SFD Report

Dipayal Silgadhi Municipality
Nepal

Final Report

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

Date of production: 30/06/2022

Last update: 19/12/2022

SFD Report Dipayal Silgadhi Municipality, Nepal, 2022

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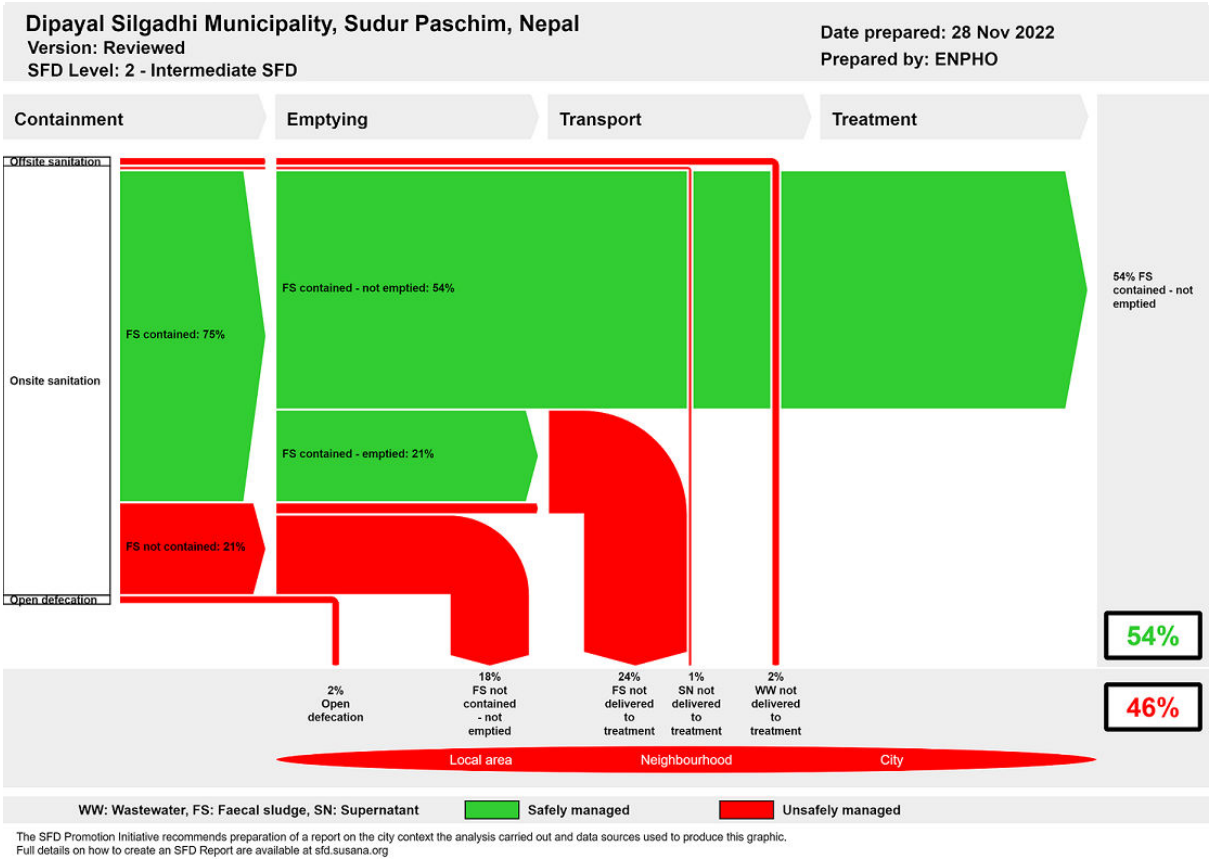
1. The SFD Graphic



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 a level 2 - Intermediate report.

Produced by:

Environment and Public Health Organization (ENPHO).

Collaborating partners:

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

Status:

Final SFD Report.

Date of production:

30/06/2022

3. General city information

Dipayal Silgadhi municipality is the district headquarters of Doti District in Sudurpashchim Province of Nepal. The former district headquarters of Far Western Development Region, Dipayal Silgadhi lies in the lesser Himalayas on the bank of Seti River at 29°16′N 80°56′E. The municipality comprises nine wards, the smallest local government unit. (Municipality, 2018).

The total population of the municipality is 32,941, with male and female population percentage of 49.24% and 50.26%, respectively. The family size of the municipality is 4.99 (MoFAGA, 2017).

The range of temperature varies from the excessive heat that reaches up to 42ºC during summer near Dipayal area to cold climate that reaches up to -20 ºC near Khaptad area. Both sub-tropical and moderate climates can be experienced in the region, resulting from the municipality's land structure varying from plain terai, bank of rivers to high hills. The month with the highest relative humidity is July (89.44%). The month with the lowest relative

humidity is April (47.58%). The month with the highest number of rainy days is July (28.93 days). The month with the lowest number of rainy days is December (2.77 days).

4. Service outcomes

The overview of different sanitation technologies across the sanitation value chain in the municipality is briefly explained in this section. Basic sanitation coverage in the municipality is only 98.07%. The families without their own toilets defecate in open places or use a neighbour's toilet.

Although there is a lack of sewerage network and a Wastewater Treatment Plant (WWTP), 2.0% of the population have a connection of their toilet to an open drain and water bodies near their houses without any treatment which indicates unsafe sanitation practice.

36% of Households (HHs) have a toilet connected to a lined tank with impermeable walls and open bottom whereas 5.5% have constructed a toilet connected to a fully lined tank. HHs with a toilet have constructed a circular containment, specifically, 1% have constructed unlined pits, 47% have constructed single pits and 0.9% have constructed twin pits.

There are nine public toilets in the municipality where floating population and service seekers are high. These toilets are in the bus park areas, highway road, *tudikhel* (open ground space), local market area, near temples and other populated areas.

Only 25% of containments have been emptied at least once since the installation. Both traditional manual scavenging and mechanical emptying of the containments are practised in the municipality. Among the containments that have been emptied at least once, only 6.2% were mechanically emptied by private desludging service providers. The mechanical emptying facility is provided by private desludgers of Dhangadhi sub-metropolitan city who travel to Dipayal Silgadhi municipality once or twice every year to provide the service.

Dipayal Silgadhi does not have a treatment plant for wastewater or faecal sludge. Lack of treatment plant in the municipality has led 83% of FS emptied to be applied unsafely in the farmlands and a few percentage of FS emptied to be dumped into forest areas and nearby water bodies.

5. Service delivery context

The Constitution of Nepal 2015 in Article 35 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 recognizes that every person shall have the right to live in a healthy and clean environment (GoN, 2015). To respect, promote and fulfil the provisions related to right on water and sanitation, Government of Nepal has billed Drinking Water and Sanitation Act, 2019 through Ministry of Water Supply. The act elaborates right to clean water as to receive affordable, sufficient, and quality drinking water regularly as well as access to sanitation as affordable access to quality sanitation services (MoWS, 2017).

Several policies have been in place to accomplish the sanitation need of people. Particularly, the National Sanitation and Hygiene Master Plan (NSHMP) 2011 has proved as an important strategic document for all stakeholders to develop uniform programs and implementation mechanism at all levels. It strengthens institutional set up with the formation of water and sanitation coordination committee at every tier of government to actively engage into sanitation campaign. The document adopted sanitation facilities as improved, basic, and limited in line with WHO/UNICEF guideline. The sanitation campaign throughout the country focused to achieve universal access to improved sanitation (NPC, 2020).

The draft Sector Development Plan (SDP) has envisioned the delineation of roles and responsibility of federal, provincial, and local government in an aim to initiate sustainability of Open Defecation Free (ODF) outcomes.

It is the duty and responsibility of the Dipayal Silgadhi municipality to improve access to accessible, safe and sustainable drinking water and sanitation services to the people of the municipal area as mentioned in chapter 3 of the Local Government Operation Act 2074 under the title of municipal work, duties and rights; the policy, laws, standards, plan implementation and regulation related to local water supply mentioned in sub-section D of section 11. In order to implement this responsibility, water supply, sanitation and hygiene plan and policy has become essential. Development without planning and estimation will not lead to the expected success in the areas of access to water and sanitation (UNICEF, 2020).

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 Local Government	Dipayal Silgadhi Municipality.
Non-governmental Organizations	Environment and Public Health Organization (ENPHO).
Private Sector	Private FS Emptying and Desludging facility providers, public toilet operators.
Development Partners, Donors	MuAN, BMGF, UCLG ASPAC.

7. Credibility of data

Primary data were collected from random household sampling. Altogether, 364 households and 49 institutions were surveyed from nine wards of the municipality. Primary data on emptying, transportation and current sanitation practices in the municipality were validated from Key Informant Interviews (KIIs) with private desludgers, public toilet management, sanitation, and environmental section. The overall data and findings were shared with the stakeholders of the municipality and validated through sharing program.

8. Process of SFD development

Data on sanitation situation is collected through household and institutional survey. Enumerators from the municipality were mobilized after providing orientation on sanitation technologies, objectives of the survey and proper use of mobile application, KOBOCOLLECT for collection of data for the survey. Along with this, KIIs were conducted with officers of municipality, private desludging service providers and engineer of International non-governmental organizations (INGO) to understand the situation practices across the service chain. Data were entered in the SFD graphic generator to produce the SFD graphic.

8. List of data sources

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

- GoN. (2015, September 30). Constitution of Nepal: Goverment of Nepal. Retrieved from https://lawcommission.gov.np/en/wp-content/uploads/2021/01/Constitution-of-Nepal.pdf
- MoFAGA. (2017). Ministry of Federal Affairs & General Administration. Retrieved from Government of Nepal, Ministry of Federal Affairs & General Administration: https://www.sthaniya.gov.np/gis/
- MoWS. (2017). Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (2016-2030). Ministry of Water Supply.
- Municipality, D. S. (2018). Policy, program, budget and municipality development plan of FIscal Year 2078/2079. Dipayal Silgadhi: Dipayal Silgadhi Municipality Office.
- NPC. (2020). National Review of Sustainable Development Goal. Kathmandu Nepal: National Planning Commission.
- UNICEF. (2020). Water, Sanitation and Hygiene (WASH) Plan of Dipayal Silghadi Municipality (2020-2030). Dipayal Silgadhi: UNICEF.

