SFD Report

Sunwal Municipality
Nepal

Final Report

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

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SFD Report Sunwal Municipality, Nepal, 2023

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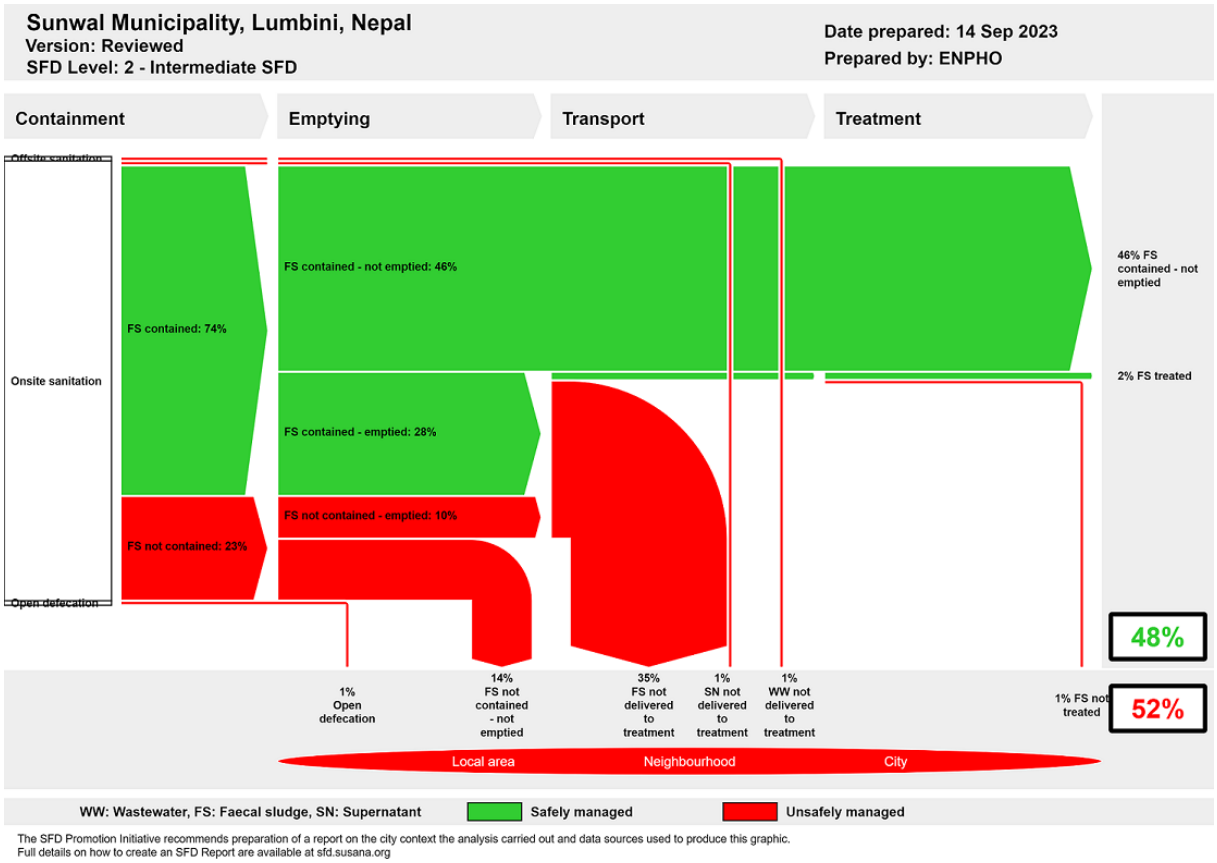
1. The SFD Graphic



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.
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.

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Collaborating partners:

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

Status:

Final SFD report.

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3. General city information

Sunwal Municipality is situated in Nawalparasi District of Lumbini Province in the southern region of Nepal. It is divided into thirteen wards and covers an area of 139.10 sq. km.

It was established on May 18, 2014 by merging the Village Development Committees (VDCs), Swathi and Sunwal. On March 10, 2017, it was reformed by merging the Ramnagar area and ward 6 of Dhurkot VDC with the already-existing Sunwal Municipality. It lies at 27.55869° N latitude, 83.661249°E longitude and at the altitude from 138 metres above sea level (masl) to 1,023 masl (Sunwal Municipality, 2023).

A population of 72,085 is residing on 17,418 households in the municipality (National Statistics Office, 2023). It has an annual population growth rate of 2.42%. The municipality has a temperate climate with hot summers and dry winters. It has an average high temperature of 28.6°C and average low temperature of 14.6°C and receives 1,654 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). Nawalparasi District was declared Open Defecation Free (ODF) on June 30, 2015. But 1% of households do not have toilets whereas 99% of households have the coverage of improved sanitation facility. The households without improved sanitation facility opt for open defecation.

Containment:

About 1% of households with improved sanitation facility rely on offsite sanitation system and 98% rely on onsite sanitation system. The municipality does not have sewer network and thus, the households with offsite sanitation system have their toilets connected to an open drain/stormwater drain. Households with onsite sanitation systems have different sanitation technologies. About 3% of households have biogas digesters, 1% have septic tanks, 23% have fully lined tanks, 18% have lined tanks with impermeable walls and open bottom and 53% have lined pits with semi-permeable walls and open bottom.

Similarly, all the institutional buildings have toilets. Among which, 64% have fully lined tansk, 14% have lined tanks with impermeable walls and open bottom and, 22% have lined pits with semi-permeable walls and open bottom.

The municipality has two functional toilets located in ward no. 1 whereas as one located at Ban Kathi in ward 5 is not open for the use. These toilets were observed for the information collection. The toilet located at Chauraha of ward 1 and Ban Kathi of ward 5 is constructed by the municipality whereas one located at Haat Bazar in ward 1 is constructed by Rural Water Supply and Sanitation Fund Development Committee. All toilets have separate male and female compartments. The toilet at Chauraha and Haat Bazar serves 11 and 10 people respectively at a time. The service recipient of this toilet are public passing by and customers of the local marketplace.

Emptying and Transport:

Among the buildings with onsite sanitation system, 49% of households and 33% of institutional buildings have emptied their containment. Mechanical emptying is prevalent in the municipality. The municipality has commercial desludging services only. Among which one service has a desludging vehicle with tank capacity of 5000-litres. It generally makes 5 trips per week and charges NRs.1,000 (USD 7.4) to NRs.3,500 (USD 26.1).

Treatment and Disposal/Reuse:

Here, mechanically emptied FS is disposed of into farmlands or in a forest and manually emptied FS is composted, dug and dumped and applied to farmlands. All these practises are not considered as safely managed FS. However, FS fed to biogas digesters is used for biogas production and treated sludge is applied to farmlands. Therefore, all the emptied FS is disposed of unsafely into an open environment except the FS fed into the biogas digesters.

The SFD graphic shows that excreta generated from 48% of the population are safely managed while 52% of the population are unsafely managed. The safely managed FS generated from 46% 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.

Sunwal Water Supply Users and Sanitation Organization (SWSUSO) is providing drinking water service in Sunwal Municipality. It has distributed 4,048 private taps in households and provides 15.57 Million Litres per Day (MLD) of water. However, 47% of households still rely on handpumps 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. Almost 59% of the population using lined tanks with impermeable walls and open bottom and 57% of population using lined pit with semi-permeable walls and open bottom possesses the significant risk to groundwater pollution.

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 Supply, Rural and Urban Development
Public Institutions at Local Government	Sunwal Municipality
Non-governmental Organizations	Environment and Public Health Organization (ENPHO)
Private Sector	Sunwal Water Supply Users and Sanitation Organization Private FS Emptying and Desludging facility providers
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). Enumerators from the municipality have been 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 was conducted with officers and engineers of municipality, Water Supply and Sanitation Users Committee. Types of sanitation technologies used in various locations have been mapped using ARCGIS. For the Shit Flow Diagram (SFD) graphic production, initially, a relationship between sanitation technology used in questionnaire survey and Shit Flow Diagram Promotive Initiatives (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, 376 households and 36 institutions were surveyed from thirteen wards of Sunwal Municipality. Primary data on emptying, transportation and current sanitation practices in the municipality were validated from KII with public toilet management, sanitation and environmental section 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/western-development-region/sunwal-422367/ [Accessed 23 August 2023].
- ENPHO, 2023. Sanitation Situation Assessment of Sunwal 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.

SFD Sunwal Municipality, Nepal, 2023

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Abbreviations

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
MoPIT	Ministry of Physical Infrastructure and Transport
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
NUWSSSP	National Urban Water Supply and Sanitation Sector 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
SWSUSO	Sunwal Water Supply Users and Sanitation Organization
UCLG ASPAC	United Cities and Local Governments Asia Pacific
VDC	Village Development Committee
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WSSDO	Water supply and Sanitation Divisional Office
WSUC	Water Supply and User's Committee
WW	Wastewater
WWTP	Wastewater Treatment Plant

1 City context

Sunwal Municipality is situated in Nawalparasi District of Lumbini Province in the southern region of Nepal. It was established on May 18, 2014 by merging the Village Development Committees (VDCs), Swathi and Sunwal. On March 10, 2017, it was reformed by merging the Ramnagar area and ward 6 of Dhurkot VDC with the already-existing Sunwal Municipality. It is divided into 13 wards. It shares its boundary with Sarawal Municipality on the east, Rupandehi District on the west, Bardaghat Municipality and Binayi Tribeni Rural Municipality on the east-north, Palpa District on the north and Ramgram Municipality on the south (Sunwal Municipality, 2023). Figure 1 shows the ward boundary map of Sunwal Municipality.

