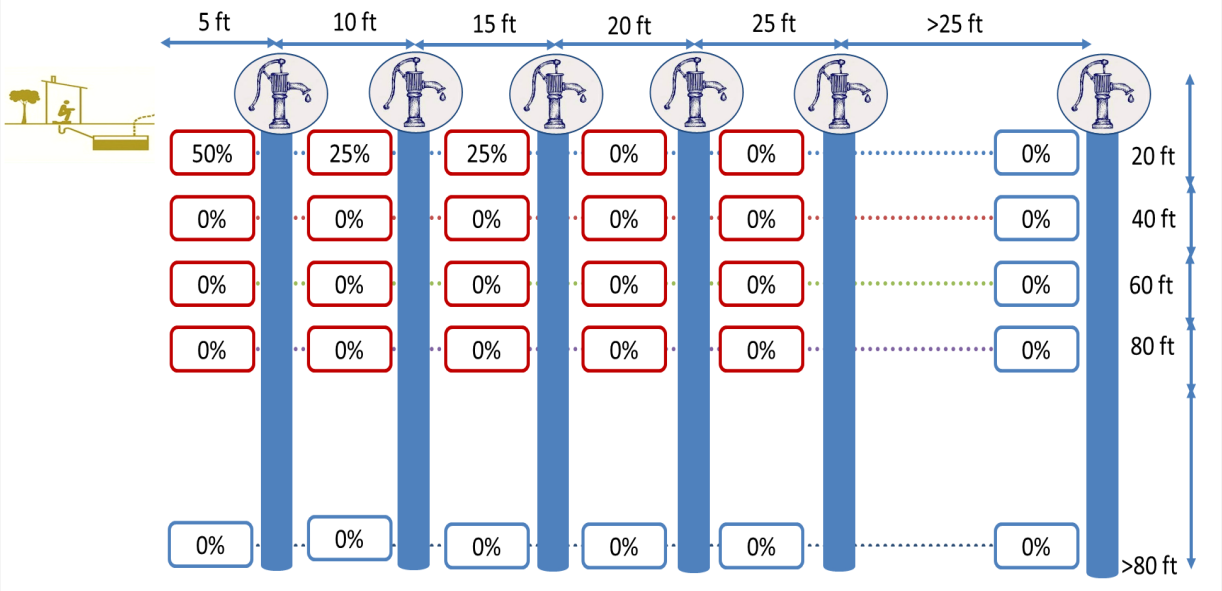


Figure 17: Depth of hand pumps and lateral spacing of it with containment type lined pit with semi-permeable walls and open bottom and unlined pit.

In context of households using spring sources, the sources lie below the community and within the distance of 25 feet from the source of pollutant. Thus, almost 4% of households (1% of households with lined tanks with impermeable walls and open bottom and 3% of households have unlined lined pits) possess significant risk of pollution to these sources. Therefore, T2A4C10 = 2% +1% = 3% and T2A6C10 = 1% + 3% = 4%.

Furthermore, these households do not use any kind of purification for drinking water collected from spring sources. Thus, these households are at risk of consuming contaminated water.

2.2 SFD Selection Grid

Figure 18 shows the types of sanitation technologies present in the Shaarada Municipality selected in the Shit Flow Diagram (SFD) selection grid. The vertical column on the left side of grid represents sanitation technologies to which toilet is connected to, and horizontal row at top is connection of the technologies. The households with single pit and twin pits are selected as lined pit with semipermeable walls and open bottom in this selection grid.