SFD Dipayal Silgadhi Municipality, Nepal, 2022

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Abbreviations

BMGF	Bill and Melinda Gates Foundation
CAO	Chief Administrative Officer
DUDBC	Department of Urban Development and Building Construction
DWSSM	Department of Water Supply and Sewerage Management
ENPHO	Environment and Public Health Organization
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSTP	Faecal Sludge Treatment Plant
GDP	Gross Domestic Product
GON	Government of Nepal
HH	Household
IRF	Institutional and Regulatory Framework
JMP	Joint Monitoring Programme
KII	Key Informant Interview
KM	Kilometre
MDG	Millennium Development Goal
MICS	Multiple Indicator Cluster Survey
MoUD	Ministry of Urban Development
MTEF	Medium-Term Expenditure Framework
MuNASS-II	Municipalities Advocacy on Sanitation in South Asia – II
NGO	Non-Governmental Organization
NRS	Nepali Rupees
NWSC	Nepal Water Supply Corporation
NSHMP	Nepal Sanitation and Hygiene Master Plan
NUWSSSP	National Urban Water Supply and Sanitation Sector Policy
NWSSP	National Water Supply and Sanitation Policy
ODF	Open Defecation Free
RWSSNP	Rural Water Supply and Sanitation National Policy
SDG	Sustainable Development Goal
SDP	Sector Development Plan
SFD	Shit Flow Diagram
SFD PI	Shit Flow Diagram Promotion Initiative
SMC	Sub-metropolitan City
UCLG ASPAC	United Cities and Local Governments Asia Pacific
UNICEF	United Nations Children's Education Fund
UCLG ASPAC	United Cities Local Government – Asia Pacific
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WSP	Water Service Providers
WSSDO	Water Supply and Sanitation Divisional Office
WSUC	Water and Sanitation Supply and User's Committee
WW	Wastewater

1. City context

Dipayal Silgadhi is the district headquarters of Doti District in Sudurpaschim Province of Nepal. The former district headquarters of Far-western Development Region. It lies at 29°16′N 80°56′E in the lesser Himalayas on the bank of Seti River. The municipality is comprised of nine wards, the smallest unit of local government. The municipality was restructured during 2017 A.D. through merging Ladada Village Development Committee (VDC) and Kalena VDC, ward no. 4, 5, 6 of Khatiwada VDC, ward no. 8 and 9 of Waglek VDC (Municipality, 2018). Figure 1 shows the ward boundary map of Dipayal Silgadhi municipality.

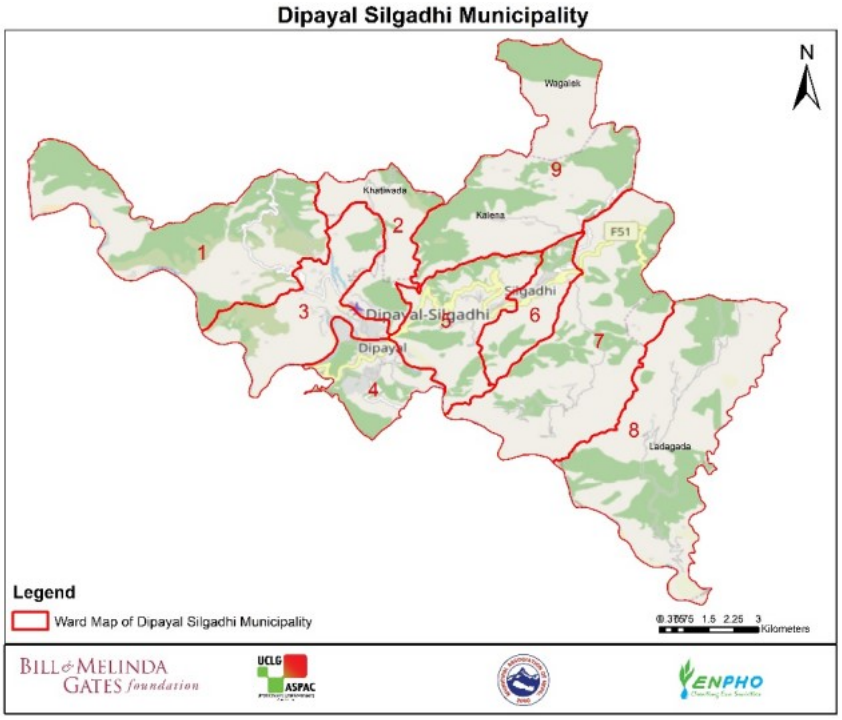

Figure 1: Map of Dipayal Silgadhi Municipality with ward boundaries.

1.1 Population

The total population of the municipality is 32,941, with male and female population percentage of 49.24% and 50.26%, respectively. The family size of the municipality is 4.99 (MOFAGA, 2017), Ward-wise population distribution in the municipality is shown in Table 1 (MOFAGA, 2017).

Table 1: Ward wise population of Dipayal Silgadhi Municipality.

Ward number	Total	No. of families
1	3,974	796
2	3,468	695
3	3,324	666
4	4,406	883
5	3,657	733
6	3,499	701
7	3,197	641
8	3,859	773
9	3,557	713
Total	**32,941**	**6,601**

Figure 2 shows the population density in different wards of Dipayal Silgadhi municipality where it can be observed that wards number 2, 4 and 6 have high population density and ward number 7, 8 and 9 have very low population density.

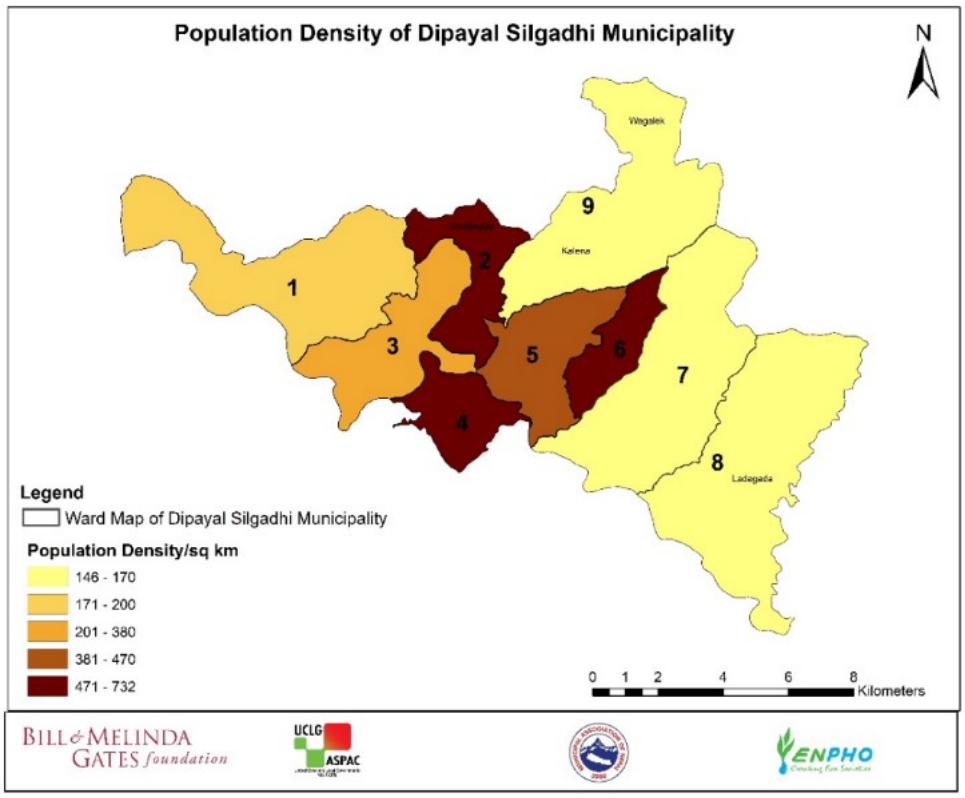

Figure 2: Population Density Map of Dipayal Silgadhi Municipality.

1.2 Climate

The month with the highest relative humidity is July (89.44%). The month with the lowest relative humidity is April (47.58%). The month with the highest number of rainy days is July (28.93 days). The month with the lowest number of rainy days is December (2.77 days). The annual rainfall is 2,611 mm (Climate Data, n.d.). Areas located near the Seti River, such as Dipayal, Rajpur Naridang, Ghataligau and Sikholisain have sub-tropical climate with excessive heat during the summer season whereas areas near Silgadhi have comparatively moderate climate. The municipality reaches its highest temperature up to 44 degrees Celsius in summer in Dipayal and the lowest temperature up to -20 degrees Celsius in winter near the Khaptad area, which is a national conservation forest area (Municipality, 2018).

1.3 Topography

Dipayal Silgadhi municipality lies at 29°16′N, 80°56′E. The altitude of Silgadhi Bazar is at 600 metres to 1,500 metres above sea level. The highest altitude of the municipality is Kalika Mandir, Bhukkaule Gada which is located near Baglek at 2,156 metres (Municipality, 2018).

2. Service Outcomes

2.1 Overview

The Joint Monitoring Programme (JMP) defines improved sanitation facilities as those designed to hygienically separate excreta from human contact (WHO, n.d.). In Dipayal Silgadhi municipality, people residing in 98% of households have access to a toilet. In the present context, the category of sanitation provision has seemingly improved from not having toilets in houses through to building a storage facility to contain Faecal Sludge (FS) produced at household level in the municipality. The municipality achieved Open Defecation Free (ODF) status in 2018 A.D. Despite being declared as ODF municipality, people residing in 1.9% households in wards number 3, 4, 6 and 8 do not have access to basic sanitation facilities and defecate openly.

2.1.1 Household Level Sanitation System

A sanitation system in which excreta and wastewater are collected and stored or treated on the plot where they are generated is an onsite sanitation system whereas a sanitation system in which excreta and wastewater are collected and conveyed away from the plot where they are generated is an offsite sanitation system. An offsite sanitation system relies on sewer technology for conveyance (Elizabeth Tilley, n.d.). Among the households having toilets, the percentage of households with connection of toilet to onsite and offsite sanitation is shown in Figure 3.

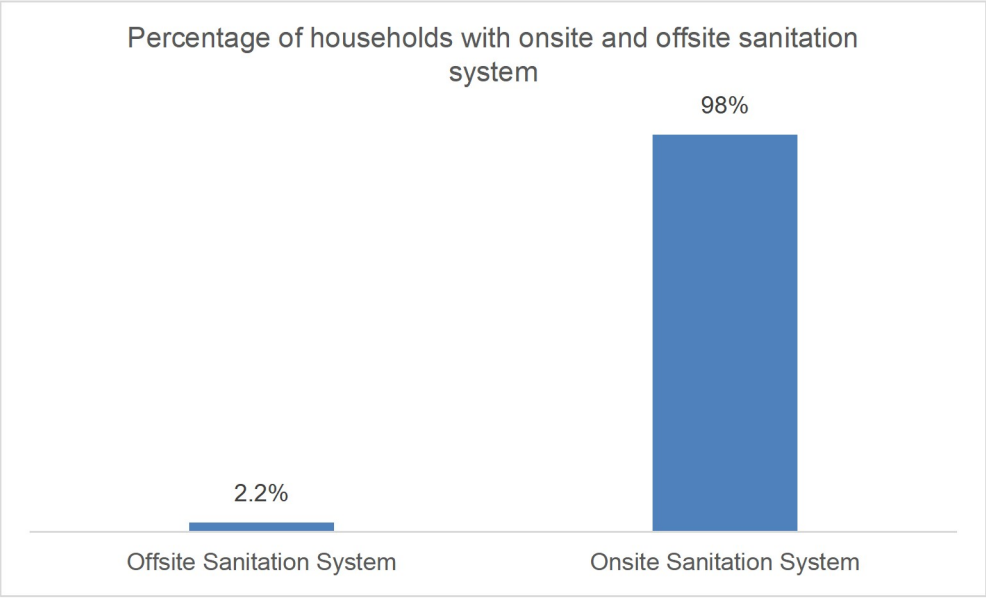

Figure 3: Percentage of households with onsite and offsite sanitation system in Dipayal Silgadhi Municipality.