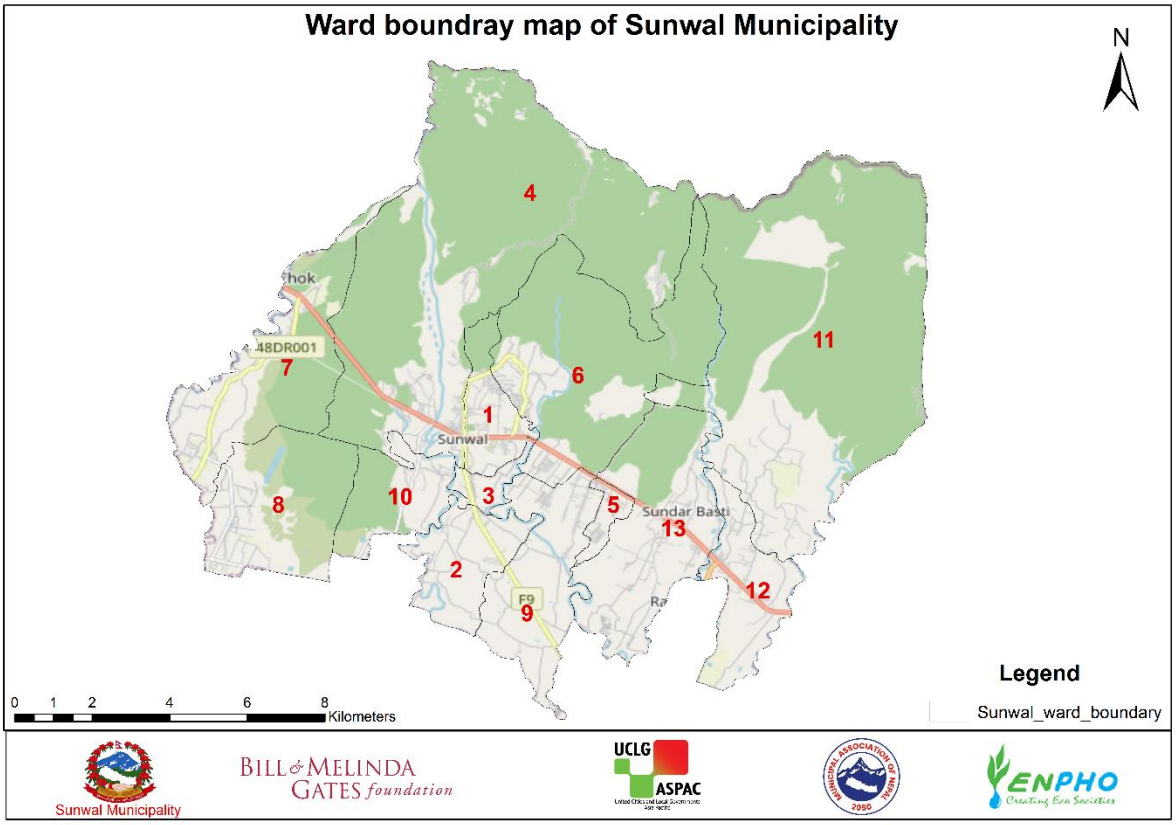

Figure 1: Ward boundary map of Sunwal Municipality.

1.1 Population

As per the national population and housing census conducted in 2021, Sunwal Municipality has a total population of 72,085 with 33,793 male and 38,292 female population. It has altogether 17,418 households (National Statistics Office, 2023). The annual population growth rate of Sunwal Municipality is 2.42% (Sunwal Municipality, 2023).

1.2 Topography and Geography

Sunwal Municipality lies at 27.55869°N latitude, 83.661249°E longitude and at the altitude from 138 metres above sea level (masl) to 1,023 masl. It is spread over the total area of 139.10 sq. km. (Sunwal Municipality, 2023). It lies in the Terai region of Nepal as well as some areas of Churia region. The soil composition of the municipality consists of alluvial and fluvial sediments i.e. sand, silt and clay along-with coarse gravels (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 Sunwal Municipality falls on temperate climate based on Köppen–Geiger classification. This climatic condition has hot summers and dry winters (Karki, et al., 2015). In the municipality, the warmest month of the year is May with an average temperature of 28.6°C and coldest month is January with an average temperature of 14.6°C. The annual average temperature of the municipality is 23.5°C. It receives 1,654 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 Sunwal Municipality.

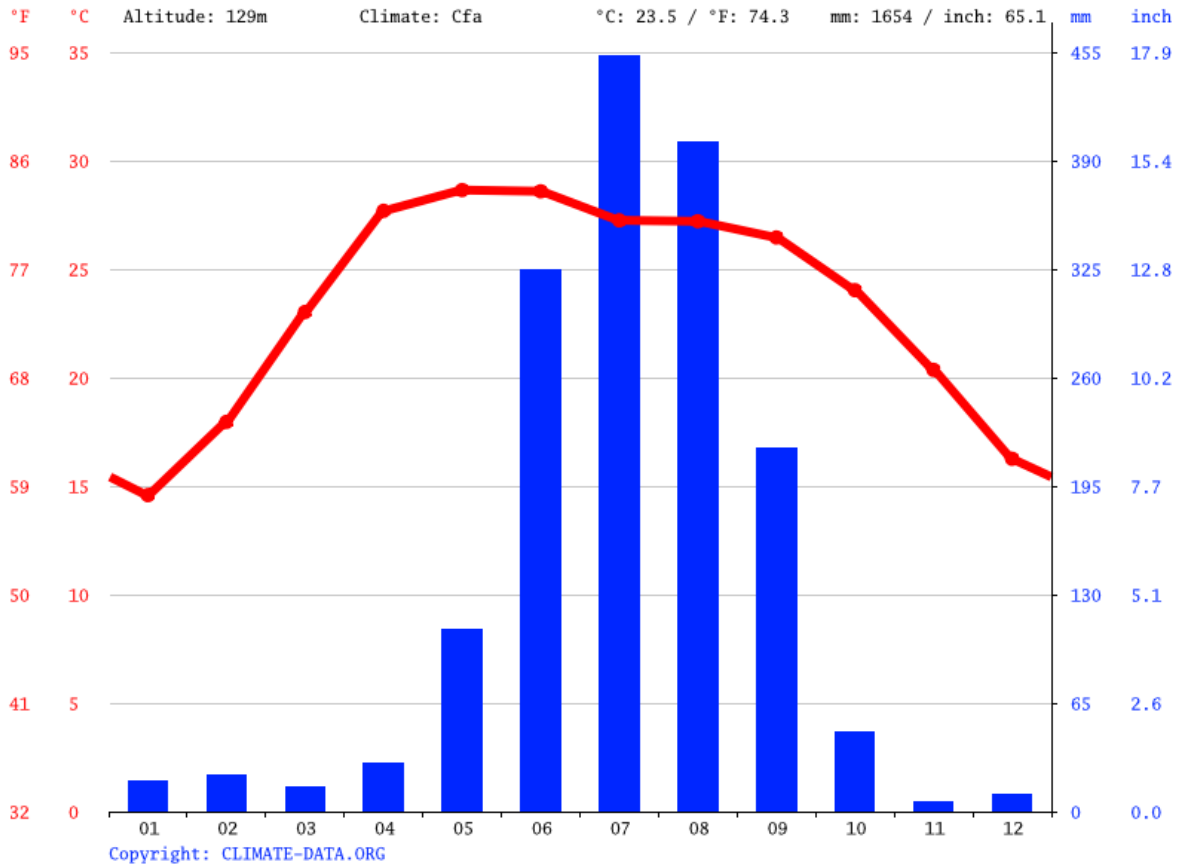

Figure 2: A graph showing the monthly average for precipitation and temperature of Sunwal Municipality,

2 Service Outcomes

2.1 Overview

Data on sanitation situation were collected through household and institutional surveys(ENPHO, 2023). A total of 376 households were sampled from 17,418 households distributed in thirteen 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

Nawalparasi District was declared Open Defecation Free (ODF) on June 30, 2015 (MoWS, 2020). The status of ODF indicates accessibility to basic sanitation on each household (HH). In Sunwal 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 outside of a household that practices open defecation.

Figure 3: Outside of a household that practices open defecation.

The remaining 99% of the households have improved sanitation facility 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% have onsite sanitation systems. Figure 4 presents the location map of households with status of access to improved sanitation.