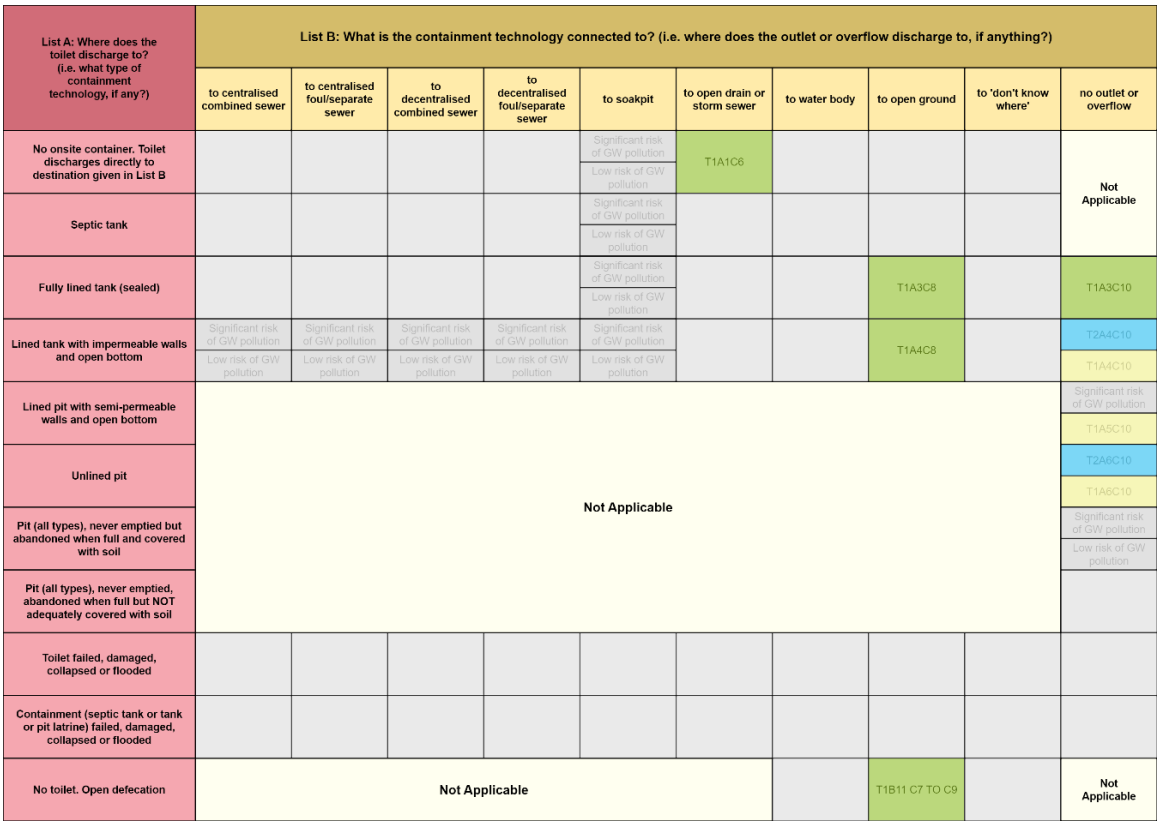


Figure 18: SFD selection grid for Shaarada Municipality.

The detail description of selected terms in the selection grid is provided in Table 4.

Table 4: Explanation of terms used to indicate different frame selected in the SFD selection grid in Figure 18.

T1A1C6	A fully functioning toilet discharging directly to an open drain or storm sewer. The excreta is raw, untreated and hazardous and since it discharges directly to an open drain or storm sewer, all the excreta in this system is considered NOT contained.
T1A3C8	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. Since the tank is fitted with a supernatant/effluent overflow connected to open ground the excreta in this system is considered NOT contained.
T1A3C10	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. However, 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. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks. Since the tank is fitted with a supernatant/effluent overflow connected to open ground, the excreta in this system is considered NOT 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. It includes all lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). However, since the tank is NOT fitted with a supernatant/effluent overflow this system is considered contained.
T1A5C10	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.
T1A6C10	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.
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.
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. It includes all lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). 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.
T2A6C10	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 but since there is a 'significant risk' of groundwater pollution this system is considered NOT contained.

2.3 SFD Matrix

2.3.1 Proportion of Faecal Sludge from types of sanitation technologies

The second step in the process of developing the SFD graphic is the calculation of the proportion of contents of each type of onsite container which is faecal sludge. SFD matrix calculates 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 SFD proportion in SFD PI was used as guide to calculate SFD proportion. As stated on 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% 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 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:

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

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

i. The proportion of FS in septic tank is 0%, since there are no septic tanks in the municipality.
ii. The proportion of FS in fully lined tanks is 100%, as none of the fully lined tanks are connected to an open/stormwater drain.
iii. The proportion of FS from lined tanks with open bottom and all types of pits is also 100%, as none of the lined tanks with impermeable walls and open bottom are connected to an open/stormwater drain.

Upon calculation of proportion of FS in each type of sanitation technologies, the population using the system selected in the SFD selection grid are fed in. The column Population (Pop) gives the proportion of population using type of sanitation system.

Figure 19 shows the SFD matrix of Shaarada Municipality.

Shaarada Municipality, Karnali, Nepal, 24 Nov 2023. SFD Level: 2 - Intermediate SFD
Population: 34663
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	W4c	W5c	F3	F4	F5
System label and description	Proportion of population using this type of system (p)	Proportion of wastewater in open sewer or storm drain system, which is delivered to treatment plants	Proportion of wastewater delivered to treatment plants, which is treated	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated
T1A1C6 Toilet discharges directly to open drain or storm sewer	1.0	0.0	0.0			
T1A3C10 Fully lined tank (sealed), no outlet or overflow	8.0			0.0	0.0	0.0
T1A3C8 Fully lined tank (sealed) connected to open ground	1.0			0.0	0.0	0.0
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	49.0			0.0	0.0	0.0
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	2.0			0.0	0.0	0.0
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	1.0			0.0	0.0	0.0
T1A6C10 Unlined pit, no outlet or overflow	30.0			1.0	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	3.0			0.0	0.0	0.0
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	4.0			0.0	0.0	0.0

Figure 19: SFD Matrix of Shaarada Municipality.

2.3.2 *Proportion of Faecal Sludge Emptied (F3)*

The proportion of faecal sludge emptied (F3) is calculated based on percentage of containment emptied (ENPHO, 2023) and amount of FS emptied during the process (KII-2, 2023) . The information on FS emptied from containment is obtained from the survey. As there is only manual emptying practice at households in the municipality, the responses of survey show complete removal sludge from the containment. Hence, the emptied proportion of FS is the actual proportion of FS emptied from each containment.

Table 5 shows the actual proportion of FS emptied from each containment.

Table 5: Sanitation technologies and proportion of emptied faecal sludge (ENPHO[1], 2023; KII-2, 2023[(2)]).