Types of Offsite Sanitation Systems

Although there are obvious advantages of sewerage networks, also known as offsite sanitation systems, in high density urban areas, the capital cost of developing sewerage network capable of connecting all households in municipalities such as Dipayal Silgadhi where the population is largely scattered can be prohibitive. Thus, there are no sewerage networks and Wastewater Treatment Plants (WWTPs) in Dipayal Silgadhi Municipality. Despite of this, 2.2% of the population have connected their toilet to open drains which are conveyed to open ground and water bodies. Such unsafe practice of wastewater disposal contributes to rise of water-borne diseases such as Diarrhoea and Typhoid. Diarrhoea is one of the leading causes of death among children under five worldwide (Central Bureau of Statistics (CBS), 2020). Thus, to prevent spread of such diseases, illegal discharge of toilet waste into water bodies and open ground should be discouraged. Figure 4 and 5 show a user interface connected directly to open ground and water sources.

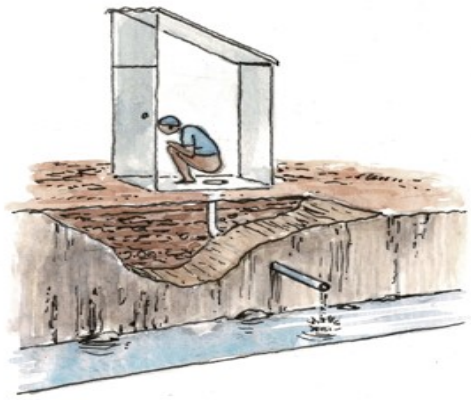

Figure 4: Toilet discharging directly to water resources.

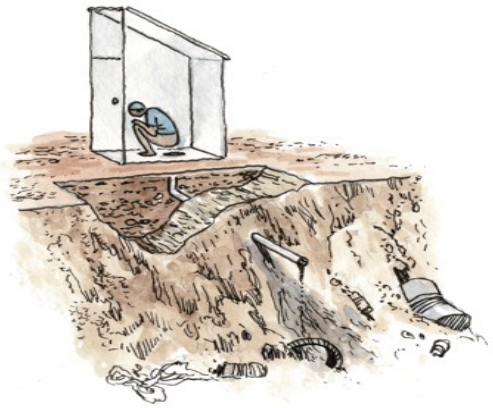

Figure 5: Toilet discharging directly to open ground.

Types of Onsite Sanitation Systems

Figure 6 shows that only 6.4% of households use fully lined tanks and twin pits for storage of FS which are safe onsite sanitation systems whereas all other households have onsite FS storage systems that are not sealed and can contribute to groundwater and soil contamination.

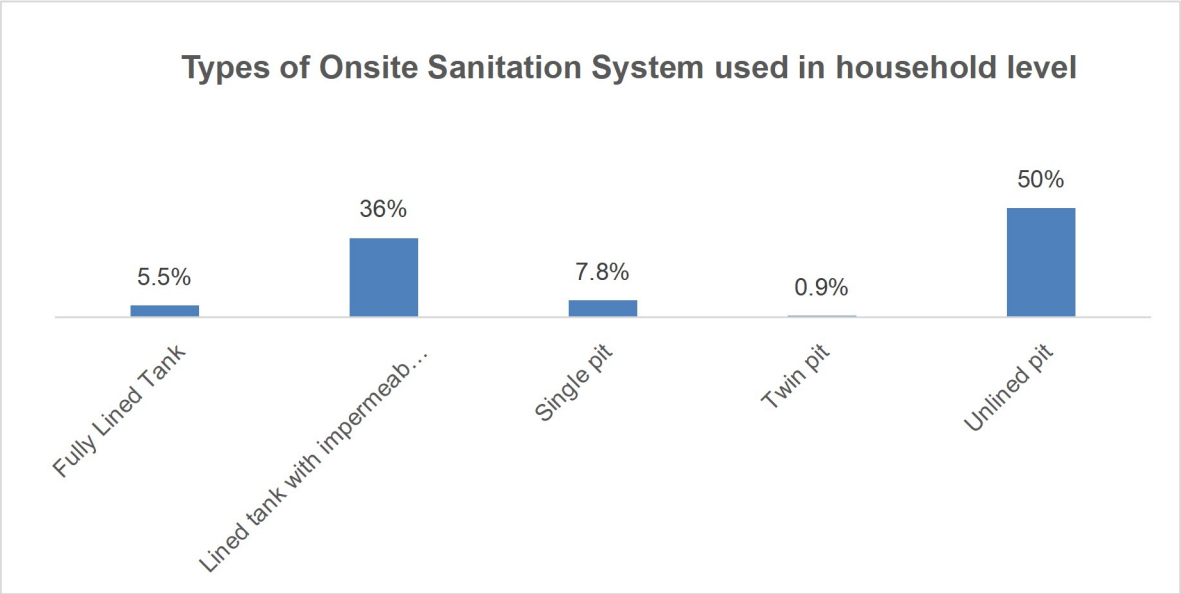

Figure 6: Types of onsite sanitation system used in household level in Dipayal Silgadhi Municipality.

Different types of onsite sanitation systems used in households of Dipayal Silgadhi municipality are described below:

Fully lined tank: Fully lined tank is a rectangular onsite sanitation technology which is used to safely store faecal sludge. There is no outlet or overflow to discharge effluent. The walls and bottom of tank is totally lined and sealed (Linda Strande, 2014). People residing in 5.5% of households with access to toilet in their houses in the municipality having onsite sanitation technology use fully lined tanks. Among them, 5.2%, 26% and 66% of households have an outlet from a fully lined tank connected to open drain, open ground or have no outlet or overflow connection, respectively. Figure 7 shows the top view of a fully lined tank built in a house in a rural area of the municipality.

Figure 7: Top view of a fully lined tank in Dipayal Silgadhi municipality.

Lined tank with impermeable walls and open bottom: Population residing in 36% of households with a toilet in their houses in the municipality have built a lined tank with impermeable walls and open bottom, which are rectangular onsite technologies where the walls of the tank are lined and the bottom of tank is not lined and allows infiltration of effluents which could contaminate groundwater.

Single Pit: Single pits are properly constructed and well-maintained pit with semipermeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur (Susana, 2018). Generally, single pits are circular in shape and do not have designed outlet. The population residing in 47% of households having access to basic sanitation in the municipality use single pit as onsite sanitation technology. Such type of pits are considered as lined pit with semi-permeable walls and open bottom in the SFD graphic.

Twin Pits: Population residing in 0.8% of households with access to a toilet in their houses use twin pits as onsite sanitation technology in Dipayal Silgadhi municipality, which are two sets of properly constructed and well-maintained pits with semipermeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. Although there are two pits, they are not used alternatively like traditional twin pits where second pit is used after the first one is completely filled and left to decompose. Instead, it was confirmed from field observation that outlet of the toilet is connected to both pits through the same line and are used in the same time. Thus, this percentage of twin pit cannot be considered as safely treated.

Unlined Pit: Unlined pits are a hole dug into the ground just beneath the toilet to store FS onsite. Population residing in 1% of households with access to toilet in their houses have built such type of onsite sanitation technology. There are no lining and the walls and bottom

of such type of pits are not sealed. Figure 8 shows top view of unlined pit observed in the household survey in the municipality.

Figure 8: Top view of unlined pit with an exhaust pipe.

Figure 9 shows the distribution of various types of sanitation technologies in different wards of Dipayal Silgadhi municipality. As seen in Figure 9, unlined pits are used in majority of the households, i.e., 50% in ward 9 whereas single pits and lined tanks with impermeable walls and open bottom are used in households of wards 2, 3, 5 and 6.

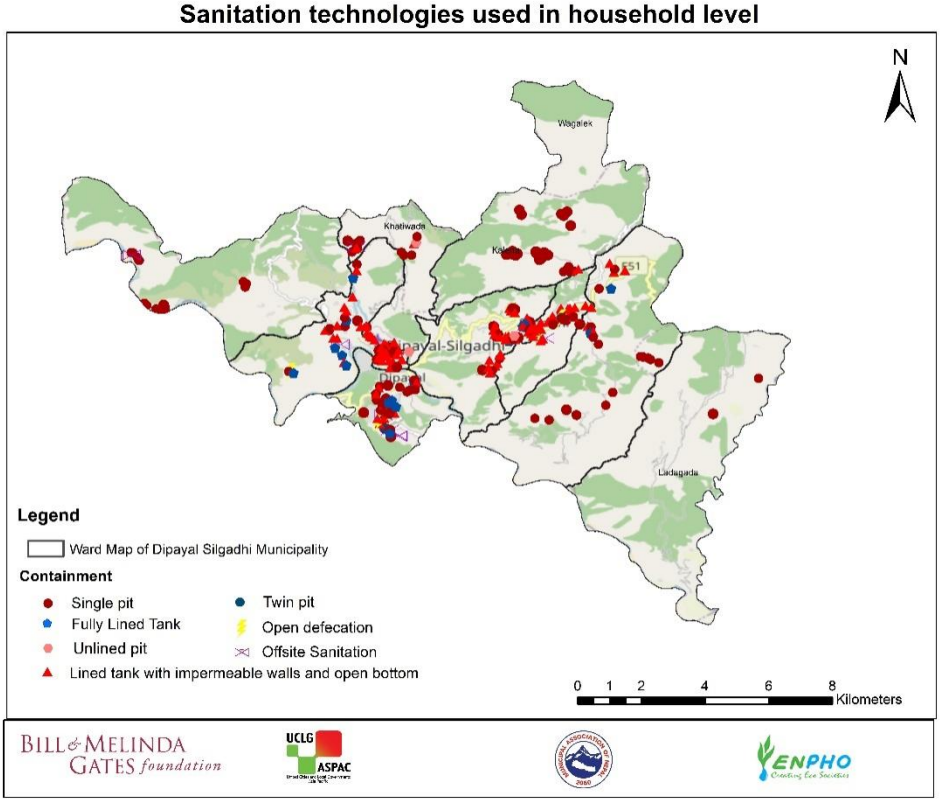

Figure 9: Sanitation technologies installed in household levels.

2.1.2 Percentage of FS emptied from onsite sanitation technologies

Emptying is one of the major components of the sanitation value chain. Regular emptying prevents overflow of the sludge and blockages (Linda Strande, 2014). Onsite sanitation technologies that have and have not been emptied in different wards throughout different wards of the municipality is shown in Figure 10. Only 25% of containments have been emptied at least once since the installation. Instead of practising emptying of containment regularly, most of the households cover or seal the pit after it is filled and left FS to decompose. Further, they dig another pit and connect the outlet of the toilet to that pit. This type of practice is mostly seen in the rural areas of the municipality where there is land availability as compared to congested urban areas. Blue circle in the figure represents the containments that have not been emptied and the red circle represents containments that have been emptied at least once after construction.