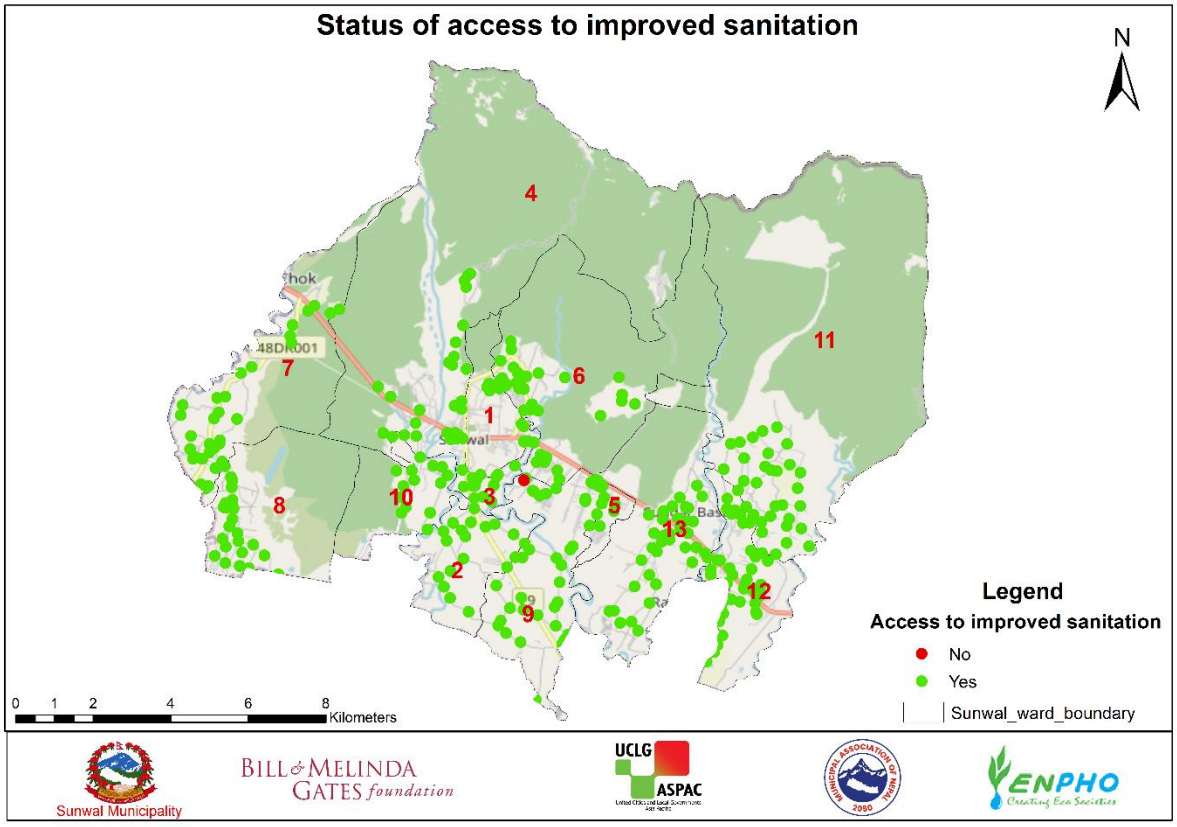

Figure 4: Location map of households with status of access to improved sanitation.

Types of Offsite Sanitation Systems

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

Figure 5: Wastewater in an open drain.

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 the percentage of households using it at Sunwal Municipality.

Table 1: Types of onsite sanitation system at households of Sunwal Municipality.

Containment	Wall construction materials	Bottom of containment	Chamber	Number	Connected to	%
Biogas Digester	NA	NA	NA	NA	No outlet/overflow	3%
Septic tank	Concrete walls or Cemented brick/stone walls	PCC or plastered	Two or more than two	NA	Soak pit Sewer Open drain/open ground	1%
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	23%
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	18%
Single pit	Concrete rings piled one after other	Soiling or Nothing	NA	One	NA	40%
Twin pit	Concrete rings piled one after other	Soiling or Nothing	NA	Two	NA	13%

Biogas Digester is a waste to energy conversion technology designed to treat household organic waste and FS to generate biogas. 3% of households have built a biogas digester in their houses. Alternative Energy Promotion Centre (AEPC) has promoted biogas technology at households in 75 districts of Nepal. The installation of biogas at households has supported in improving situation of health status and sanitation status in Nepal (AEPC, 2018). Figure 6 shows the types of biogas digesters in Sunwal Municipality.

Figure 6: Types of biogas digesters in Sunwal Municipality.

Septic tank is a watertight rectangular chamber with two or more than two compartments for better storage and stabilization of Faecal Sludge (FS). The technology is properly sealed, and the effluent is discharged into soak pit (SuSanA, 2018). 1% of households in the municipality have septic tanks.

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 effulent (Strande, et al., 2014). 23% 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). 18% of households have these types of containments in the 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). 40% of households have single pits in the municipality. Figure 7 shows pictures of a single pit found in the municipality.

Figure 7: Single pits found in the Sunwal Municipality.

Twin Pit is also a circular onsite sanitation technology with two sets of concrete rings. It has semi-permeable walls and a permeable base (SuSanA, 2018). Each pit is used alternatively after filled. This technology is ideally designed to safely store and treat FS. It effectively treats FS if there is no exfiltration of water (Saxena & Den, 2022). The facility consists of two sets of pits with the minimum horizontal distance of 1.2m. Both the pits are connected from diversion box. However, most twin pits installed by the households are not as per the design. 13% of households have twin pits. Figure 8 shows the inappropriate design of twin pits in the municipality.

Figure 8: Inappropriate design of twin pits, where the distance between the two pits is less than 1.2m.

Table 2 shows the types of sanitation technologies recategorized according to the Shit Flow Diagram Promotion Initiative (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	
Septic tank (T1A2C6)	1%
Fully lined tank (T1A3C8 and T1A3C10)	26%
Lined tank with impermeable walls and open bottom (T1A4C6, T1A4C8, T1A4C10 and T2A4C10)	18%
Lined pit with semi-permeable walls and open bottom (T1A5C10 and T2A5C10)	53%
Grand Total	**100%**

Here, biogas digesters and fully lined tanks are recategorized as fully lined tanks and single pits and twin pits are recategorized as lined pits with semi-permeable walls and open bottom. Thus, 26% households have fully lined tanks and 53% of the households have lined pits with semi-permeable walls and open bottom.

Figure 9 shows location map of households with different types of containment at Sunwal Municipality.

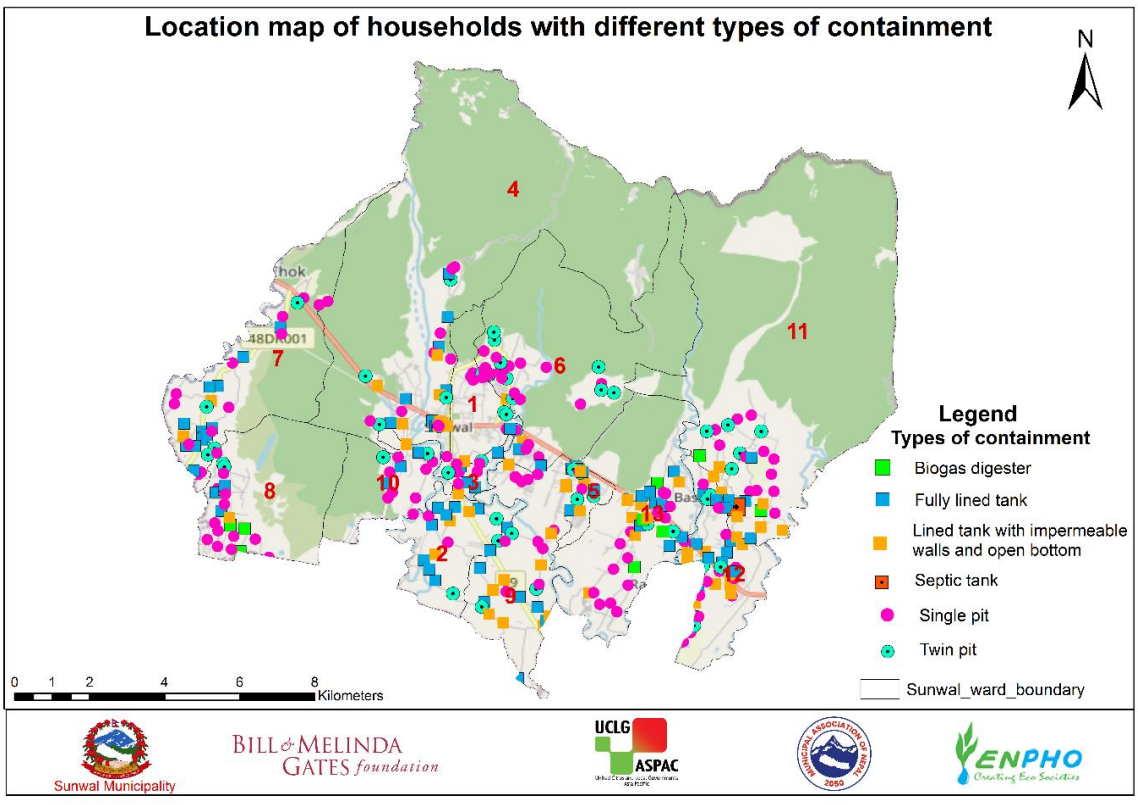

Figure 9: Location map of household with different types of containment.

2.1.2 Sanitation System in Institutional Buildings

Altogether 36 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	16
Government /Non-government Office	11
Health care centre	9
Grand Total	**36**

All the institutional buildings in the municipality have toilets with onsite sanitation systems. No containments met the criteria of standard septic tank but most buildings have holding tanks to safely store FS. About 64% of buildings have fully lined tanks, 14% have lined tanks with impermeable walls and open bottom and 22% have lined pits with semi-permeable walls and open bottom. Figure 10 shows the location map of institutional buildings with different types of containments in Sunwal Municipality.