Sanitation Technologies	SFD Reference Variable	Emptied Proportion of FS (1)	FS Emptied from Containment (2)	Actual Proportion of Emptied FS (F3)
Toilet discharges directly to open drain or storm sewer	T1A1C6	0%	0%	0%
Fully lined tank (sealed) connected to open ground	T1A3C8	0%	0%	0%
Fully lined tank (sealed), no outlet or overflow	T1A3C10	0%	0%	0%
Lined tank with impermeable walls and open bottom, connected to open ground	T1A4C8	0%	0%	0%
Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	0%	0%	0%
Lined pit with semi-permeable walls and open bottom, no outlet or overflow	T1A5C10	0%	0%	0%
Unlined pit, no outlet or overflow	T1A6C10	1%	100%	1%
Open defecation	T1B11 C7 TO C9	0%	0%	0%
Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A4C10	0%	0%	0%
Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A6C10	0%	0%	0%

2.3.3 *Proportion of WW transported which is delivered to Treatment Plant (W4c and W5c)*

The variable W4c is the proportion of wastewater (WW) in open sewer or stormwater drain that is delivered to treatment plant and variable W5c is the proportion of wastewater delivered to treatment plant and treated. The municipality does not have a Wastewater Treatment Plant (WWTP). Hence, discharged wastewater is not treated and thus, the value for variables W4c and W5c is set to 0%.

2.3.4 Proportion of FS emptied which is delivered to Treatment Plant (F4 and F5)

The municipality does not have a Faecal Sludge Treatment Plant (FSTP). Hence, the portion of FS delivered to treatment plant (F4) and treated (F5) is set to 0% in all sanitation systems.

2.4 SFD Graphic

Figure 20 shows the SFD graphic of Shaarada Municipality. The graphic shows that excreta generated from the proportion of population that are safely managed is shown in green coloured whereas unsafely managed excreta are shown in red coloured arrowhead. It shows that excreta from 88% of the population are safely managed and excreta from 12% of the population are unsafely managed. It also represents the sanitation value chain going from left to right.

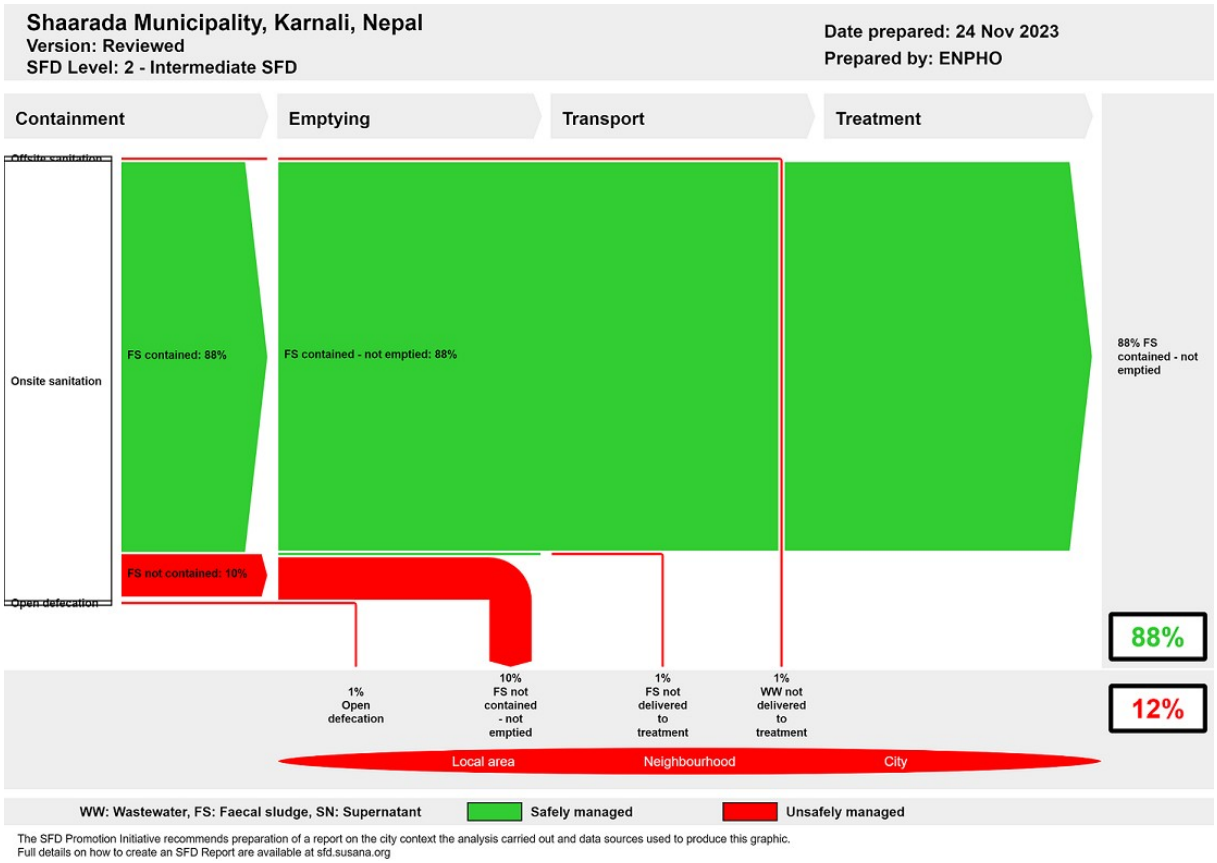


Figure 20: SFD Graphic of Shaarada Municipality.

Offsite Sanitation

Shaarada Municipality does not have a sewer network, however, 1% of households have offsite sanitation systems. The wastewater generated from these households is disposed of untreated to open/stormwater drain. Therefore, wastewater from 1% of the population is not treated and is unsafely managed.