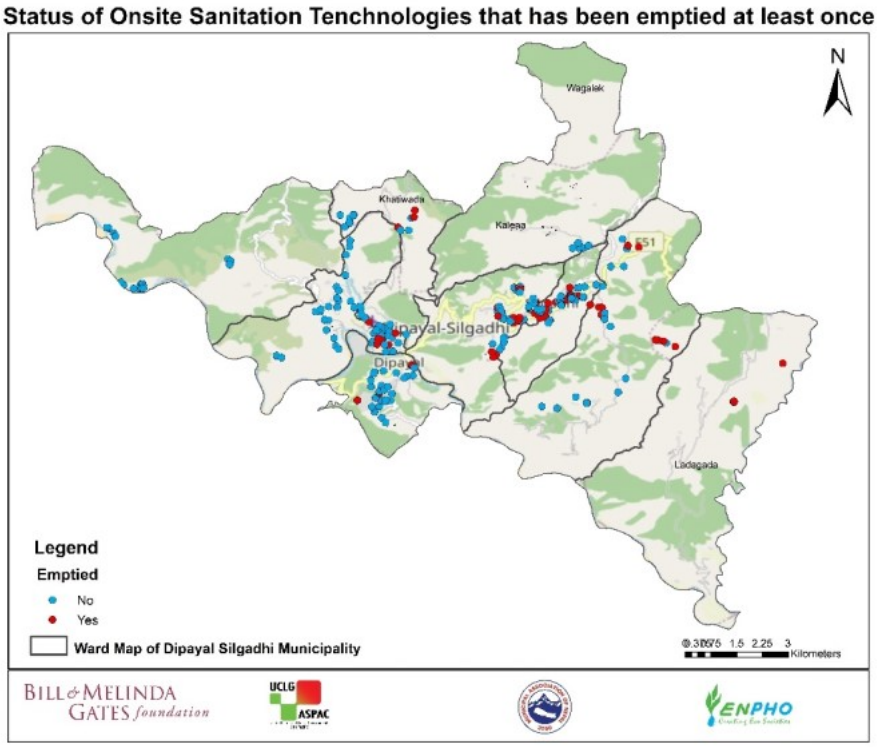

Figure 10: Status of onsite sanitation technologies that has been emptied at least once.

The municipality has started providing service of mechanical FS emptying and desludging facilities to the residences from August 2022 which is after the SFD survey was conducted in the municipality. Thus, it is observed from the survey that lack of availability of mechanical FS emptying and desludging facilities in the municipality in the previous years had led majority of households to use manual method of emptying containment after it is filled. Both traditional manual scavenging and mechanical emptying of the containment were practised in the municipality. Among the containments that have been emptied at least once, only 6.2% were mechanically emptied by private desludging service providers. The mechanical emptying facility was provided by private desludgers of Dhangadhi sub-metropolitan city who come to Dipayal Silgadhi municipality once or twice every year to provide the service. The cost of mechanically emptying containment is NRS 7,000 (US$ 54) per trip. Rest of the households practise manual emptying either by household members or by traditional labours.

Table 2 shows the average emptying frequency of onsite sanitation technologies in the municipality. Frequency of emptying of sealed containments is higher than pits, which can be justified by the volume of onsite containments, which shows the size of sealed containments to be greater than the size of pits.

Table 2: Average emptying frequency of different types of onsite sanitation technologies in Dipayal Silgadhi Municipality.

Onsite Sanitation Technology	Average Emptying Frequency
Fully lined tank	Once every four years
Lined tank with impermeable walls and open bottom	Once every three years and five months
Lined pit with semi-permeable walls and open bottom	Once every one year and two months

2.1.3 Treatment and Disposal/Reuse

Dipayal Silgadhi does not have any form of treatment plant for faecal sludge. The majority of FS emptied is applied in farmlands and a few percentages of the emptied is dumped into forest areas and nearby water bodies. Application on farm is the most easy and convenient way for disposal of FS as it can be used as compost for agricultural purposes since there is no treatment plant. Fewer households in the city have illegal connection of their toilet to an open drainage.

2.1.4 Institutional Level Sanitation System

95% of the surveyed institutions have an onsite sanitation system in the municipality. Institutions buildings such as community school, health post, government buildings, etc. were surveyed. The percentage of types of sanitation technologies in these buildings are shown in Figure 11.

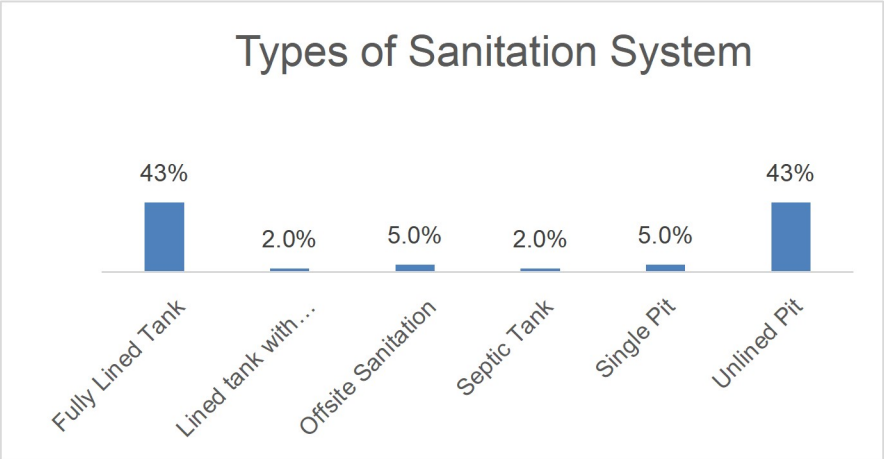

Figure 11: Types of containment in institutions of Dipayal Silgadhi Municipality.

Only 10% of the institutions having an onsite sanitation system have emptied their containment at least once after construction. Rest of the institutions have never emptied their containment because it has never been filled. Distribution of different types of sanitation technologies of institutions in various wards of Dipayal Silgadhi municipality city is shown in Figure 12.

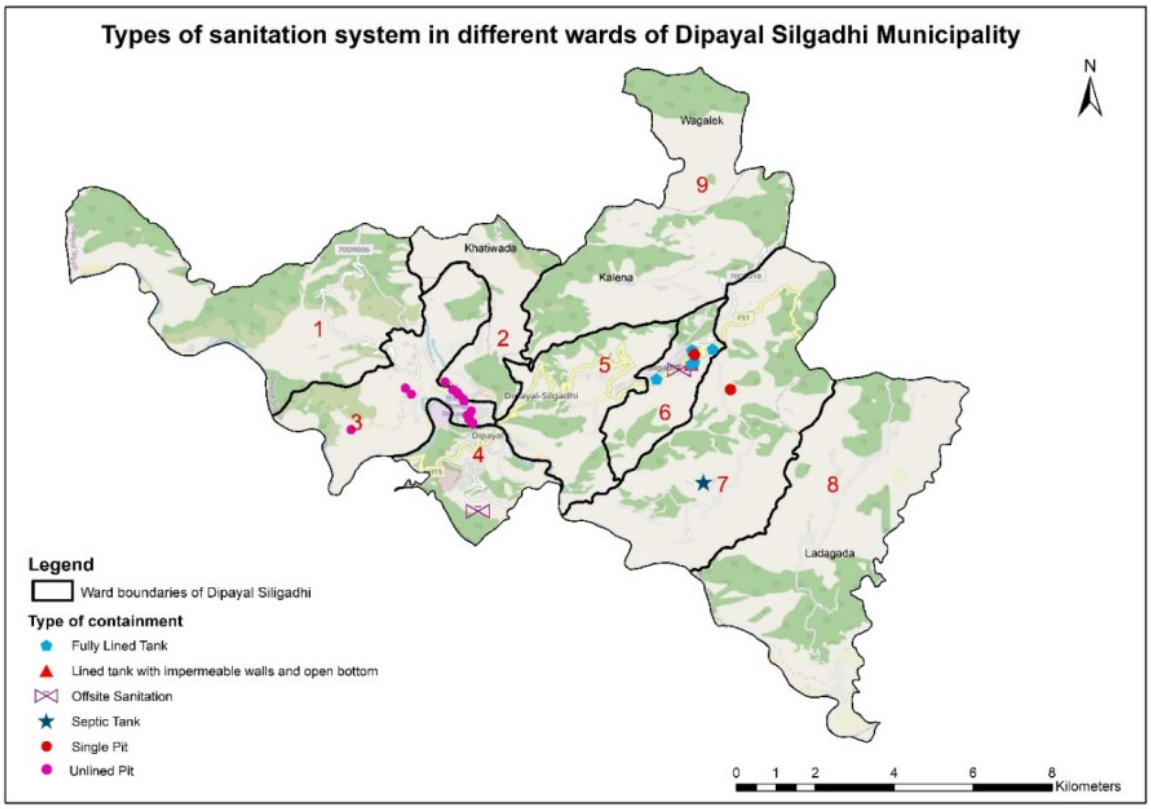

Figure 12: Types of onsite sanitation systems in institutions of Dipayal Silgadhi Municipality.

2.1.5 Public Toilets

Public Toilets (PT) are installed for commuters to achieve and sustain open defecation free status in the municipality. Altogether, nine public toilets are installed to serve the floating population and travellers. These toilets are located in the bus park areas, highway road, *Tudikhel* (open ground space), local market area, near temples and other populated areas (KII-1, KII-2, KII-6, 2022). List of pictures of public toilet located at highway (PT: A), public toilet located near community temple (PT: B), and public toilet located at big open space, *Tudikhel* (PT: C) are shown in Table 3.

Table 3: Pictures of public toilets in Dipayal Silgadhi Municipality.

		
Public toilet structure (PT: A)	Handwashing basin (PT: A)	Squatting pan (PT: A)
		
Urinal (PT: A)	Public toilet structure (PT: B)	Squatting pan (PT: B)
		
Public toilet structure (PT: C)	Pans and basins (PT: C)	Containment (PT: A)

The public toilet near a highway road in Silgadhi has capacity of four users at a time, two in male and three in female compartment. Initially, the toilet was maintained and operated by a local person appointed by the municipality. At present, overall operation and maintenance of the public toilet is carried out by the shopkeeper near the toilet.

Toilets in the public bus station serve passengers and local people operating their small business around the bus park. Toilets near temple areas can also be considered as community toilet as they are used by both moving population and worshippers of temple. Commuters can use a public toilet in the marketplace of Silgadhi and *Tudikhel* free of cost

and in all other public toilets fare for urination is NRS 5 (US$ 0.04) and for defecation is NRS 10 (US$ 0.08). Most of the toilets have an outlet connected to a sealed rectangular containment with a manhole at top for access to empty the containment after it is filled.

2.2 SFD Selection Grid

Sanitation technologies selected in the SFD grid in Dipayal Silgadhi municipality is shown in Figure 13. The vertical column in the left side of the SFD selection grid has a list of technologies to which the toilet is connected to, and open defecation in case of households without toilet. Similarly, horizontal row at the top of the selection grid shows options for connection for the outlet or overflow discharge from the toilet. Twin pits, unlined pits and single pits observed in the household survey are selected as lined pits with semi-permeable walls and open bottom in the SFD grid.

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

List A: Where does the toilet discharge to? (i.e. what type of containment technology, if any?)	List B: What is the containment technology connected to? (i.e. where does the outlet or overflow discharge to, if anything?)									
	to centralised combined sewer	to centralised foul/separate sewer	to decentralised combined sewer	to decentralised foul/separate sewer	to soakpit	to open drain or storm sewer	to water body	to open ground	to 'don't know where'	no outlet or overflow
No onsite container. Toilet discharges directly to destination given in List B					Significant risk of GW pollution Low risk of GW pollution		T1A1C7	T1A1C8		Not Applicable
Septic tank					Significant risk of GW pollution Low risk of GW pollution					
Fully lined tank (sealed)					Significant risk of GW pollution Low risk of GW pollution	T1A3C6		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	T2A4C5 Low risk of GW pollution			T1A4C8		T2A4C10 T1A4C10
Lined pit with semi-permeable walls and open bottom	Not Applicable									T2A5C10 T1A5C10
Unlined pit										Significant risk of GW pollution T1A6C10
Pit (all types), never emptied but abandoned when full and covered with soil										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil										
Toilet failed, damaged, collapsed or flooded										
Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded										
No toilet. Open defecation	Not Applicable							T1B11 C7 TO C9		Not Applicable

Figure 13: SFD selection grid for Dipayal Silgadhi Municipality.