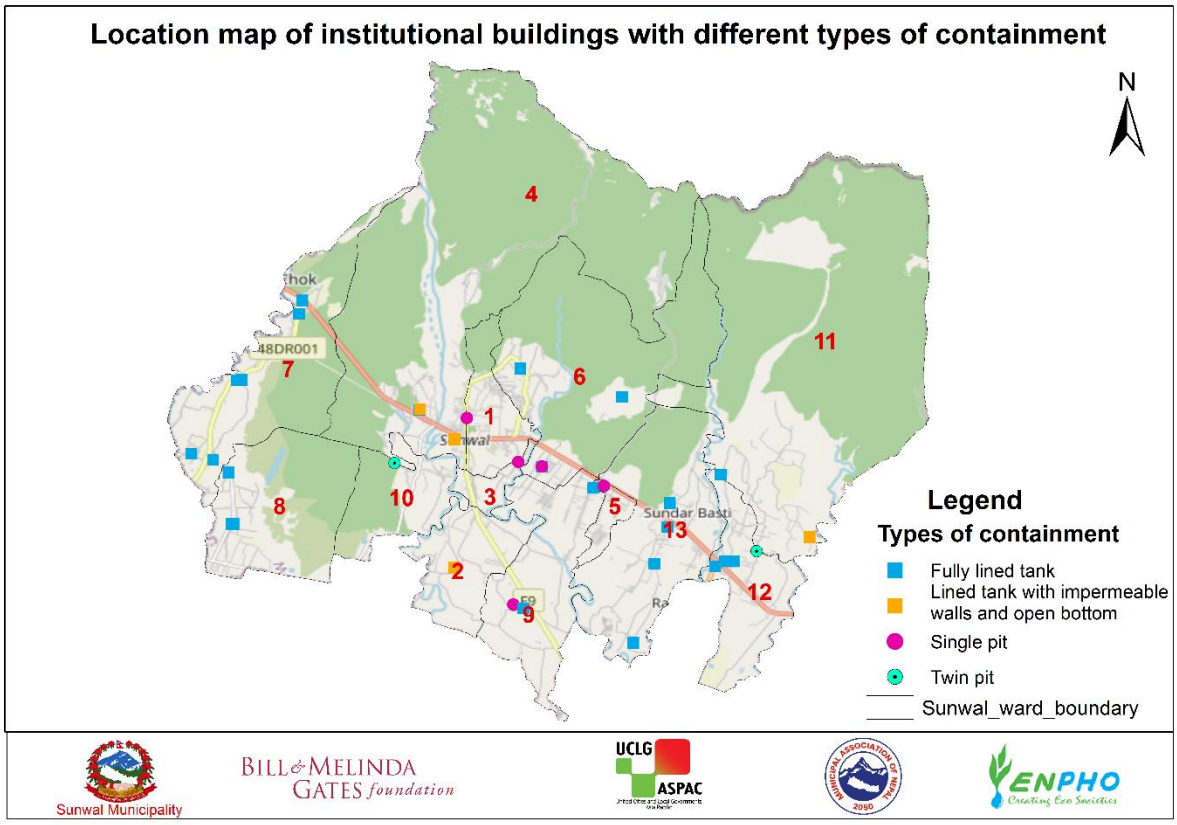

Figure 10: Location map of institutional buildings with different types of containment in Sunwal Municipality.

2.1.3 Public Toilets

Sunwal Municipality has two functional public toilets and one is not open for use. These public toilets were observed, and information were collected. The toilets are located at *Haat Bazar* (a local marketplace) and at *Chauraha* in ward 1, and at *Ban Kathi* in ward 5. The obtained information is fed in this report.

Public toilet at *Chauraha*

The toilet located at *Chauraha* in ward 1 was constructed by the municipality and is being managed by a caretaker. It has separate male and female compartments. It serves11 people at a time with 3 pans and 4 urinals in male compartment and 4 pans in female compartment. The outlet of the toilet is connected to the containment installed just outside the toilet. The public passing by the area is the service recipient of this toilet.

Water is supplied to the tap in toilet compartment. It is supplied from a 1000-litre tank placed over the roof of the toilet. The toilet compartments do have ventilation and are clean. Also, the toilet has a handwashing facility just outside the toilet with a handpump for a water supply. Figure 11 is the picture of public toilet at *Chauraha*.

Figure 11: Public toilet located at Chauraha, Ward-1.

Public toilet at *Haat Bazar*

The toilet located at *Haat Bazar* in ward 1 is constructed and managed by the Rural Water Supply and Sanitation Fund Development Committee under the Ministry of Water Supply. It was built in 2021. It has separate male and female compartments. It serves 10 people at a time with 3 pans in female compartment and, 2 pans and 5 urinals in male compartment. The outlet of the toilet is connected to the containment installed just outside the toilet. The customers of local marketplace are the service recipient of this toilet. It serves 200-300 users per day on the day of local market placement and no charges are taken from service recipients.

Water is supplied to the tap in toilet compartment. It is supplied from two 1000-litre tanks placed over the roof of the toilet. The toilet compartments do have ventilation and are clean. Also, the toilet has a handwashing facility inside the toilet building (KII-1, 2023). Figure 12 presents the structure and status of public toilet at *Haat Bazar* in ward 1.

Figure 12: Public toilet located at Haat Bazar, Ward-1.

Public toilet at *Ban Kathi*

The toilet located at *Ban Kathi* in ward 5 was constructed by the municipality in 2018. It is a properly built public toilet with separate compartments for male, female and physically challenged people. Each compartments have 2 pans while only male compartment has additional 3 urinals. The outlet of the toilet is connected to a biogas digester, to treat FS generated from the toilet. Despite the properly built structure of toilet and FS management system, the toilet has not been open for the use (KII-4, 2023).

Figure 13 present the structure and status of public toilet at *Ban Kathi* in ward 5.

Figure 13: Public toilet located at Ban Kathi, Ward-5.

2.1.4 Emptying and Transport

Emptying is one of the key elements of sanitation service chain. 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, about 49% of the households have emptied their containment whereas 51% have not emptied them. Similarly, about 33% of the institutional buildings have emptied their containments. Mostly emptied containment types are single pits and twin pits. The size of circular containments is smaller than rectangular containments (KII-2, 2023). The size of the containments also affects the emptying frequency. This is one of the reasons for the greater emptying ratio of single pits and twin pits than other containment types.

Both manual and mechanical emptying is practised in the municipality while mechanical emptying is more prevalent. Among the households that have emptied their containments, 84% of households have emptied mechanically while 16% have emptied manually. In contrast to it, institutional buildings that have emptied their containments have emptied mechanically only. Containments are emptied mechanically on on-demand basis.

The municipality has desludging service but does not have desludging vehicle. Here, the service is being provided by the commercially operating desludging services. Four desludging services has been registered in the municipality for this service (KII-1, 2023). Moreover,

unregistered private desludging service providers within and from outside the municipality also provide this service in the municipality (KII-2, 2023).

YP Sanitary Sewa was registered in FY 2075/76 in the municipality. It has been providing the desludging service since then. It is one among the other service providers that serves in the Sunwal Municipality. The service provider is equipped with a desludging vehicle with a tank capacity of 5,000 litres. For the service, it charges NRs.1,000 (USD 7.4) to NRs.3,500 (USD 26.1) per trip on average. Generally, it makes 5 trips per week. The service provider involves one driver and two helpers at a time of desludging (KII-2, 2023). Figure 14 shows the Key Informant Interview (KII) with the owner of private desludging service provider.

Figure 14: KII with the owner of private desludging service provider.

2.1.5 Treatment and Disposal/Reuse

Sunwal Municipality does not have a Faecal Sludge Treatment Plant (FSTP). Here, mechanically emptied FS is either disposed of in the forest or in farmlands (KII-2, 2023) while manually emptied FS is dug and dumped, composted, or applied to farmlands. All these practises are not considered as safely managed FS. Thus, in the municipality, the emptied FS is ultimately disposed of unsafely and untreated in an open space.

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

Sunwal Water Supply Users and Sanitation Organization (SWSUSO) is providing drinking water service in Sunwal Municipality. It was registered at District Water Resources Committee on April 8, 2003 and started distribution of water after 6 years on February, 2009. Water is supplied through a properly built water supply system. The system has two reservoir tanks,

each with a capacity of 4 lakh[1] litres. The tanks have a pipe connection to supply water. Over a distance of around 125 km, the water supply pipe is expanded and installed in six wards (wards nos. 1, 2, 3, 4, 6 and 10). Additionally, the water supply pipe has outlets for private tap connections (KII-3, 2023) (SWSUSO, 2023).

On April 13, 2004, the organization received an approval to use municipality's water resources for drinking water supply service. Currently, water is being extracted from three deep bores and one spring source, the Belari River. Water from deep bores is extracted from 134 m and 168 m which is stored in reservoir tanks. About 18.5 Million Litres per Day (MLD) water is extracted whereas, due to leakage, only 15.75 MLD water is distributed. Before distribution, water is purified through a slow sand filter at reservoir. The organization has connected 4,048 taps in households and provides drinking water supply service to 32,000 people. Still more than 50% of population in the municipality has no access to piped drinking water supply. The population relies on other sources of drinking water including groundwater source. In the municipality, about 47% of households rely on handpumps for drinking water supply (KII-3, 2023) (SWSUSO, 2023).

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 soil composition of Sunwal Municipality consists of alluvial and fluvial sediments i.e. sand, silt and clay along-with coarse gravels (Upreti, 1999) but has thicker composition of clay layer. Thus between 25 and 50 days, the pollutant could travel to the depth of approximately 18 metres (57.6 feet) in the soil type of Sunwal Municipality 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 60 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 15 shows a well log profile with soil composition.