Onsite Sanitation

In the municipality, 98% of households rely on onsite sanitation systems. Of the total households having an onsite sanitation system, 88% of the population uses containment

where FS is contained and 10% of the population uses containment where FS is not contained.

FS contained

The definition of 'FS contained' is faecal sludge contained within an onsite sanitation technology which ensures safe level of protection from excreta i.e. pathogen transmission to the user or general public is limited. These are tanks or pits that are correctly designed, properly constructed, fully functioning, and/or are causing no risk- or only a 'low' risk- of polluting groundwater used for drinking (SuSanA, 2018).

The value of FS contained i.e. 88% is obtained from the summation of population using fully lined tanks with no outlet or overflow (T1A3C10), lined tanks with impermeable walls and open bottom connected with no outlet or overflow (T1A4C10), lined pits with semi-permeable walls and open bottom with no outlet or overflow (T1A5C10) and unlined pit with no outlet or overflow (T1A6C10) without posing a significant risk to groundwater.

FS not contained

The definition of 'FS not contained' is faecal sludge contained within an onsite sanitation technology which does not ensure safe level of protection from excreta i.e. pathogen transmission to the user or general public is likely. These are tanks or pits that are incorrectly designed, or poorly constructed, or poorly functioning, and/or are causing a 'significant' risk of polluting groundwater used for drinking (SuSanA, 2018).

The value of FS not contained i.e. 10% is obtained from the summation of population using fully lined tanks connected to an open ground (T1A3C8), lined tanks with impermeable walls and open bottom connected to an open ground (T1A4C8), lined tanks with impermeable walls and open bottom with no outlet or overflow with 'significant risk' to groundwater (T2A4C10) and unlined pits with no outlet or overflow with 'significant risk' to groundwater (T2A6C10).

FS contained - not Emptied

The value of 88% is obtained from the proportion of the population using sanitation systems where the FS is contained and have not emptied their containment. However, this 88% 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.

FS not delivered to treatment

The proportion of FS not delivered to treatment, i.e. 1%, is the proportion of population using containment type that has FS not contained but emptied. Shaarada Municipality does not have a FSTP and thus, emptied FS is disposed of untreated to farmlands or unsafely composted. Therefore, this proportion of disposed FS possesses risk to local area and neighbourhood.

Open Defecation

Despite Open Defecation Free (ODF) status, people residing in 1% of households still go for open defecation. Mostly, people living in poverty do not have toilets.

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 citizen 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 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. However, it was unable to address the complex operational issue of urban water supply and sanitation service delivery. 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. After the MDGs, United Nations General Assembly set 17 global goals as Sustainable Development Goals (SDGs). Sanitation is prioritized on SDG 6. The target 6.2 of SDG 6 majorly focuses on sanitation. It mentioned to 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 by 2030. In line with SDG 6.2, Nepal has targeted to provide improved sanitation to 95% households that are not shared and urban households with toilets connected to sewer system or proper FSM to 90% by 2030 (NPC, 2017). 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, 2020) however, the target of 90% households with toilets connected to sewer system or proper FSM is yet to be achieved.

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 policy, plans and programs. It supports, facilitates, and coordinates with federal, provincial, and local government 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 21.

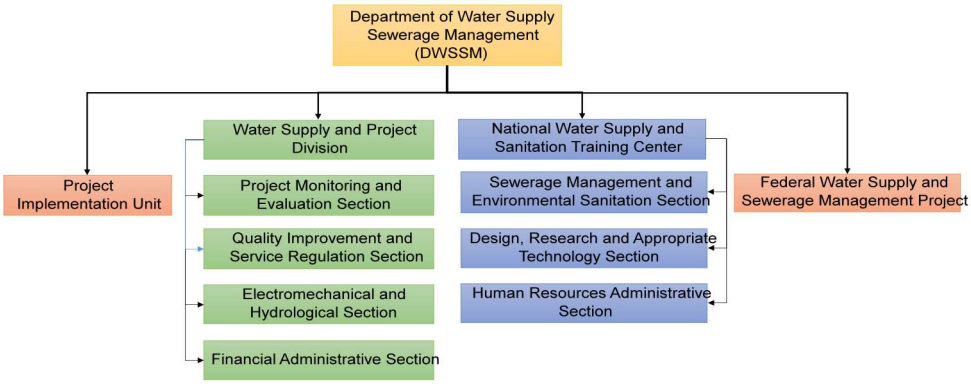


Figure 21: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).

Ministry of Urban Development: The Ministry of Urban Development (MoUD) works on integrated urban planning and development in municipalities, including faecal sludge management. Department of Urban Development and Building Construction (DUDBC) under MoUD is implementing body and sets the standards for safe, affordable building construction and implementation for managed residential environment.

At Provincial Level

Ministry of Water Resources and Energy Development: Ministry of Water Resources and Energy Development of provincial government in Karnali Province is major executing body in the province 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 Drinking Water, Irrigation and Energy Development Office (DWIEDO). DWIEDO 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 Level

Shaarada Municipality has a Water and Sanitation Section for implementation of WASH related activities. The activities related to sanitation is managed under this section with major

focus on water supply and sanitation management. However, FSM is still the secondary priority in the municipality as the section primarily focuses on drinking water supply and solid waste management.

3.1.3 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, 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).