Here, sanitation technologies and/or systems which ensure safe level of protection from excreta i.e., pathogen transmission to the user or general public is limited, are considered to contain the FS. Similarly, sanitation technologies and/or sanitation systems which do not ensure safe level of protection from excreta. I.e., pathogen transmission to the user or general public, do not to contain FS (Susana, 2018).

Brief explanation of terms used to indicate different frame selected in the SFD selection grid in Figure 13 is explained in Table 4.

Table 4: Explanation of terms used to indicate different frame selected in the SFD selection grid in Figure 13.

T1A1C7	A fully functioning toilet discharging directly to a water body. All the excreta in this system is considered not contained.
T1A1C8	A fully functioning toilet discharging directly to open ground. The excreta is raw, untreated and hazardous and since it discharges directly to open ground, all the excreta in this system is considered not contained.
T1A3C6	A correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and open bottom. 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.
T1A3C8	A correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and open bottom. Since the tank is fitted with a supernatant/effluent overflow connected to open ground the excreta in this system is considered not contained.
TA3C10	A correctly designed, properly constructed and well-maintained fully lined tank with impermeable walls and base. Since the tank is not fitted with a supernatant/effluent overflow this system is considered contained.
T2A4C5 (High Risk)	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. It includes wall-lined but open bottomed tanks and containers. Since there is a 'significant risk' of groundwater pollution, all 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. Since the tank is fitted with a supernatant/effluent overflow connected to open ground, the excreta in this system is considered not contained.
T2A4C10 (High Risk)	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. The tank is NOT fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered not contained.
T1A4C10	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. However, since the tank is not fitted with a supernatant/effluent overflow this system is considered contained.
T2A5C10 (High Risk)	A correctly designed, properly constructed and well-maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is not fitted with a supernatant/effluent overflow 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.
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 but since there is a 'significant risk' of groundwater pollution this system is considered not contained.
T1B11C7 to C9	With no toilet, users defecate in water bodies, on open ground and to don't know where; consequently, the excreta is not contained.

2.2.1 SFD proportion and matrix

The second step in the process of developing the SFD graphic is the calculation the proportion of contents of each type of onsite container which is faecal sludge. A detailed instruction on how to calculate SFD proportion in SFD PI was used as guide to calculate SFD proportion. It stated that the default "100%" value is used where onsite containers are connected to soak pits, to 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. Where onsite containers are connected to a sewer network or to open drains, a value of "50%" is used which means that half the contents are modelled as faecal sludge; 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 used for FS proportion calculation is shown below:

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

Here, data for each selected sanitation system on the SFD Matrix is entered. The proportion of the contents of each type of onsite container (either fully lined tanks (sealed) or lined tanks with impermeable walls and open bottom and all types of pits), is shown in column Population (Pop) of Figure 14. F3 is the proportion of the contents of each type of onsite container which is emptied at least once after its construction. Here, only 80% of the proportion of FS in the containment is emptied as suggested from KII-2.

Variable F4 accounts for FS emptied that is delivered to treatment plant. Similarly, variable F5 accounts for FS delivered to treatment plant that is treated. This percentage of FS which is delivered to treatment plant and treated is zero as obtained from household survey and were verified during the field visit observation as none of the FS emptied is properly treated before its application as compost.

Here, for systems where there is groundwater pollution risk such as lined pits and lined tanks, values for variables F3, F4 and F5 differ despite being the same system. The population using such systems are scattered in different wards of the municipality where some households have access to road networks and mechanical FS emptying facilities whereas many other households do not have that option. Similarly, land availability plays a vital role in the management of FS generated at the household level. Population residing in households in rural areas of the municipality have farmland and open spaces providing them with an option to dig and dump and use the FS generated as compost whereas population living in city areas of the municipality cannot afford to use expensive commercial lands for FS disposal contributing to unsafe FS disposal in nearby river and open ground. Thus, the varying percentage of FS emptied, managed and treated can be observed in the SFD matrix in similar containment systems.

Figure 14 shows the SFD matrix of Dipayal Silgadhi municipality.

Dipayal Silgadhi Municipality, Sudur Paschim, Nepal, 28 Nov 2022. SFD Level: 2 - Intermediate SFD
Population: 32941
Proportion of tanks: septic tanks: 0%, fully lined tanks: 99%, lined, open bottom tanks: 98%

Containment						
System type	Population	FS emptying	FS transport	FS treatment	SN transport	SN treatment
	Pop	F3	F4	F5	S4e	S5e
System label and description	Proportion of population using this type of system (p)	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated	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
T1A1C7 Toilet discharges directly to water body	1.0					
T1A1C8 Toilet discharges directly to open ground	1.0					
T1A3C10 Fully lined tank (sealed), no outlet or overflow	11.0	59.0	0.0	0.0		
T1A3C6 Fully lined tank (sealed) connected to an open drain or storm sewer	1.0	0.0	0.0	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	25.0	21.0	0.0	0.0		
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	8.0	10.0	0.0	0.0		
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	38.0	24.0	0.0	0.0		
T1A6C10 Unlined pit, no outlet or overflow	1.0	40.0	0.0	0.0		
T1B11 C7 TO C9 Open defecation	2.0					
T2A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	1.0	21.0	0.0	0.0		
T2A4C5 Lined tank with impermeable walls and open bottom, connected to a soak pit, where there is a 'significant risk' of groundwater pollution	1.0	0.0	0.0	0.0		
T2A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	9.0	20.0	0.0	0.0		

Figure 14: SFD Matrix of Dipayal Silgadhi Municipality.

2.2.2 *Risk of Groundwater Pollution*

According to the sample household survey method performed during the Water, Sanitation and Hygiene (WASH) plan survey conducted in 190 households, it was found out that 98% of the households have installed private water taps from Water Service Providers (WSP) and 1.6% of the households use unsafe wells and stream as their main source of drinking water in Dipayal Silgadhi municipality (UNICEF, 2020). Groundwater vulnerability is specific to containment type and pollution scenarios (Andreo, 2013). Thus, a higher percentage of HHs using piped network water indicates that the probability of groundwater pollution at household level is very low to none. Table 5 shows the major sources of drinking water used at random sampled HHs in different wards of the municipality.

Table 5: Main source of drinking water at HH level in different wards of Dipayal Silgadhi municipality. Source: (UNICEF, 2020).

Ward Number	Main source of drinking water			Number of surveyed houses
	Piped private water supply	Safe source	Unsafe source	
1	25	0	0	25
2	15	0	0	15
3	19	1	1	21
4	30	0	0	30
5	25	0	0	25
6	18	0	0	18
7	11	0	0	12
8	19	0	1	19
9	25	0	0	25
Total	**187**	**1**	**2**	**190**
Percentage	**98.42**	**0.53**	**1.05**	**-**

Although many households have a connection to private WSPs, most of service providers do not measure the quality of water, do not pay attention to source conservation, maintenance and cleanliness of structures. Due to this, the number of households with access to quality water is low (UNICEF, 2020). A water quality data analysis test was conducted by Suaahara II Phase 1 in 2018. Among the test conducted in one source, one reservoir tank, nine drinking water sample and three taps, total coliform was present in all samples ranging from 40 CFU/100 ml to 8,000 CFU/100 ml. Similarly, the was presence of *E.Coli* was seen in the source, RVT, all three taps and four drinking water samples.

2.3 Summary of assumptions

Offsite sanitation systems:

- ✓ 2% of the toilets discharge directly to water body or open ground (T1A1C7 and T1A1C8). Since there is no treatment plant, all wastewater is disposed of untreated into the environment.

Onsite sanitation systems:

- ✓ The proportion of FS in septic tanks were set to 0% (no septic tanks were found in the city), the proportion of FS in fully lined tanks was set to 99% and the proportion of FS in lined tanks with impermeable walls and open bottom and all types of pits was set to 98% according to the relative proportions of the systems in the municipality, as per the guidance given in the Frequently Asked Questions (FAQs) in the Sustainable Sanitation Alliance (SuSanA) website.
- ✓ Variables F3, F4 and F5 for all onsite sanitation systems were derived from the HH survey and cross-checked with the KIIs conducted.
- ✓ The traditional practice of composting and dig and dump the FS after emptying is not considered to be as a safely practice of managing emptied faecal sludge. Moreover, the municipality does not have any designated faecal sludge treatment plant. Therefore, variables F4 and F5 are both set to 0% for all sanitation systems.

2.4 SFD Graphic

Figure 15 shows the SFD graphic for Dipayal Silgadhi municipality. The percentage of FS and wastewater (WW) in the graphic that is coloured green indicates that they are being handled or stored safely, while the percentage that is coloured red indicates that they are being managed or stored in an unsafe manner. It also represents the sanitation value chain going from left to right.

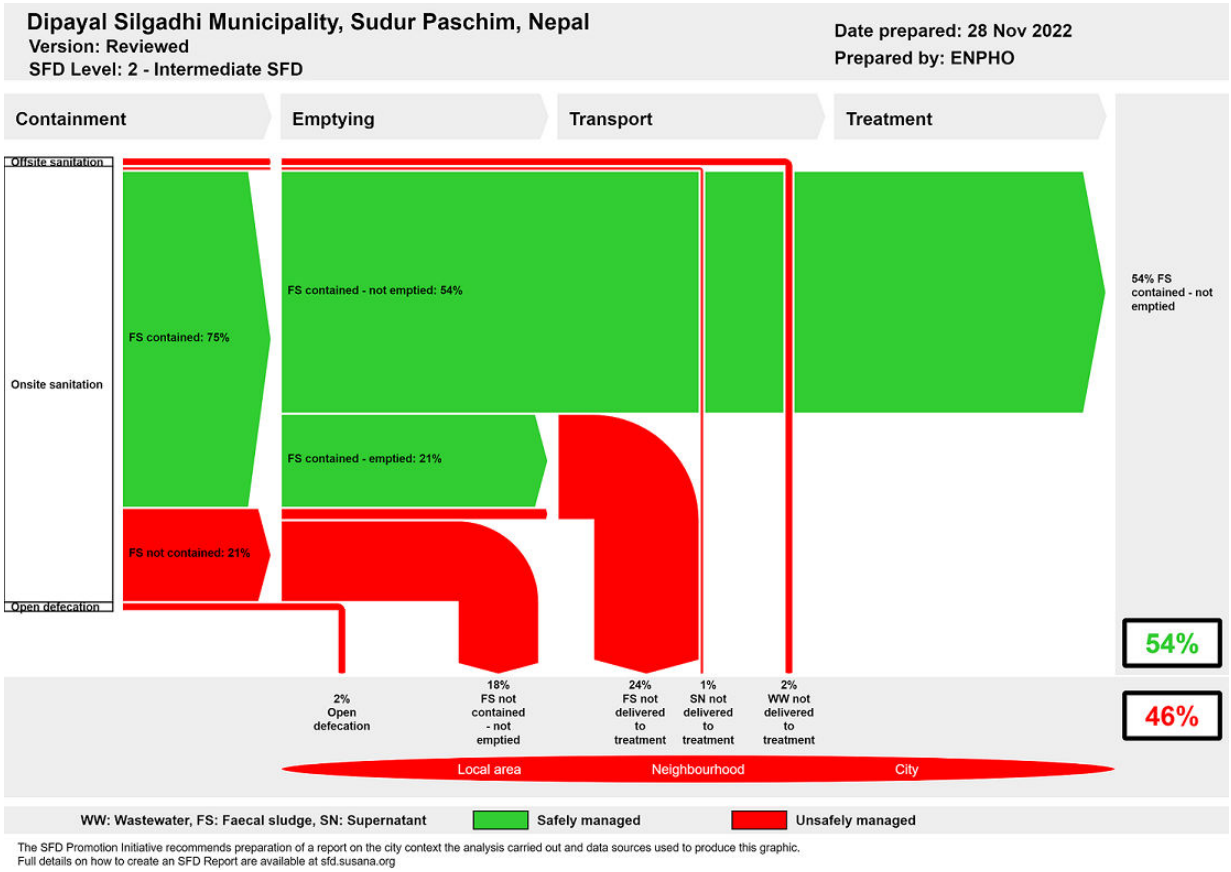

Figure 15: SFD graphic of Dipayal Silgadhi Municipality.