[1] One lakh = 10^5

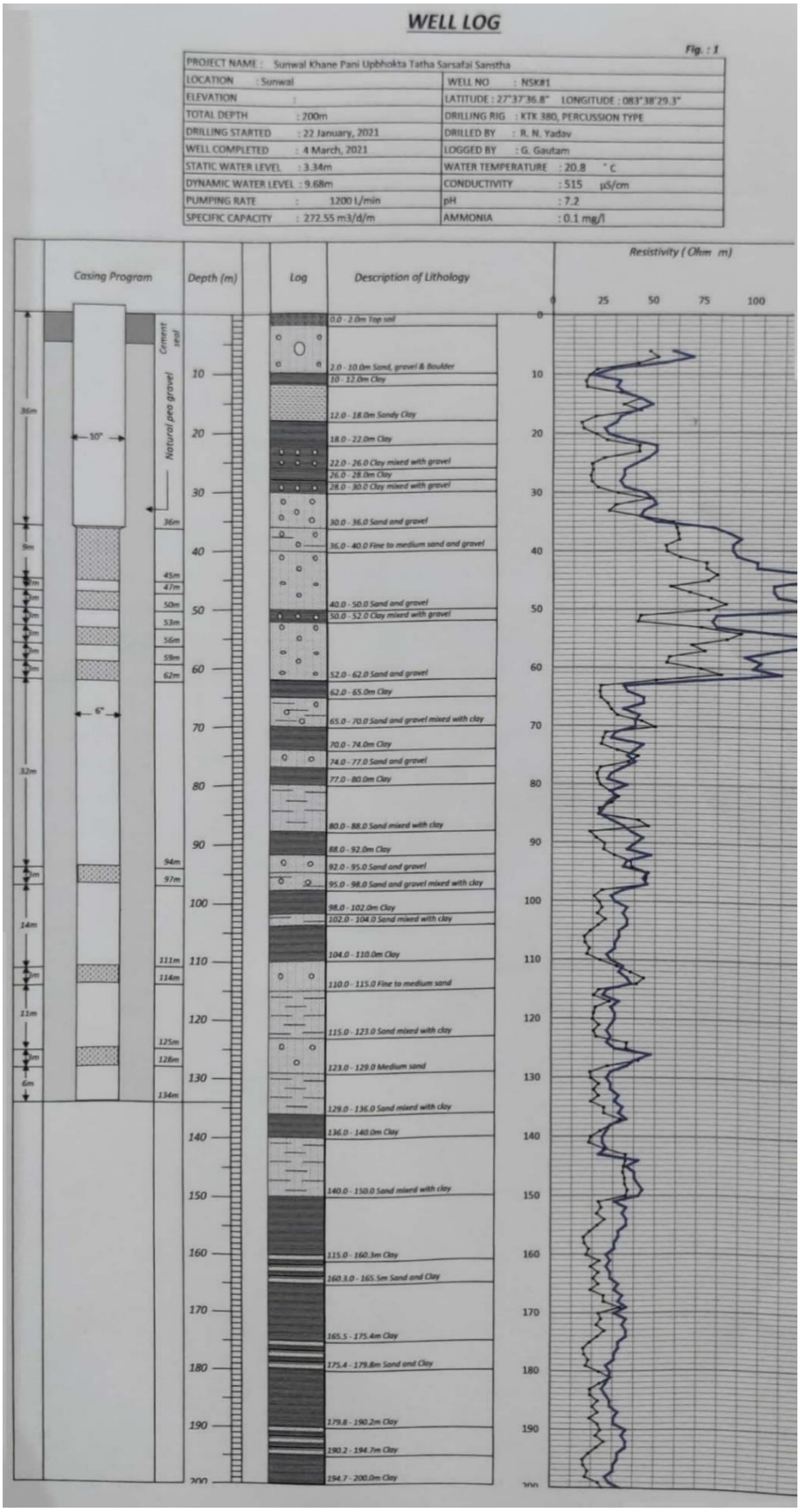

Figure 15: Well log profile with soil composition.

Figure 16 shows the depth of handpumps and horizontal distance of it from source of pollutant by lined tanks with impermeable walls and open bottoms. Almost 59% of the households (i.e.T2A4C10: 59% x 7% ≈ 4% of the overall population, where 7% 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.

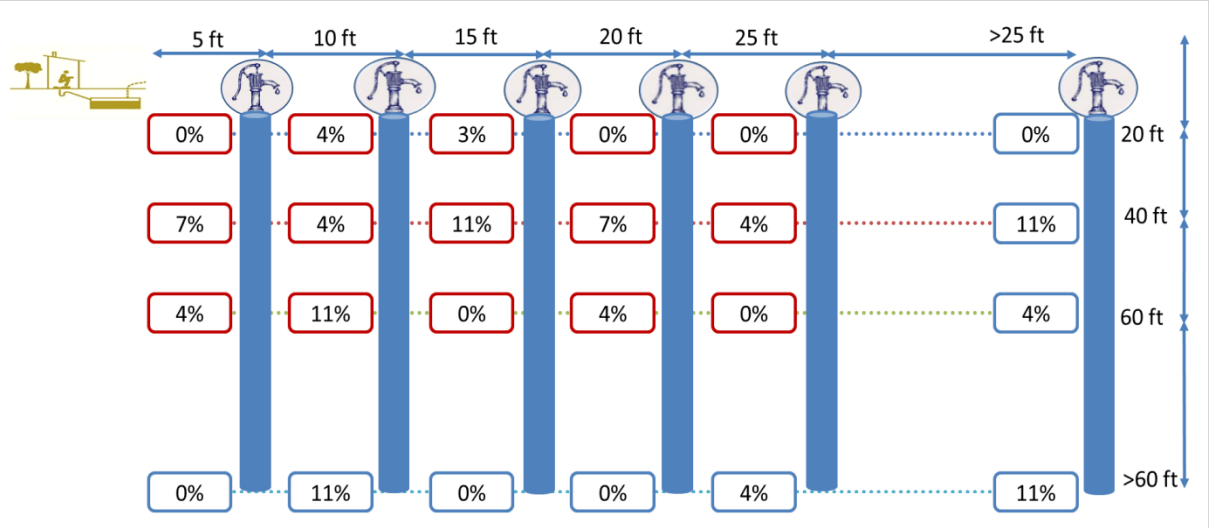

Figure 16: Depth of hand pumps and lateral spacing of it with containment type lined tank with impermeable walls and open bottom.

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 almost 57% of the households (i.e.T2A5C10: 57% x 27% ≈ 15% of the overall population, where 27% 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.

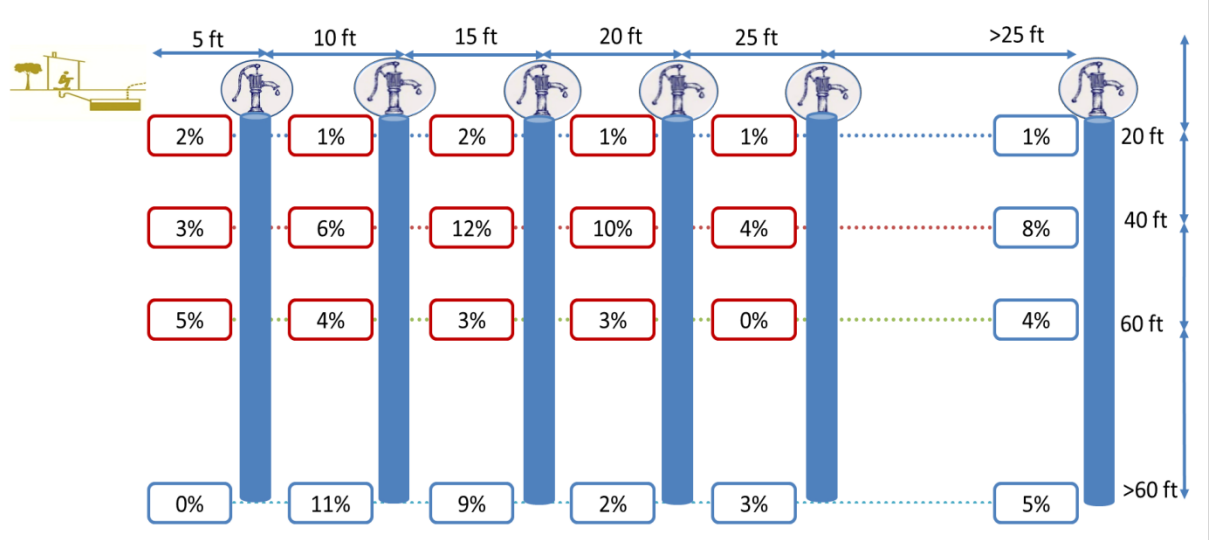

Figure 17: Depth of hand pumps and lateral spacing of it with containment type lined pit with semi-permeable walls and open bottom.

2.2 SFD Selection Grid

Figure 18 shows the types of sanitation technologies present in the Sunwal 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 pits and twin pits are selected as lined pit with semipermeable walls and open bottom in this selection grid.

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	T1A1C6				Not Applicable
Septic tank					Significant risk of GW pollution / Low risk of GW pollution	T1A2C6				
Fully lined tank (sealed)					Significant risk of GW pollution / Low risk of GW pollution			T1A3C8		T1A3C10
Lined tank with impermeable walls and open bottom	Significant risk of GW pollution / Low risk of GW pollution	Significant risk of GW pollution / Low risk of GW pollution	Significant risk of GW pollution / Low risk of GW pollution	Significant risk of GW pollution / Low risk of GW pollution	Significant risk of GW pollution / Low risk of GW pollution	T1A4C6		T1A4C8		T2A4C10 / T1A4C10
Lined pit with semi-permeable walls and open bottom	Not Applicable									T2A5C10 / T1A5C10
Unlined pit										Significant risk of GW pollution / Low risk of GW pollution
Pit (all types), never emptied but abandoned when full and covered with soil										Significant risk of GW pollution / Low risk of GW pollution
Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil										
Toilet failed, damaged, collapsed or flooded										
Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded										
No toilet. Open defecation	Not Applicable						T1B11 C7 TO C9			Not Applicable

Figure 18: SFD selection grid for Sunwal 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.
T1A2C6	A correctly designed, properly constructed, fully functioning septic tank with an outlet connected to an open drain or storm sewer. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, therefore 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.
T1A4C6	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 an open drain or storm sewer, the excreta in this system is considered NOT 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.
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.
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.
T2A5C10	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 but since there is a 'significant risk' of groundwater pollution this system is considered NOT 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.
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

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 50%, since the septic tanks are connected to open drain in the municipality. It implies that this type of containment is connected to an open or stormwater drain.

ii. The proportion of FS in fully lined tank is 100%, as the FS from fully lined tanks are not connected to open drains.

iii. The proportion of FS from lined tanks with open bottom and all types of pit is 99%, as the proportion of lined tanks with impermeable walls and open bottom connected to open drain is only 1%.