The municipality does not have a sewer network. The toilet system is directly connected to open drain, water bodies or open ground. The toilets that are connected to containments are emptied mechanically by desludging suction truck from municipality or private service providers whereas manually emptied by traditional desludgers.

3.1.4 Service standards

The sanitation service standards have been 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 6. However, FSM specific standards have yet to be developed and implemented.

Table 6: 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	✓	✓	✓

4 Stakeholder Engagement

4.1 Key Informant Interview

The Key Informant Interviews (KIIs) and objective sharing of the study were conducted with major stakeholders of the sanitation sector in the municipality. The focal persons at the municipality were interviewed on current sanitation services with respect to technical, institutional, and financial aspects. Also, the KII was performed with water service provider to understand drinking water supply system and management, and caretaker of public toilet along with observation to find sanitation status and management practice of public toilet (Table 7 and Figure 22).

Table 7: List of Key Informant Interviewed personnel.

S.N.	Name	Designation	Organization/Company	Purpose of KII	Date
1.	Prakash Bhandari (KII-1)	Mayor	Shaarada Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	24 April, 2023
2.	Kailash Chanar (KII-2)	Water and Sanitation Technician	Shaarada Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development and Emptying practices, finances, requirement, disposal and treatment	24 April, 2023
3.	Keshab Bahadur Budathoki (KII-3)	President	Khalanga Shitalpati Water and Sanitation Users' Committee	Water Supply Services	24 April, 2023
4.	Bharat Bista (KII-4)	Caretaker	Public toilet-Khalanga	Public Toilet Services	24 April, 2023
5.	Keshab Mahar (KII-4)	Caretaker	Public toilet-Shreenagar	Public Toilet Services	24 April, 2023

Figure 22: KII with water service provider and caretaker of public toilet.

4.2 Household Survey

A random household survey was conducted in all wards of the municipality. The local enumerators selected from the municipality were oriented prior to the survey and were mobilized for data collection. A mobile application "KOBOCOLLECT" was used for data collection from the households and institutions. In the orientation, enumerators were clarified on survey objectives, technical terms concerning sanitation, use of the mobile application and procedure of random sampling survey based on the provided map (Figure 23).

Figure 23: SFD orientation to local enumerators of Shaarada Municipality.

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^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

$n_h = (N_h/N)*n$, where N_h is a total population in each stratum.

A total of 368 households were sampled from 8,898 households distributed in fifteen wards with proportionate stratification random sampling. The household samples surveyed in the municipality is shown in Figure 24.

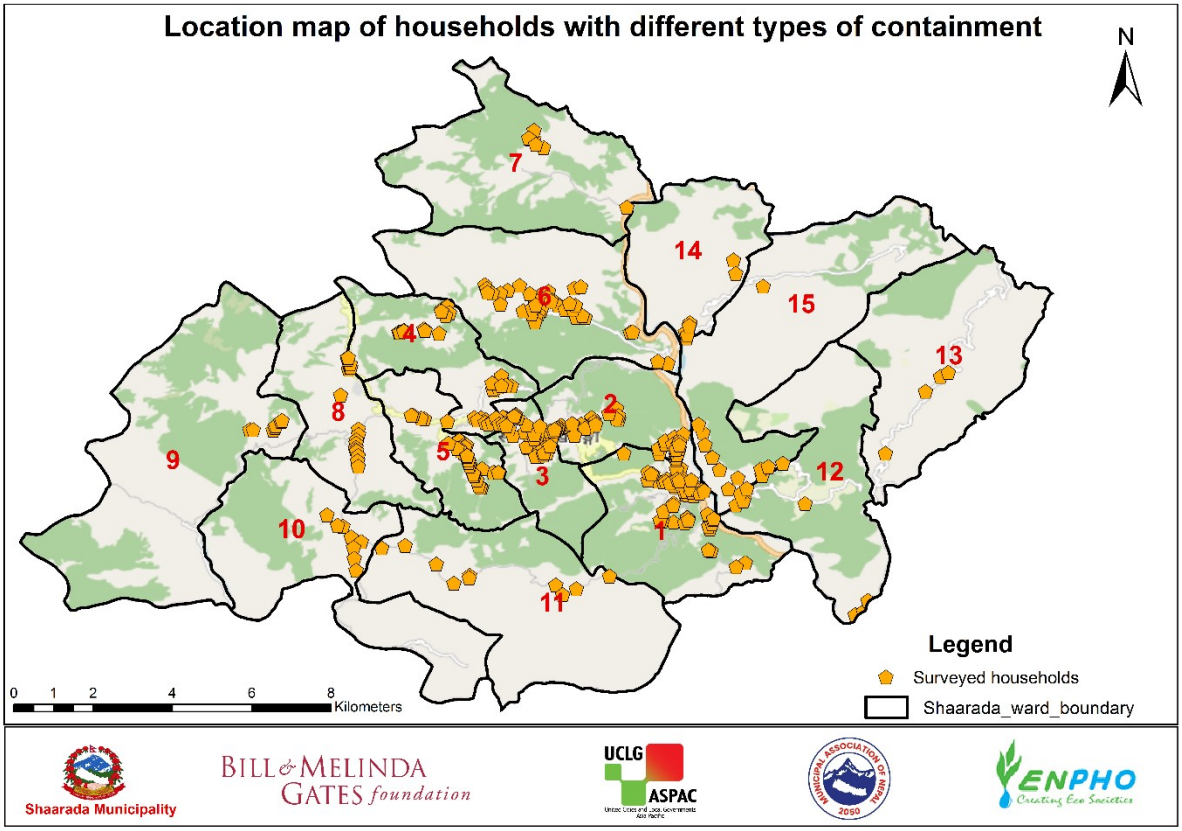


Figure 24: Location map of surveyed households.