Here, 2% of the toilets are directly connected to water resources or open drainage. They are transported at a certain distance from the household and disposed of in an unsafe environment, either directly in river, riverside or open spaces without treatment (wastewater not delivered to treatment, 2%).

75% of FS is contained i.e., FS kept in a container, either emptied or not, is safe from human contact. 54% is FS contained not emptied which is stored in fully lined tanks, lined tanks and pits which are in safe distance from sources of drinking water. However, these systems will require emptying services in the short and medium term as they fill up.

All 21% of FS contained - emptied is represented as safely managed until it is emptied as it is stored safely which eventually is considered unsafe after it is emptied and dumped without any form of treatment. Likewise, 21% is FS not contained, that is FS kept in containment which possess risk to human health through groundwater contamination or human contact. 3% of this FS not contained is emptied but not disposed safely. Lack of a treatment facility in the municipality leads to disposal of FS in farmland and water bodies which is unsafe practice.

Despite ODF status, people residing in 2% of households still go for open defecation. This percentage of population going for open defecation are people from low-income families who are not financially sound enough to build toilets and containment.

3. Service Delivery Context

3.1 Policy, legislation, and regulation

3.1.1 *Policy*

The Constitution of Nepal 2015 in Article 35 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 recognizes that every person shall have the right to live in a healthy and clean environment (GoN, 2015). To respect, promote and fulfill the provisions related to right on water and sanitation, Government of Nepal has billed Drinking Water and Sanitation Act, 2019 through Ministry of Water Supply. The act elaborates right to clean water as to receive affordable, sufficient, and quality drinking water regularly as well as access to sanitation as affordable access to quality sanitation services (MoWS, 2019).

Historically, 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 in the marginalized and vulnerable groups. Participatory approach, community leadership project development, optimization of local resources and installation of locally appropriate technologies were major principles in the policy (DWSSM, 2004). However, it was unable to address the complex operational issue of urban water supply and sanitation service delivery (DWSSM, 2009) .Thus, 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. Cost recovery principles, public private partnership, and sector effectiveness for improved service delivery are key principles of the policy (DWSSM, 2009). Both these policies were limited to address emerging issues and challenges in the rural and urban areas. Thus, the National Water Supply and Sanitation Policy (NWSSP) was formulated in 2014 by the Government of Nepal (GON) to address the emerging challenges and issues with the adoption of innovative 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.

Recently, National Water, Sanitation and Hygiene Policy, 2022 has been drafted and undergone the process for endorsement. The draft policy is updated till date, including the wide range of sanitation services including treatment, reuse/safe disposal of faecal sludge/wastewater. It emphasizes on the preparation of the municipal level WASH plan with the local leadership to ensure the WASH services for all (MoWS, 2022).

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

Similarly, Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (SDP 2016-2030) was formulated in 2016 for sector convergence, institutional and legal reforms, capacity development and establishing coordination and harmonization in the sector. The SDP classified service system and delineated roles and responsibilities for effective and sustainable service delivery. The SDP highlighted that majority of households rely on onsite sanitation system (70%) that requires effective treatment of faecal sludge. However, there is lack of concrete policies, guidelines, and indicators on Faecal Sludge Management in the sector for effective planning, implementation, and service delivery. In alignment, 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). It is framed upon existing laws such as Environmental Protection Act (2019) and Environmental Protection Rules (2020), Self-Local Governance Act and Rules 1999, Environmental Standards on Effluent Discharge 2000, Nepal National Building Code 2003, and Land Acquisition Act amendment 2010 (MoWS, 2017) . 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 Water and Sanitation User's Committee (WSUC) in the framework reflects a participatory approach that would help in sustaining the interventions.

The constitution of Nepal has provided the right for local government to form acts, rules and regulation based on the national policies and laws. Local Governance Operation Act 2017 has been formed to implement the right of local government and promote co-operation, co-existence, and co-ordination among federal, provincial, and local government. The act has mentioned the rights, roles, and responsibility of municipalities along with provision and procedure for approving laws and regulations at local level.

It is the duty and responsibility of the Dipayal Silgadhi municipality to improve access to accessible, safe, and sustainable drinking water and sanitation services to the people of the municipal area as mentioned in chapter 3 of the Local Government Management Act 2074 under the title of municipal work, duties, and rights; the policy, laws, standards, plan implementation and regulation related to local water supply mentioned in sub-section D of section 11. To implement this responsibility, water supply, sanitation and hygiene plan and policy has become essential. Development without planning and estimation will not lead to the expected success in access to water and sanitation (UNICEF, 2020).

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 Level

National Planning Commission: At the federal government, the National Planning Commission is the specialized and apex advisory body for formulating a national vision, develop 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, facilitate and coordinate with federal, provincial, and local government for developing policy plan and implementation.

Ministry of Water Supply: Ministry of Water Supply is the lead ministry responsible for planning, implementation, regulation, and monitoring and evaluation of sanitation programs in the country (GoN, 2015). Under the MoWS, Department of Water Supply and Sewerage Management (DWSSM) plan and implement water and sanitation projects funded by foreign donors or inter provincial projects or serves at least 15,000, 5,000 and 1,000 people in terai, hilly and mountain region respectively (GoN, 2015). The organizational structure of DWSSM is shown in Figure 16.

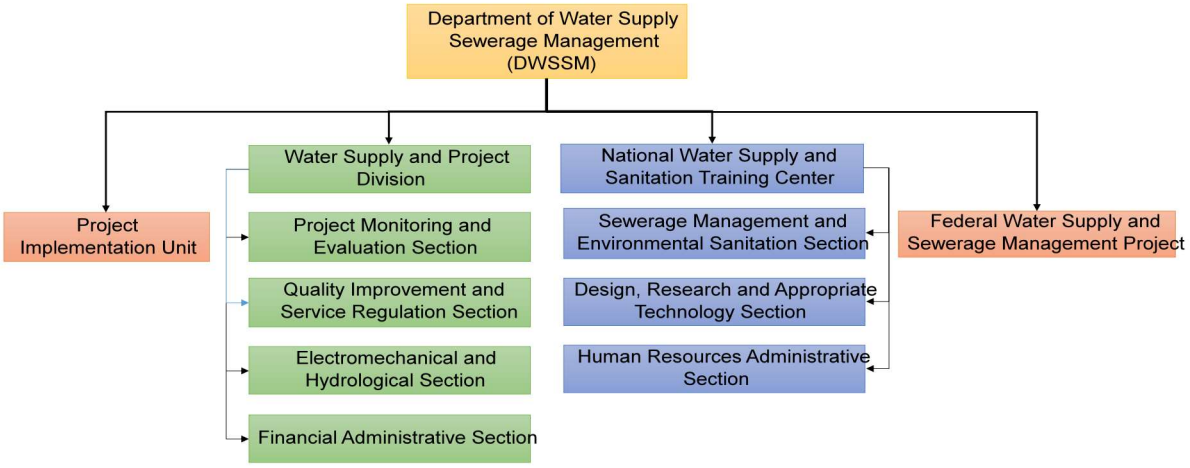

Figure 16: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).

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 also sets the standards for safe, affordable building construction and implementation for managed residential environment.

At Provincial Level

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

i. Inter local government projects

ii. Beneficiaries between 5,000 to 15,000 in terai region, 3,000 to 5,000 in hilly region and 5,00 to 1,000 in Himalayan region.

3.1.3 *Service standards*

The sanitation service standards have set by Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (2016-2030). It classifies sanitation services as high, medium, and basic based on sanitation facilities in place. The sanitation service levels with indicators are shown in Table 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 grewater	✓	✓	✓
6	Small-bore sewer collection for toilet and septic tank effluent, low-cost treatment and disposal		✓	
7	Sanitary sewers for wastewater collection, transmission, non-conventional treatment, and disposal	✓		
8	Sanitary sewers for wastewater collection, the transmission of conventional treatment and disposal	✓		
9	Limited solid waste collection and safe disposal	✓	✓	✓

3.2 Planning

3.2.1 *Service targets*

The plans and programs for development in Nepal is guided by a national development framework formulated by the national planning commission in coordination with sectoral ministries. The ministry of finance allocates budgets and releases them to executing agencies and coordinates with development partners to address resource gaps. Nepal is committed to the Sustainable Development Goals (SDGs) which has been reaffirmed in key documents such as the current 15th development plan and the 25-year long-term vision 2100 that internalizes the sustainable development goals (NPC, 2020) . The SDGs codes are assigned for all national development programs through the Medium-Term Expenditure Framework (MTEF). The MTEF sets out three-year spending plans of the national and provincial governments which aims to ensure that budgets reflect social and economic priorities and give substance to reconstruction and development commitments (NPC, 2020). Further, Nepal has prepared the SDG status and roadmap to localize the SDG indicators with baselines and targets for 2030. Nepal has set the following target and indicator focused on sanitation based on global SDGs as shown in table 7.

Table 7: National SDG target and indicator on sanitation.

National SDG Target and Indicator		2015	2019	2022	2025	2030
Target 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations						
6.2.1 Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water						
1	Households using improved sanitation facilities which are not shared (%)	60	69.3	78.7	85.7	95
2	Proportion of population using latrine (%)	67.6	75.7	83.8	90	98
3	Sanitation coverage (%)	82	86.5	89.9	93.3	99
4	Urban households with toilets connected to sewer systems/ proper FSM (%)	30	46	62	74	90

3.3 Investments

A preliminary estimate of the annual investment requirement for the entire SDG period, 2016-2030 ranges between 42% to 54% of Gross Domestic Product (GDP). The average requirement is estimated to be about NPR 1,770 billion (USD 9.17 billion) per year, or nearly 49% of GDP over the entire duration of the SDGs (NPC, 2017).

The 15th year sanitation sector road map has estimated NRP 696 billion (USD 5.45 billion) for implementing the sector development plan of WASH. The gap on the budget allocated and required on WASH sector as mentioned in SDP (2016-2030) is shown in Figure 17. This

scale of investment needs a full mobilization of all national and international sources including both public and private sector (MoWS, 2017).