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 Sunwal Municipality.

Sunwal Municipality, Lumbini, Nepal, 14 Sep 2023. SFD Level: 2 - Intermediate SFD
Population: 72085
Proportion of tanks: septic tanks: 50%, fully lined tanks: 100%, lined, open bottom tanks: 99%

Containment								
System type	Population	WW transport	WW treatment	FS emptying	FS transport	FS treatment	SN transport	SN treatment
	Pop	W4c	W5c	F3	F4	F5	S4e	S5e
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	Proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants	Proportion of supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated
T1A1C6 Toilet discharges directly to open drain or storm sewer	1.0	0.0	0.0					
T1A2C6 Septic tank connected to open drain or storm sewer	1.0			0.0	0.0	0.0	0.0	0.0
T1A3C10 Fully lined tank (sealed), no outlet or overflow	25.0			31.0	25.0	95.0		
T1A3C8 Fully lined tank (sealed) connected to open ground	1.0			35.0	0.0	0.0		
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	11.0			8.0	0.0	0.0		
T1A4C6 Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	1.0			0.0	0.0	0.0	0.0	0.0
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	2.0			20.0	0.0	0.0		
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	38.0			51.0	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	4.0			10.0	0.0	0.0		
T2A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	15.0			57.0	0.0	0.0		

Figure 19: SFD Matrix of Sunwal 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 KII with desludging service providers. In an average, 20% of the FS in the containment which is very thick and does not dissolve in water is not removed during emptying (KII-2, 2023). Hence, actual proportion of FS emptied from each containment is calculated as:

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

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

Table 5: Sanitation technologies and proportion of emptied faecal sludge (ENPHO, 2023(1); 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%
Septic tank connected to open drain or storm sewer	T1A2C6	0%	0%	0%
Fully lined tank (sealed) connected to open ground	T1A3C8	44%	80%	35%
Fully lined tank (sealed), no outlet or overflow	T1A3C10	39%	80%	31%
Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	T1A4C6	0%	0%	0%
Lined tank with impermeable walls and open bottom, connected to open ground	T1A4C8	25%	80%	20%
Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	10%	80%	8%
Lined pit with semi-permeable walls and open bottom, no outlet or overflow	T1A5C10	64%	80%	51%
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	13%	80%	10%
Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A5C10	71%	80%	57%

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

The variable W4c is the proportion of wastewater 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 treatment plant, however 2% of FS is treated. The value for FS treated is obtained from the biogas digesters which is reclassified as fully lined tanks with no outlet or overflow (T1A3C10). The emptying proportion of FS for the system is 25% (F4 = 25%) and the capacity of fully functioning biogas digester is taken to 95% (F5 = 95%). Apart from this technology, the rest of the FS extracted from the remaining sanitation technologies is not treated. Also, the people using twin pits reclassified as lined pits with semi-permeable walls and open bottoms are not using them properly. Hence, the portion of FS delivered to treatment plant for the remaining technologies (F4) and treated (F5) is 0%.

2.3.5 Proportion of Supernatant in Open Drain or storm sewer delivered to treatment (S4e and S5e)

The variable S4e is the proportion of supernatant disposed of in an open drain or storm sewer that is delivered to treatment plant and S5e is the proportion of supernatant that is delivered to treatment plant that is treated. The actual proportion of supernatant from the containment to open drain and stormwater drain is not able to observe. Thus, the proportion is estimated at 50% of the faecal sludge in the containment connected to open drain and storm sewer. While the proportion delivered to treatment plant (S4e) and treated (S5e) is 0% as there is no treatment facility.

2.4 SFD Graphic

Figure 20 shows the SFD graphic of Sunwal 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 48% of the population are safely managed and excreta from 52% of the population are unsafely managed. It also represents the sanitation value chain going from left to right.

Offsite Sanitation

Sunwal municipality does not have sewer network, however, 1% of households have offsite sanitation systems. The wastewater generated from these households is disposed of untreated to open drain or storm sewer. 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, 74% of the population uses containment where FS is contained and 23% of the population uses containment where FS is not contained.

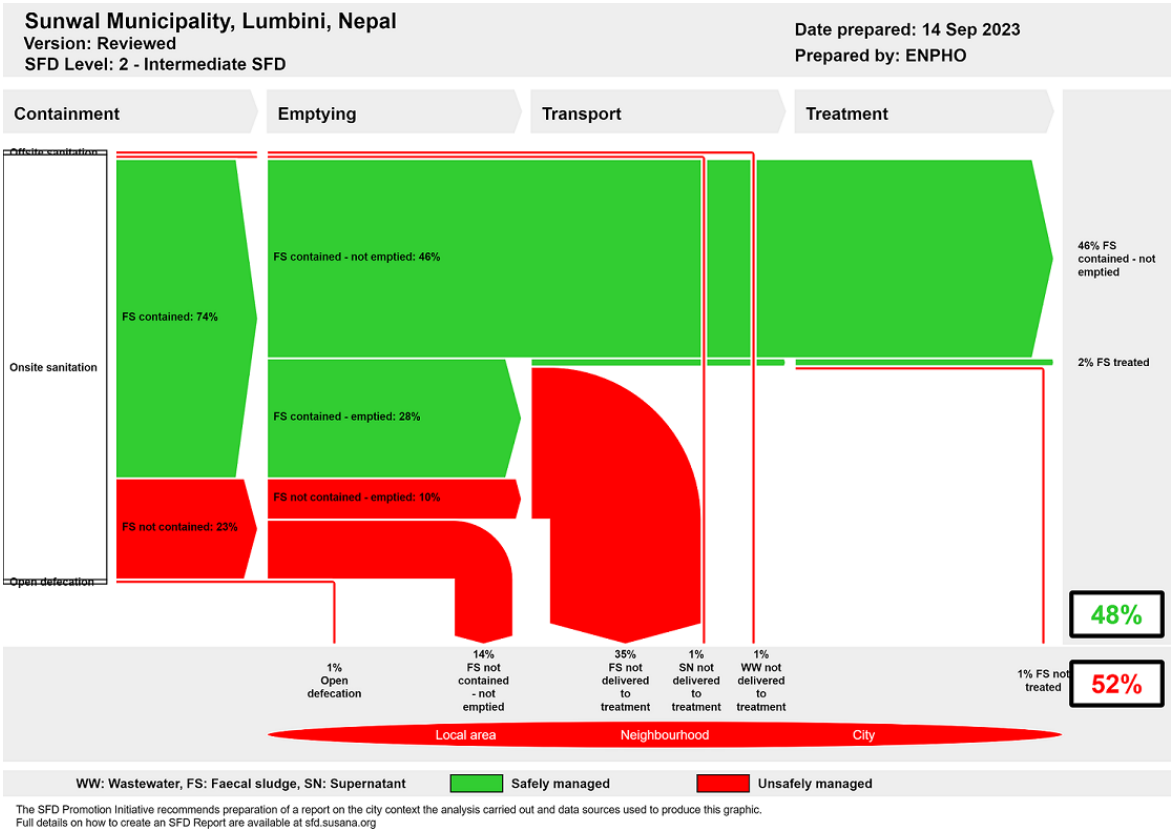

Figure 20: SFD Graphic of Sunwal Municipality.

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. 74% 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 with no outlet or overflow (T1A4C10) and lined pits with semi-permeable walls and open bottom with no outlet or overflow (T1A5C10) 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. 23% is obtained from the summation of population using septic tanks connected to open drain or storm sewer (T1A2C6), fully lined tanks connected to an open ground (T1A3C8), lined tanks with impermeable walls and open bottom connected to an open drain or storm sewer and to open ground (T1A4C6 and T1A4C8), lined tanks with

impermeable walls and open bottom with no outlet or overflow with 'significant risk' to groundwater (T2A4C10) and lined pits with semi-permeable walls and open bottom with no outlet or overflow with 'significant risk' to groundwater (T2A5C10).

FS contained - not Emptied

The value of 46% is obtained from the proportion of the population using sanitation systems where the FS is contained and have not emptied their containment. However, this 46% 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 contained - Emptied

The value of 28% is obtained from the proportion of population using sanitation systems where the FS is contained and have emptied their containment.

FS not contained - Emptied

The value of 10% is obtained from the proportion of the population using sanitation systems where the FS is not contained and have emptied their containment.

FS not contained - not Emptied

The value of 14% is obtained from the proportion of the population using sanitation systems where the FS is not contained and have not emptied their containment.

FS not delivered to treatment

The proportion of FS not delivered to treatment, i.e. 35%, is the summation of FS contained emptied and FS not contained emptied. Since Sunwal Municipality does not have FSTP, emptied FS is disposed of untreated to farmlands and forest. Therefore, this proportion of disposed FS possesses risk to local area and neighbourhood.