4.3 Direct Observation

Various sanitation technologies in the households were observed and visual references were kept. Also, observation of the toilet, water source and containments were carried out. Figure 25 shows the sanitation facility at households in Shaarada Municipality.

Figure 25: Observation of sanitation facility of household at Shaarada Municipality.

4.4 Sharing and Validation of Data

The Shit Flow Diagram Sharing and Validation Workshop was conducted at Shaarada Municipality to share the findings on sanitation situation survey and receive the suggestions from the municipal stakeholders. Altogether, 32 participants including deputy mayor, ward chairpersons, municipal council members, sectoral staffs and other relevant stakeholders actively participated on the workshop and provided valuable suggestions. Deputy Mayor focused on planning for containment improvement, management of resources for FSM and FSTP during her remarks. Figure 26 shows the picture of SFD findings sharing to the participants. The list of participants with their designation is attached in Appendix 4.

Figure 26: Sharing of findings during validation workshop.

5 Acknowledgements

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

We offer sincere acknowledgement to Mr. Prakash Bandari, Mayor, Mr. Liladhar Babal, CAO and Mr. Kailash Chanara, Water and Sanitation Technician of the municipality for providing valuable time and information during study. Similarly, we would like to thank all the respective staffs of the municipality and key stakeholders involved during the study, without whose help this study would not have been completed.

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

We are grateful to Ms. Bhawana Sharma, Executive Director and Mr. Rajendra Shrestha, Program Director of Environment and Public Health Organization (ENPHO) for tremendous support and guidance during the whole process of the study. Together, we would like to thank the entire team of ENPHO for their support and MuNASS-II team without whom the study would not have been possible.

We are grateful towards the enumerators, Ms. Keshari Shrestha, Ms. Sujata Budhathoki, Ms. Jamuna Kunwar, Ms. Pratikshya Giri K.C., Ms. Sita Bhandari, Ms. Anjana Chand, Ms. Sushila Chand, Ms. Gita Acharya, Ms. Puspa K.C. Chand, Ms. Bimala Kumari Dangi and Mr. Prabin Dangi for their support during the survey.

6 References

Affam, A. C. & Ezechi, H. E., 2021. Sanitation Systems and Technology Options. In: *Clean Water and Sanitation.* Cham: Springer, pp. 1-16.

Climate-Data, 2021. *Climate-Data.* [Online]
Available at: https://en.climate-data.org/asia/nepal/mid-western-development-region/salyan-khalanga-1025332/
[Accessed 24 October 2023].

ENPHO, 2023. *Sanitation Situation Assessment of Shaarada Municipality. Unpublished,* s.l.: s.n.

EPA, 2015. *United States Environmental Protection Act.* [Online]
Available at: https://www.epa.gov/sites/default/files/2015-08/documents/mgwc-gwc1.pdf

Foster, S., Hirata, R. & Andreo, B., 2013. The aquifer pollution vulnerability concept: aid or impediment in promoting groundwater protection?. *Hydrogeology Journal,* 21(7), p. 1389–1392.

GoN, 2015. *Constitution of Nepal: Goverment of Nepal.* [Online]
Available at: https://lawcommission.gov.np/en/wp-content/uploads/2021/01/Constitution-of-Nepal.pdf

Karki, R., Talchabhadel, R. & Aalto, J., 2015. New climatic classification of Nepal. *Theoretical and Applied Climatology,* pp. 799-808.

KII-1, 2023. *Sanitation and Drinking Water Supply Status of Shaarada Municipality.* Shaarada: s.n.

KII-3, 2023. *Water Supply and quality of water in Shaarada Municipality.* Shaarada: s.n.

KII-4, 2023. *Public toilet operation, management and services data of Shaarada Municipality.* Shaarada: s.n.

Krishnan, S., 2011. *On-Site Sanitation and Groundwater Contamination: A Policy and Technical Review,* Anand, India: INREM Foundation.

MoF, 2015. Public-Private Partnership Policy. In: Kathmandu, Nepal: Goverment of Nepal.

MoPIT, 2009. National Urban Water Supply and Sanitation Sector Policy. In: s.l.:Ministry of Physical Infrastructure and Transport.

MoWS, 2020. *Open Defecation Free Nepal:Narration of the Journey,* Kathmandu: Secretariat of National Sanitation and Hygiene Coordination Committee, Nepal.

National Statistics Office, 2023. *National Population and Housing Census 2021 National Report,* Kathmandu: National Statistics Office.

NPC, 2017. *Nepal Sustainable Development Goals, Status and Roadmap: 2016-2030.* s.l.:National Planning Commission.

Peal, A. et al., 2020. Estimating Safely Managed Sanitation in Urban Areas; Lessons Learned From a Global Implementation of Excreta-Flow Diagrams. *Frontiers in Environmental Science,* Volume 8, pp. 1-13.

Shaarada Municipality, 2023. *Shaarada Municipality.* [Online]
Available at: https://shaaradamun.gov.np/en
[Accessed 12 December 2023].

Strande, L., Ronteltap, M. & Brdjanovic, D., 2014. *Faecal Sludge Management: Systems Approach for Implementation and Operation,* London: IWA Publishing.