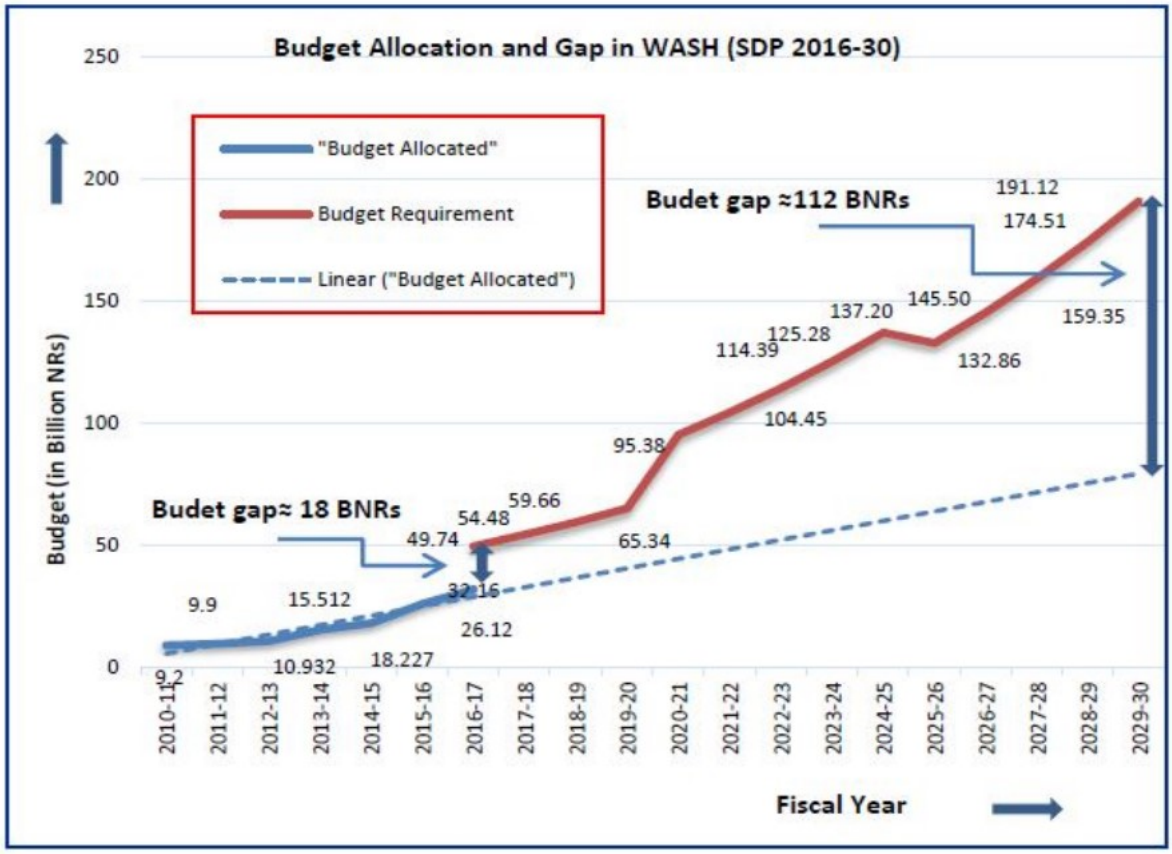

Figure 17: Budget allocation and GAP in WASH SDP 20016-2030. Source: (MoWS, 2017).

3.4 Equity

3.4.1 *Current choice of urban poor*

The government has developed a Multiple Indicator Cluster Survey (MICS) for periodic monitoring of different sectors of SDG including water and sanitation service delivery (CBS, 2022) . The program is supported by the Joint Monitoring Programme (JMP) from the WHO/UNICEF.

3.4.2 *Stimulating demand for services*

The mandatory provision of septic tanks during construction of building as per the National Building Code is major legal initiative for stimulating sanitation service demand in the city. Besides, the municipality must conduct awareness programs on sanitation at the community level for increasing the demand.

3.4.3 *Strengthening service provider roles*

Local government operation act 2017 and bill on drinking water and sanitation 2019 has entitled local government with authority for planning, implementation, monitoring and

supervision of water and sanitation programs and services in the city. Similarly, institutional and regulatory framework on FSM has designated the local government with authority for planning, implementation, monitoring and supervision of sanitation programs (MoWS, 2017).

4. Stakeholder Engagement

4.1 Key Informant Interviews

Key Informant Interviews (KIIs) and objective sharing of the study were conducted with the major stakeholders of sanitation sector of the municipality. Interviews were performed with Ms. Kalawati Mahar Saud, Deputy Mayor, Mr. Ramesh Chandra Joshi, Officer and ward chairpersons of Dipayal Silgadhi Municipality on current sanitation services practices with respect to technical, institutional and financial aspects of the municipality.

Similarly, private desludging service providers were interviewed to understand faecal sludge management practice and the business opportunities of the sector in the municipality. KIIs were also performed in context of public toilets with operators of the toilets. Other stakeholders interviewed were a sub-engineer of UNICEF (United Nations International Children's Emergency Fund) and an officer from Water Supply and Sanitation Division Office to find supply and demand, water sources and distribution practice for drinking water in the municipality. Table 8 shows a list of KIIs conducted to personnel and their designation in the organization they work for.

Table 8: List of Key Informant Interviewes conducted to personnel.

S.N.	Name	Designation	Organization	Purpose of KII
1.	Kalawati Mahar Saud (KII-1)	Division Engineer (Urban Development and Technical Section)	Dipayal Silgadhi Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development
2.	Ramesh Chandra Joshi (KII-2)	Section Head (Social Development and Sanitation Section)	Dipayal Silgadhi Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development
3.	Ward Representatives (KII-3)	Ward Chairperson	Dipayal Silgadhi Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development
4.	Deepak Bhatt (KII-4)	Sub-engineer in UNICEF project	UNICEF	Policies and plan for Sanitation development
5.	Shiva Kumar Chaudhary (KII-5)	Private Desludging Service Provider	Private Desludging Service Provider	Emptying practices, finances, requirement, disposal and treatment
6.	Public toilet operator (KII-6)	Public Toilet Operator		Quantitative and management data on public toilet and public toilet operation

4.2 Household Questionnaire Survey

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

4.2.1 *Determining Sample Size*

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

Thus, a total of 364 households were sampled from 6,601 households distributed in nine wards with proportionate stratification random sampling which is shown in Figure 18.

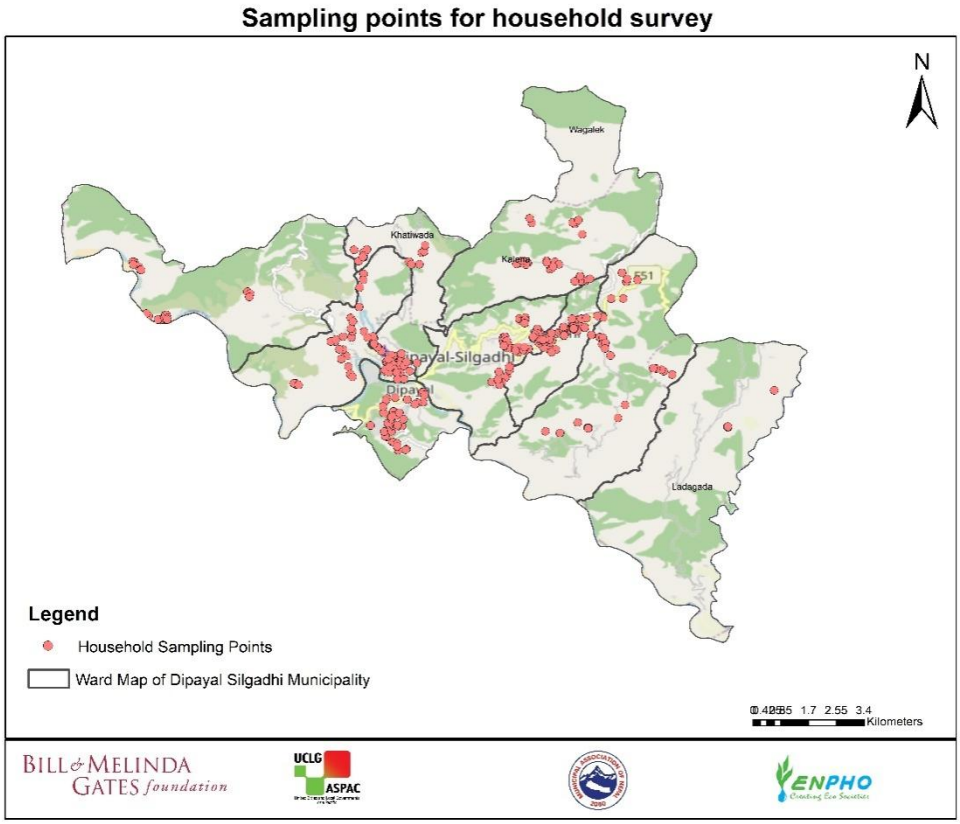

Figure 18: Distribution of sampling points in different wards of Dipayal Silgadhi municipality.

4.2.2 *Direct Observation*

Various sanitation technologies in the households in all the wards were observed and visual references were kept. Also, observation of the emptying of containments and transportation of faecal sludge were carried out. The disposal of private entrepreneur was observed during the usage.

4.3 Sharing and Validation of Data

The Shit Flow Diagram Sharing and Validation workshop was conducted in the municipality to share the finding of the sanitation situation survey and receive the suggestion from municipal stakeholders. Altogether, 36 participants including the mayor, deputy mayor, ward chairpersons, other members from municipal executive council, sectoral staffs, faecal sludge de-sludging service providers etc. actively participated on the workshop and provided the valuable suggestions. Baji Singh Khadka, mayor of the municipality suggested exploring opportunity to construct a Faecal Sludge Treatment Plant (FSTP) in the municipality and improving desludging FS emptying and transportation facilities. Shankhar Suchikar, Chief Administrative Officer (CAO) recommended to study and understand the reason behind practice of open defecation in the respective wards. The local representatives realized the need for enhancement of the sanitation status in their sub-metropolitan city. Further, he also suggested promoting activities and campaigning for sustainability of ODF. They agreed on the data obtained from the households and institutional survey. The list of participants with

their designation is attached in Appendix 2. Figure 19 shows participants in sharing and validation workshop in Dipayal Silgadhi municipality.

Figure 19: Validation workshop at Dipayal Silgadhi Municipality.

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 our sincere gratitude to Mr. Baju Si Khadka, Mayor, Ms. Kalawati Mahar Saud, Deputy Mayor and Mr. Ramesh Chandra Joshi, Section Head of Social Development and Sanitation Section of Dipayal Silgadhi Municipality. We would also like to thank ward chairpersons and entire staff of municipality for their remarkable support during the study. We are grateful towards Mr. Deepak Bhatt, engineer of UNICEF project for his support in the study.

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

We are very much 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 entire team of ENPHO for their gracious support and MuNASS-II team without whom the study would not have been possible.

We are grateful towards the enumerators, Mr. Bikash Nath, Ms. Jenisha Khadka, Ms. Shostika Khatri, Ms. Urmila Joshi, Ms. Narapata Balayar, Ms. Nirmala Damai, Ms. Pabitra Kunwar, Ms. Nirmala Saud, Ms. Durga Bist, Mr. Prince Nepali, Mr. Keshab Bist, Mr. Dil Bahadur Mahara and Mr. Nar Bahadur Bogati for their support during the survey.