Supernatant (SN) not delivered to treatment

The proportion of supernatant is obtained from containments connected to open drain or stormwater sewer calculated as 50% of FS contained in each containment. The total proportion of supernatant (SN) is 1% of FS generated by the total population. Since the municipality lacks the sewer network and treatment plant, the supernatant is disposed of directly into water bodies. Hence the proportion of SN not delivered to treatment is 1%.

Open Defecation

Despite Open Defecation Free (ODF) status, people residing in 1% of households still go for open defecation. Mostly, people living in poverty and who do not own land, do not have toilets and despite having toilets, lack in behaviour change have led to open defecation in the municipality.

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.

3.2 Policies

Historically, the National Sanitation Policy (1994) was the guideline for the planning and implementation of sanitation programs. The policy had promoted sanitation issues together with issues on water supply in rural communities. Also, Rural Water Supply and Sanitation National Policy (RWSSNP) 2004, has set a new target to provide safe, reliable, and affordable water supply with basic sanitation facilities. The policy focused on delivering quality services on water and sanitation to the marginalized and vulnerable groups. However, it was unable to address the complex operational issue of urban water supply and sanitation service delivery. 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.

3.3 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.

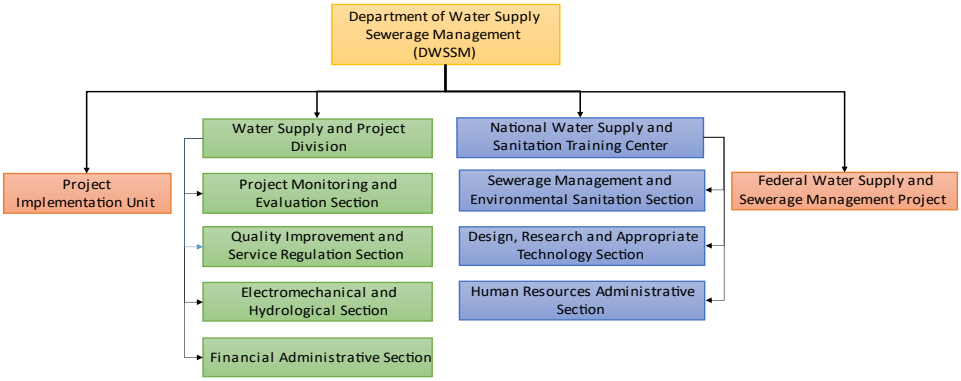

Figure 21: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).

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 Supply, Rural and Urban Development: Ministry of Water Supply, Rural and Urban Development of provincial government in Lumbini 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 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 Level

Sunwal Municipality does not have a defined section for WASH related activities. However, activities related to the environment and WASH are managed and implemented under administrative section. Vehicle registration for private desludging is also managed under this section.

3.4 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.

3.5 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. WASH focal person at the municipality was interviewed on current sanitation services with respect to technical, institutional, and financial aspects. Also, the KII was performed with the owner of private desludging service provider to understand the emptying practice, disposal and treatment of FS as well as finance requirement. Also, an interview was performed with 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.	Man Bahadur Thapa (KII-1)	Ward chairperson, Ward-1	Sunwal Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	16 May, 2023
2.	Chakra Pani Bhandari (KII-1)	Section Officer	Administration	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	16 May, 2023
3.	Yagya Paudel (KII-2)	Owner	YP Sanitary Sewa	Emptying practices, finances, requirement, disposal and treatment	16 May, 2023
4.	Shovakant Sharma (KII-3)	Manager	Sunwal Water Supply Users and Sanitation Organization	Water Supply and quality of water in Sunwal Municipality	16 May, 2023
5.	Laxmi Chapagain (KII-4)	Caretaker	Public toilet-Ban Kathi	Quantitative and management data on public toilet and public toilet operation	16 May, 2023

Figure 22: KII with manager of Sunwal Water Supply Users and Sanitation Organization.

4.2 Household Survey

A random household survey was conducted in all wards of the municipality. The municipality selected local enumerators who were oriented prior to the survey and were mobilized for data collection. A mobile application “KOBOCOLLECT” was used for the household survey. 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 Sunwal 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 376 households were sampled from 17,418 households distributed in thirteen wards with proportionate stratification random sampling. The household samples surveyed in the municipality is shown in Figure 24.

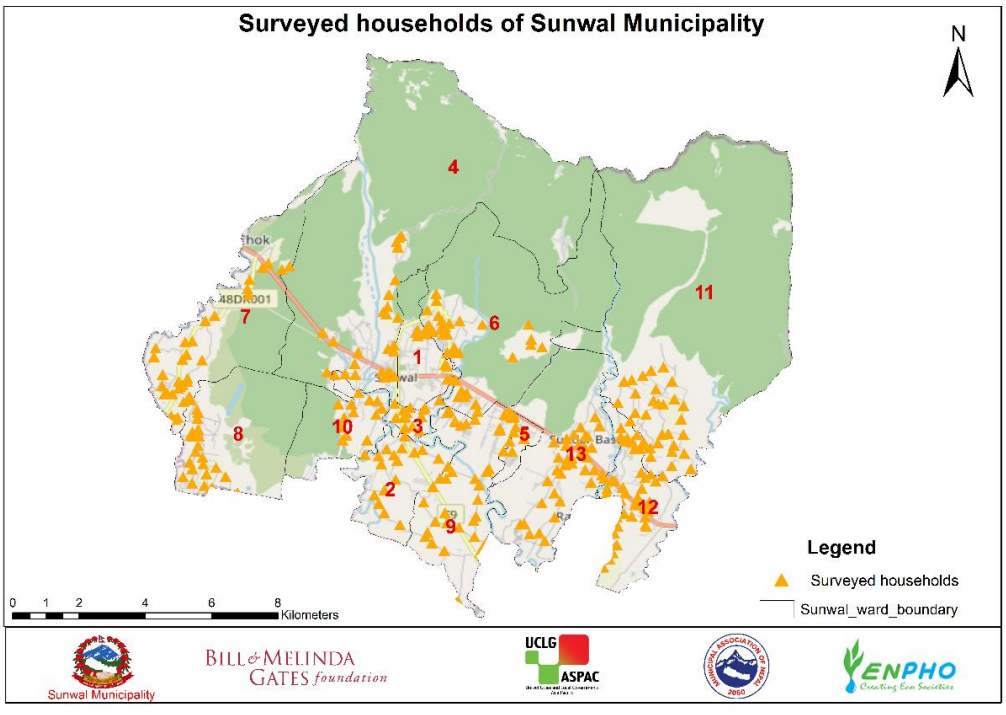

Figure 24: Location map of surveyed households.

4.3 Direct Observation

Various sanitation technologies in the households in all the wards were observed and visual references were kept. Also, observation of the toilet, water source, containments and transportation of faecal sludge were carried out. Figure 25 shows the picture of observation and monitoring of household survey at Sunwal Municipality.

Figure 25: Field observation and monitoring of household survey at Sunwal Municipality.

4.4 Sharing and Validation of Data

The Shit Flow Diagram Sharing and Validation Workshop was conducted at Sunwal Municipality Hall to share the findings on sanitation situation survey and receive the suggestions from the municipal stakeholders. Altogether, 36 participants including mayor, ward chairpersons, municipal council members, sectoral staffs and other relevant stakeholders actively participated on the workshop and provided valuable suggestions. The participants expressed their interest on FSM at policy level and infrastructure development. 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 sub-metropolitan city.

We offer sincere acknowledgement to Ms. Bimala Aryal, Mayor, Mr. Bhaktiram Marasini, Chief Administrative Officer, Mr. Chakra Pani Bhandari and Mr. Bishal Neupane, WASH Focal Persons 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 to appreciate Dr. Roshan Raj Shrestha, Deputy Director of Bill and Melinda Gates Foundation (BMGF), Dr. Bernadia Irawati Tjandradewi, Secretary General and Mr. Satish Jung Shah, Knowledge Management Officer, UCLG ASPAC. Similarly, we are very much obliged to Mr. Ashok Kumar Byanju Shrestha, Former President. Mr. Bhim Prasad Dhungana, President, Mr. Kalanidhi Devkota, Executive Director and Mr. Muskan Shrestha, Sanitation Advocacy Specialist from MuAN for their 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.

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6 References

AEPC, 2018. *Biogas technology.* [Online]
Available at: https://www.aepc.gov.np/biogas-technology

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/western-development-region/sunwal-422367/
[Accessed 23 August 2023].

ENPHO, 2023. *Sanitation Situation Assessment of Sunwal 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 Status of Sunwal Municipaity.* Sunwal: s.n.

KII-2, 2023. *FS Emptying, Disposal and Treatment Practice in Sunwal Municipality.* Sunwal: s.n.

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

KII-4, 2023. *Quantitative and management data on public toilet and public toilet operation.* Sunwal: 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.

Saxena, S. & Den, W., 2022. In situ treatment technologies for pit latrines to mitigate groundwater contamination by fecal pathogens: a review of recent technical advances. *Journal of Water, Sanitation and Hygiene for Development,* 12(1), pp. 102-115.

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

Sunwal Municipality, 2023. *Sunwal Municipality.* [Online]
Available at: https://sunwalmun.gov.np/en
[Accessed 22 August 2023].

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

SWSUSO, 2023. *10th Annual General Meeting Report,* Sunwal: Sunwal Water Supply Users and Sanitation Organization.