SuSanA, 2018. *Shit Flow Diagram Manual; Volume 1 and 2;SFD promotion initiatives.* 2 ed. s.l.:SDF Pomotion Initiatives.

Upreti, B. N., 1999. The Physiography and Geology of Nepal and Their Bearing on the Landslide Problem. In: L. Tianchi, S. R. Chalise & B. N. Upreti, eds. *Landslide Hazard Mitigation in the Hindu Kush-Himalayas.* Kathmandu(Bagmati): Internationl Centre for Integrated Mountain Development, pp. 31- 49.

7 Appendix

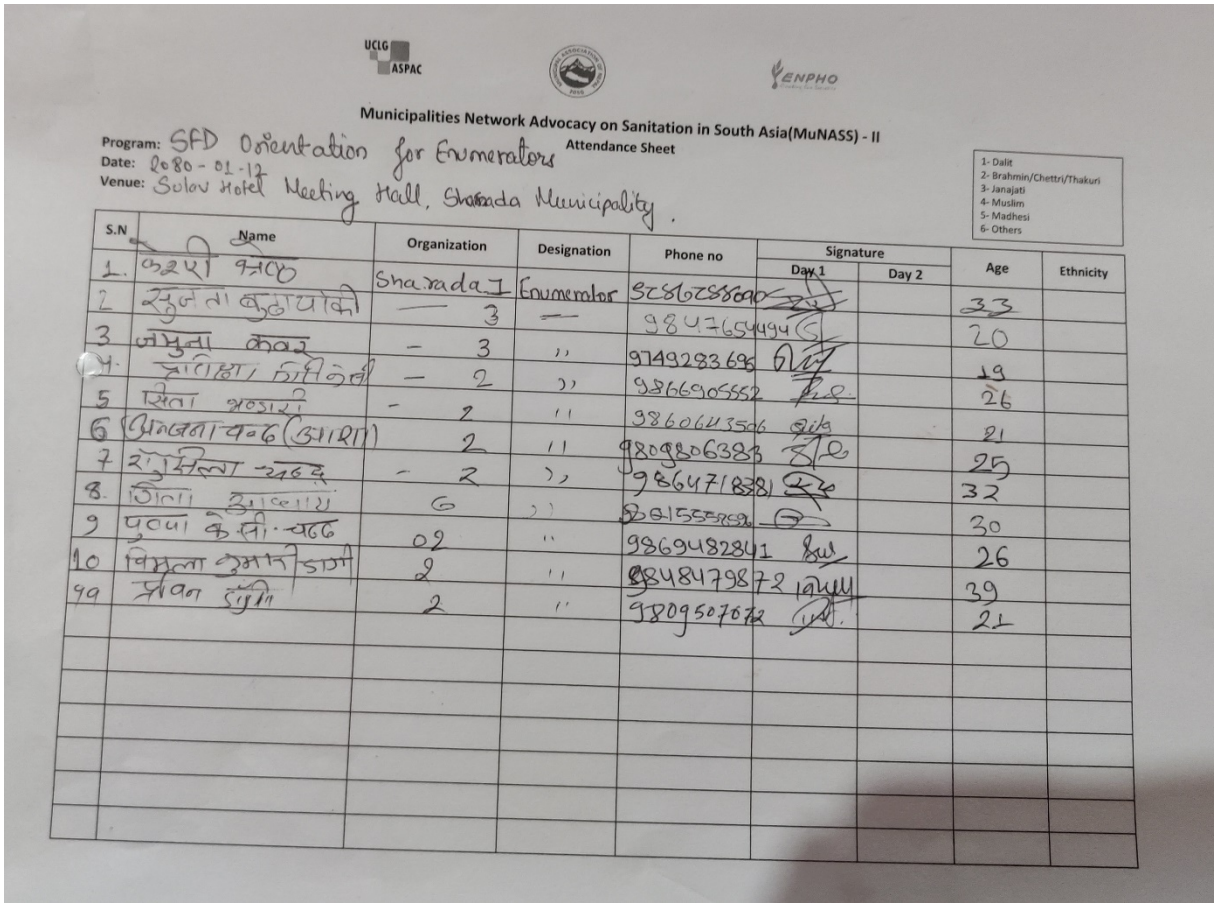
7.1 Appendix 1: Roles and Responsibility of Various Tiers of Governments Delineated in Drafted SDP 2016 – 2030

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

7.2 Appendix 2: Total number of population and household in each ward and number of surveyed households

Ward No.	Number of Surveyed households
1	74
2	55
3	37
4	37
5	37
6	37
7	7
8	18
9	7
10	7
11	7
12	22
13	7
14	7
15	7
	368

7.3 Appendix 3: List of Participants on SFD Survey Orientation



UCLG ASPAC | ENPHO

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

Attendance Sheet

Program: SFD Orientation for Enumerators
Date: 2080-01-17
Venue: Solav Hotel Meeting Hall, Shaarada Municipality.