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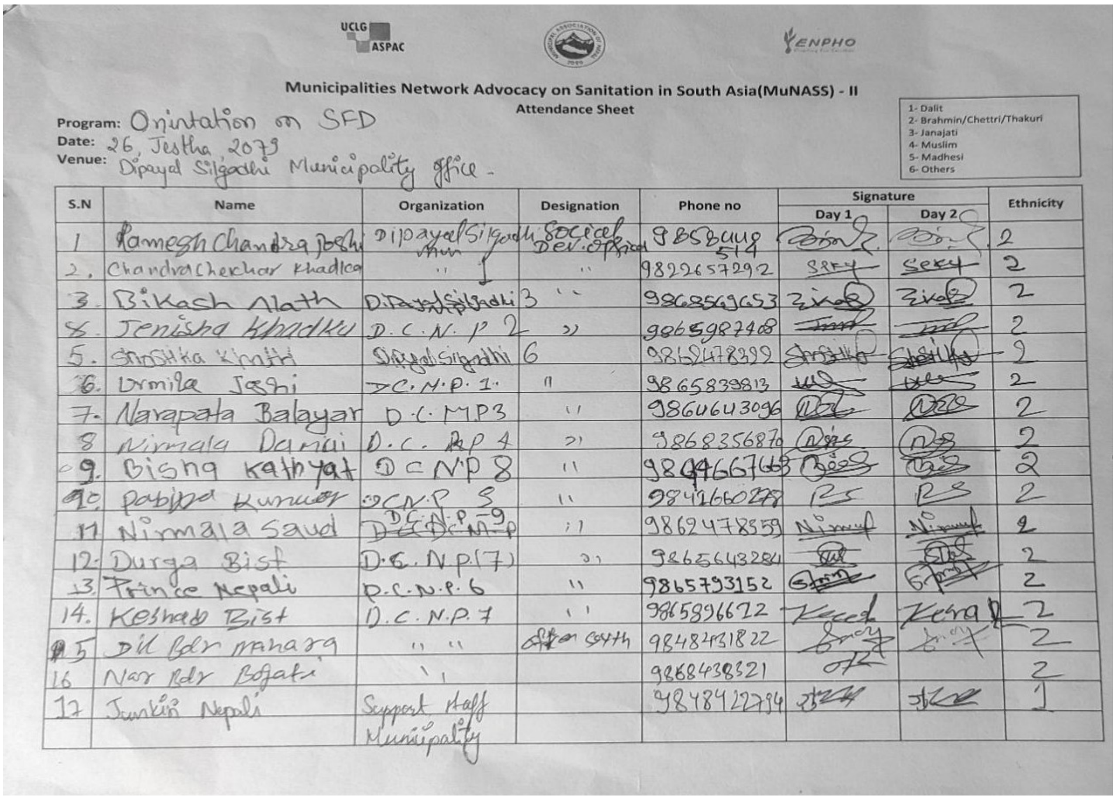
7. Appendix

7.1 Appendix 1: List of participants on orientation on survey for SFD



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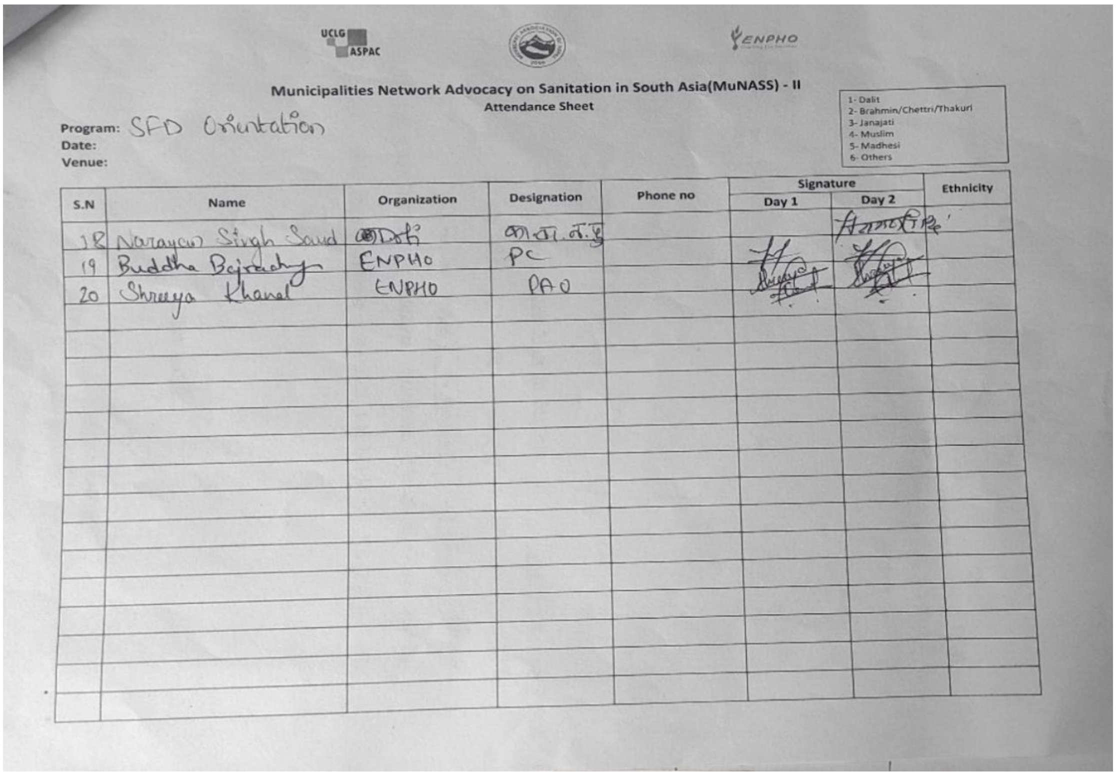
Municipalities Network Advocacy on Sanitation in South Asia(MuNASS) - II

Attendance Sheet

Program: Orintation on SFD
Date: 26, Jestha, 2079
Venue: Dipayal Silgadhi Municipality office.

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	Ethnicity
1	Ramesh Chandra Joshi	Dipayal Silgadhi Mun	Social Dev. Officer	9858448514			2
2.	Chandrachekhar Khadka	"	"	9822657292			2
3.	Bikash Nath	D. Silgadhi 3	"	9868569653			2
4.	Jenisha Khadka	D.C.N.P 2	"	9865987408			2
5.	Shristika Kimthi	Dipayal Silgadhi 6		9862478399			2
6.	Urmila Joshi	D.C.N.P. 1.	"	9865839813			2
7.	Narapata Balayar	D.C.M.P3	"	9864643096			2
8	Nirmala Damai	D.C. NP 4	"	9868356870			2
9.	Bisna Kathyat	D C N P 8	"	9844667663			2
10	Pabitra Kunwar	DCNP 5	"	9841660278			2
11	Nirmala Saud	D.C.N.P-9	"	9862478359			2
12.	Durga Bist	D.C.N.P.(7)	"	9865643284			2
13.	Prince Nepali	D.C.N.P. 6	"	9865793152			2
14.	Keshab Bist	D.C.N.P. 7	"	9865896622			2
15	Dil Bdr Mahara	" "	Office Sayth	9848431822			2
16	Nar Bdr Bofati	"		9868438321			2
17	Junkiri Nepali	Support staff Municipality		9848422794			1



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

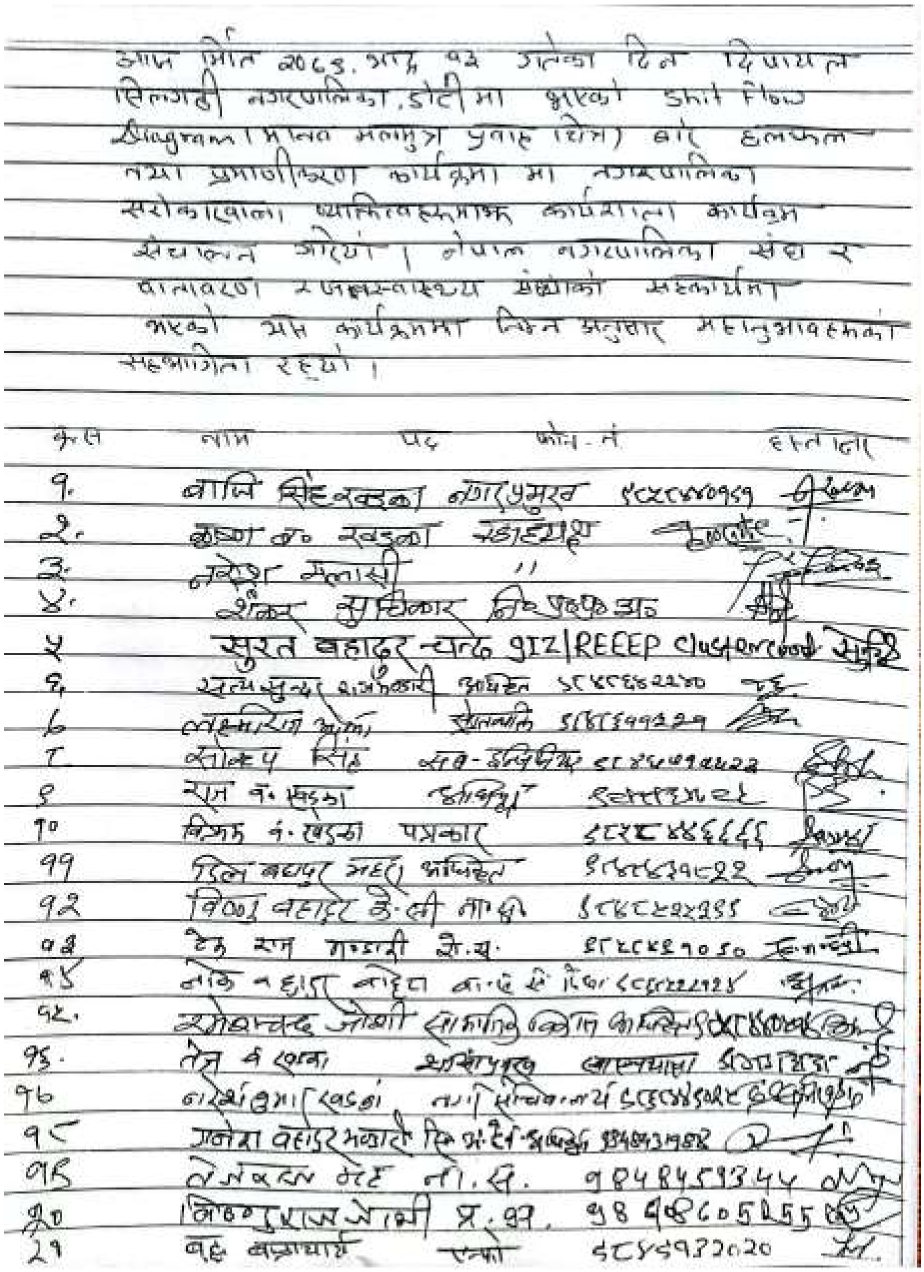
Attendance Sheet

Program: SFD Orientation
Date:
Venue:

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	Ethnicity
18	Narayan Singh Saud	Doti	[illegible]				
19	Buddha Bajracharya	ENPHO	PC				
20	Shreya Khanal	ENPHO	PAO				

7.2 Appendix 2: Attendance sheet of sharing and validation workshop



7.3 Appendix 3: SFD orientation to enumerators for household and institutional survey

SFD Dipayal Silgadhi Municipality, Nepal, 2022

Produced by:

Shreeya Khanal, ENPHO

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SFD Promotion Initiative