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

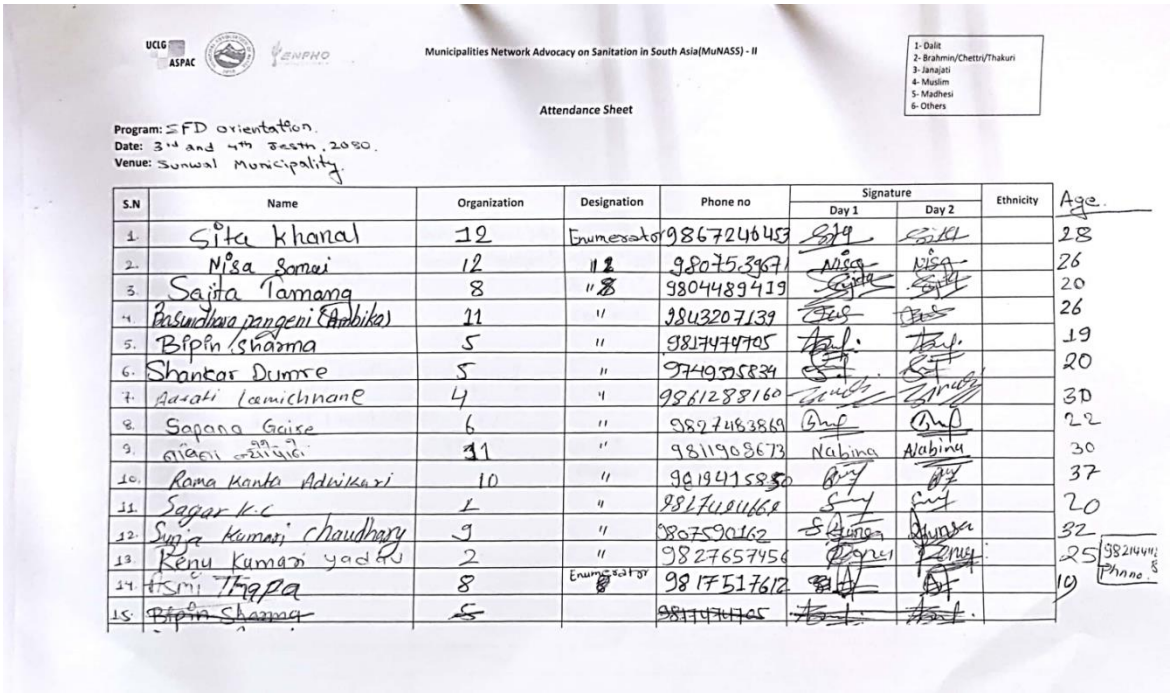
7.1 Appendix 1: Roles and Responsibility of Various Tiers of Governments Delineated in Drafted SDP 2016 – 2030

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.	Population	Households	Number of Surveyed Households
1	6,799	1,742	38
2	3,990	927	20
3	5,157	1,273	27
4	7,760	1,853	40
5	3,924	951	21
6	4,137	1,023	22
7	6,215	1,476	32
8	4,624	1,124	24
9	4,686	997	22
10	3,032	746	16
11	6,700	1,627	35
12	8,194	2,024	43
13	6,867	1,655	36
	72,085	**17,418**	**376**

7.3 Appendix 3: List of Participants on SFD Survey Orientation



UCLG ASPAC | ENPHO

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

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

Attendance Sheet

Program: SFD orientation.
Date: 3rd and 4th Jesth, 2080.
Venue: Sunwal Municipality.

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Ethnicity	Age
1.	Sita Khanal	12	Enumerator	9867246453				28
2.	Nisa Sonai	12	11	98075.39671				26
3.	Sajita Tamang	8	11	9804489419				20
4.	Basundhara pangeni (Ambika)	11	11	9843207139				26
5.	Bipin Sharma	5	11	9817474705				19
6.	Shankar Dumre	5	11	9749355834				20
7.	Aarati Lamichhane	4	11	9861288160				30
8.	Sapana Gaire	6	11	9827483869				22
9.	[illegible]	11	11	9811908673	Nabina	Nabina		30
10.	Rama Kanta Adhikari	10	11	9819415850				37
11.	Sagar K.C	1	11	9817481468				20
12.	Sujita Kumari Chaudhary	9	11	9807590162				32
13.	Renu Kumari yadav	2	11	9827657456				25
14.	Hemi Thapa	8	Enumerator	9817517612				19
15.	~~Bipin Sharma~~	~~5~~		~~9817474705~~				

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

आज मिति २०८०।५।२६ गतेका दिन नेपाल नगरपालिका संघको आयोजनामा वातावरण र जनस्वास्थ्य संस्था (एन्फो)को प्राविधिक सहयोग तथा The United Cities and Local Government Asia Pacific (UCLG-ASPAC) को सहकार्यमा Municipalities Network on Advocacy on Sanitation in South Asia (MuNASS II) कार्यक्रम अन्तर्गत सुनवल नगरपालिकामा संचालन गरिएको Shit Flow Diagram (SFD) सम्बन्धी अन्तरक्रिया र प्रमाणीकरण गोष्ठी र दिसाजन्य लेदो व्यवस्थापन सम्बन्धी अन्तरक्रियामा निम्न अनुसार मुख्य सरोकारवालाहरुको सहभागीता रह्यो।

उपस्थिति

क्र.सं.	नाम	पद	फोन नं.	हस्ताक्षर
१.	बिमला अर्याल	नगर प्रमुख	९८५७०४८१०२	[illegible]
२.	सुर्य प्रसाद दुबे	नगर उप-प्रमुख	९८५७०४८१०३	[illegible]
३.	भक्तिराम मरासिनी	प्रमुख प्रशासकिय अधिकृत	९८५७६३८१११	[illegible]
४	कृष्ण प्रसाद [illegible]	नगर प्रवक्ता	९८४६२८७४६७	[illegible]
५	चुडामणि पाडल	अध्यक्ष -१२	९८५६०४५५०६	[illegible]
६	विनोद लाम्ता खाती	का.पा.स.	९८५६०८६५६१	[illegible]
७	जानिमाया पुन	का० पा० स०	९८०५१७४८६२	[illegible]
८	सीता भण्डारी	का० पा० सदस्य	9847287223	[illegible]
९	माया कुमाल	,, ,,		[illegible]
१०	दिल बहादुर थापा	वडा -१० वडाध्यक्ष	९८६६०४४६४५	[illegible]
११	[illegible]	उपभोक्ता हित संरक्षण मञ्च अध्यक्ष	९८५६०४५५३५	[illegible]
१२	बिरबल चौधरी	वडा-नं-९	९८६६१२८०६८	[illegible]
१३	कमल प्रसाद उपाध्याय	वडा अध्यक्ष - ११	९८५६०४६८३६	[illegible]
१४	बाल कृष्ण पंजेनी	वडा अध्यक्ष - ४	९८४४६०६००५	[illegible]
१५	ऋषि कला थापा	कार्यपालिका स.	9848250705	[illegible]
१६	चक्रपाणि भण्डारी	अधिकृत छैठौं	9857053205	[illegible]
१७	विशाल च्यौपाने	वन प्राविधिक	9841775448	[illegible]
१८	राजेन्द्र प्रसाद कोइराला	सि.प.अ.	9857045277	[illegible]
१९	मिश्री प्रसाद खड्का	अधिकृत स्तर छैठौं	9851244533	[illegible]

क्र.सं.	नाम	पद	फोन नं.	हस्ताक्षर
२०	मोहनराज ज्ञवाली	अधिकृत आठौं	९८५६०४५६५५४	[illegible]
२१	विष्णु प्रसाद गौताने	उप-सचिव	९८५८०४५१६३०	[illegible]
२२	अमृनाथ शुक्ल	स. पाचौं	९८६२०६६३५	[illegible]
२३	पुरुषोत्तम ढकाल	अधिकृत छैठौं	9847020565	[illegible]
२४	तोत्रलाल शर्मा (तिवारी)	गा.पा.-५ वडाअध्यक्ष	9867252310	[illegible]
२५	कल्पना घिमिरे	तो. अ.	9867002125	[illegible]
२६	राधा गौतम	अधिकृत छैठौं	9847065498	[illegible]
२७	हिमलाल शर्मा	वडा अध्यक्ष सु.६	९८४७६३४६०६९	[illegible]
२८	सिता तिमिल्सिना	कार्यपालिका सदस्य	९८४८२२३६८९	[illegible]
२९	सन्तोष कडेल	कृषि विकास अधिकृत	९८४६२४१२६२	[illegible]
३०	शंकर पन्थी	रोजगार संयोजक	९८४६०६११४६	[illegible]
३१	पुरामणि नेपाल	सिनियर (अ.स.ई.) अधिकृत	९८४६०४५५५९	[illegible]
३२	गणेश प्र. चापागाईं	अधिकृत		[illegible]
३३	कृष्णप्रसाद ओली	अ. सि. अ.	९८४६०३८३४१	[illegible]
३४	राम बहादुर थापा	वडा न. १ अ.	९८४०२८४८३५	[illegible]
३५	सारदा लामा	का. स.	९८२४५४३२०३९	[illegible]
३६	पवित्रा चौधरी	का. स.	९८२११९६००१	पवित्रा
३७	नविना चौधरी	का. अ.	९८०६५०६६०४	नविना
३८	अनिता थुजू	ENPHO	९८४१३५५८१५०	[illegible]
३९	सबुना गमाल	ENPHO	९८४३४१२२३६	[illegible]

SFD Sunwal Municipality, Nepal, 2023

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