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

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Age	Ethnicity
1.	[illegible]	Sharada I	Enumerator	[illegible]			33	
2	[illegible]	— 3	—	9847654994			20	
3	[illegible]	— 3	,,	9749283698			19	
4.	[illegible]	— 2	,,	9866905552			26	
5	[illegible]	— 2	,,	9860643506			21	
6	[illegible]	2	,,	9809806388			25	
7	[illegible]	— 2	,,	9864718381			32	
8.	[illegible]	6	,,	[illegible]			30	
9	[illegible]	02	,,	9869482841			26	
10	[illegible]	2	,,	9848479872			39	
99	[illegible]	2	,,	9809507072			21	

7.4 Appendix 4: List of Participants in Sharing and Validation Workshop

आज मिति २०८०/०८/१३ गते शारदा नगरपालिकामा नेपाल नगरपालिका संघको आयोजनामा वातावरण र जनस्वास्थ्य संस्था (एन्फो) को प्राविधिक सहयोग, The United cities and Local Government Asia Pacific (UCLG-ASPAC) को सहकार्यमा र Bill and melinda Gates Foundation (BMGF) को आर्थिक सहयोगमा मानव मलमूत्र प्रवाह रेखाचित्र (Shit Flow Diagram - SFD) प्रमाणीकरण सम्बन्धि अन्तर्क्रिया कार्यक्रममा निम्न अनुसार सरोकारवालाको उपस्थिति रहेको छ ।

उपस्थिति :-

क्र.सं.	नाम	पद	कार्यालय	फोन नं.	हस्ताक्षर
१.	सुस्मिता सापकोटा	नगर उपप्रमुख	शारदा न.पा.	९८६४३२५६७८	[illegible]
२.	लिलाधर बलाल	प्रमुख प्र.अ.	शारदा न.पा.	९८२११६३६६९	[illegible]
३.	रंगिला बुढा	प्रशासन अधिकृत	''	९८६८३९७१४९	[illegible]
४.	दिलमाया राना-कोली	सहायक पाँचौं	शा.न.पा.	९८४४८०८६३१	[illegible]
५	लोकमान [illegible]		शा.न.पा.१४	९८५६८३०२१५	[illegible]
६.	प्रकाश पुन	वडा अध्यक्ष	शा.न.पा.१४	९८४८८४४२३७	[illegible]
७	जङ्ग बहादुर पुन मगर	वडा अध्यक्ष	शा.न.पा.१३	९८४७८४४०४५	[illegible]
८	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
९	धर्मराज थापा	स्वकीय सचिव	शा.न.पा.	९८४६८४४११८	[illegible]
१०	नविन मल्ल	सूचना प्रविधि अधिकृत	''	९८२८०७१२४४	[illegible]
११	रवीन्द्र मल्ल	इन्जिनियर	''	९८५८३६७२४२	[illegible]
१३	[illegible] कुमार [illegible]	[illegible]	शा.न.पा.	[illegible]	[illegible]
१४	पुष्पा नेपाली	का. सदस्य	'' ''	९८६५२५३६८०	[illegible]
१५.	भगवती बोहरा	का. सदस्य	शा.न.पा.१२	९७४५३२८६४१२	[illegible]
१६	रत्न कु. थापा	का.पा.स.	शा.न.पा.१	९२४६५६५९१२	[illegible]
१७	मञ्जु परियार	का.पा.स	शा.न.पा.२	९८६०९६७१०३	[illegible]
~~१८~~	~~तुल्सा भण्डारी~~	~~शा.न.पा.२~~			
१९	तुल्सा भण्डारी	वडा अध्यक्ष	शा.न.पा.२	९८४६८६८२- २४१	[illegible]

क्र.सं.	नाम	पद	कार्यालय	फोन नं.	हस्ताक्षर
१९.	भोज राज विश्वकर्मा	[illegible]	शारदा	[illegible]	
२०	मित्रराज बुढाथोकी	वडा अध्यक्ष	शा.न.पा.-६	[illegible]	
२१	राजेन्द्र कुमार [illegible]	वडा अध्यक्ष,	शारदा ११	[illegible]	
२२	कृष्णबहादुर थापा	वडा अध्यक्ष	शा.न.पा.१०	[illegible]	
23	किशोर कुमार हमाल	"	" ४	[illegible]	
२४	तिलक बहादुर रोका	"	" – 6	[illegible]	
२५.	प्रदिप शाही	"	" –५	[illegible]	
२६	[illegible]	"	" -१	[illegible]	
२६	मुकुन्द राज [illegible]	MST- WSGIP	-SDS	[illegible]	
२८	जय शंकर झा	MST, WaSGIP (DTL)		[illegible]	
२९	सुरेन्द्र [illegible]	[illegible] वडा अधिकृत	वडा कार्यालय	[illegible]	
30	कैलाश [illegible]	DWSST	शारदा	[illegible]	
३१	केशव ब. बुढाथोकी	योजना अधिकृत	शारदा	[illegible]	
३२	नबिन बुढाथोकी	चालक	शारदा	[illegible]	
३३	सेवक गिरी	चालक	शारदा	[illegible]	
३४	अनिता भुजु	A.P.O.	ENPHO	9849358397	
३५	रुपक [illegible]	Engineer	ENPHO	9849463846	
३६	बुद्ध बज्राचार्य	कार्यक्रम संयोजक	एन्फो		

SFD Shaarada Municipality, Nepal, 2024

Produced by:
Anita Bhuju, ENPHO
Jagam Shrestha, ENPHO
Rupak Shrestha, ENPHO
Shreeya Khanal, ENPHO
Buddha Bajracharya, ENPHO
Sabuna Gamal, ENPHO

This Executive Summary and the SFD Report are available from:

www.sfd.susana.org

SFD Promotion Initiative