SFD Report

Phidim Municipality
Nepal

Final Report

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

Date of production: 30/05/2023
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SFD Report Phidim Municipality, Nepal, 2023

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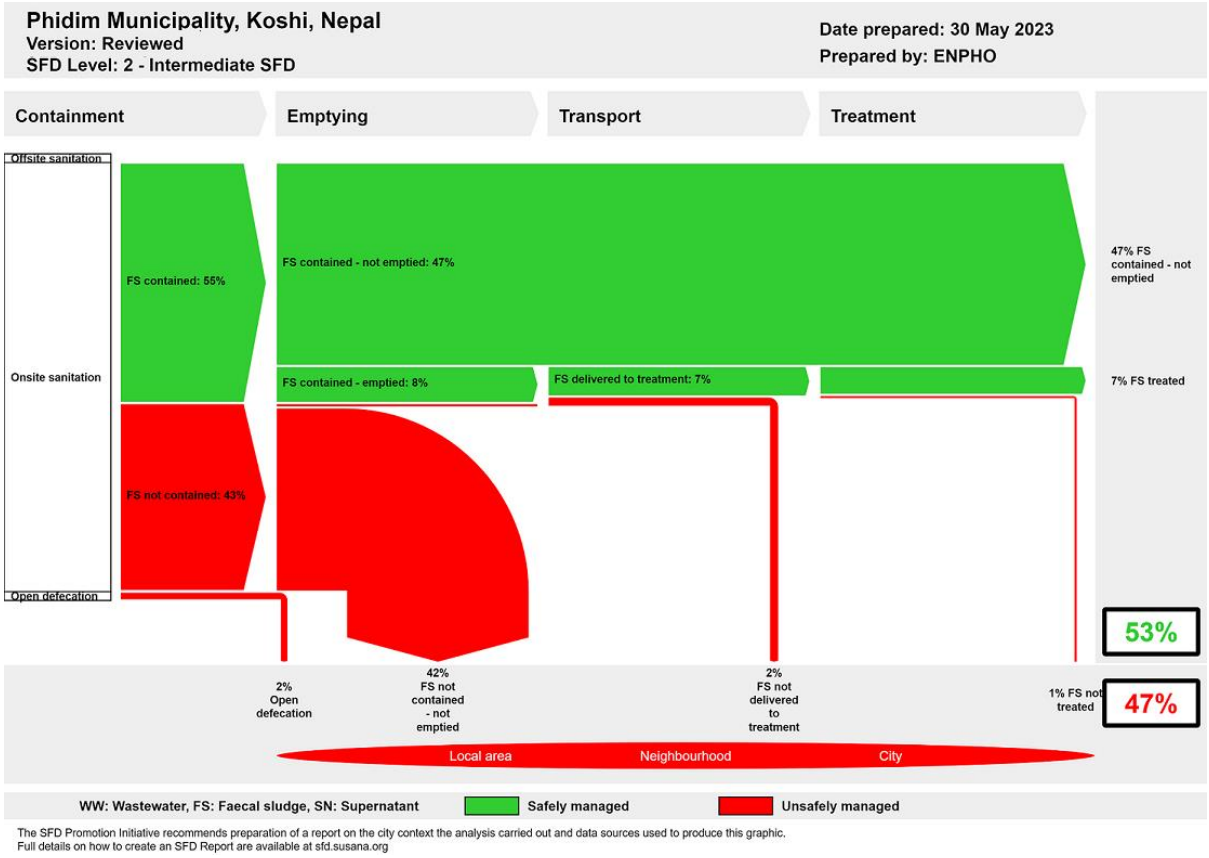
1. The SFD Graphic



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 a level 2- Intermediate report.

Produced by:

Environment and Public Health Organization (ENPHO).

Collaborating partners:

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

Status:

Final SFD report.

Date of Production: 30/05/2023

3. General city information

Phidim Municipality was declared as municipality on 18th May 2014. It is in Panchthar District, Koshi Province in the eastern Nepal. It is divided into 14 political wards.

The municipality has a total population of 48,495 with 23,679 males and 24,816 females (Census 2021, n.d.). Out of total wards, ward number 1 has the largest population (8,944) while ward number 9 has the least population with (1,992). The municipality has a total of 12,336 households. Ward number 1 has the most households with a total of 2,558, while ward number 9 has the least number of households with a total of 496.

The municipality is located at an elevation of 1,756.48 metres above sea level. Phidim has a humid subtropical, dry climate (classification: Cwa). The district's average yearly temperature is 28.2ºC (82.76ºF).

4. Service outcome

The overview of different sanitation technologies across the sanitation value chain in the municipality is briefly explained in this section (ENPHO, 2022). Basic sanitation coverage in the municipality is 98.45% where, basic sanitation is defined as having access to facilities for the safe disposal of human waste (faeces and urine), as well as having the ability to maintain hygienic conditions, through services such as garbage collection, industrial/hazardous waste management, and wastewater treatment and disposal. The families without toilets defecate in open places, public toilets or use neighbour's toilet. All the households that have their own toilets depend on onsite sanitation systems.

Containment:

Different types of containment used to store faecal sludge in onsite sanitation systems are fully lined tanks (16%), lined tanks with impermeable walls and open bottom (33%) and unlined pits (49%). 2% of the households practise open defecation.

Emptying and Transportation:

There are no regular emptying practices of the containments. However, 10.57% of the households had emptied the containment at least once since installation. Both manual and mechanical desludging mechanism is practiced.

Treatment and Disposal:

The municipality lacks a faecal sludge treatment facility. The majority of FS emptied is used in agricultural lands untreated. Households using biogas digesters utilize its energy in cooking and other purposes.

The SFD graphic shows that 53% of the excreta generated are safely managed while 47% of the excreta generated are unsafely managed. The safely managed percentage of FS generated by 47% of the population is temporary until the tanks and pits become full and FS from the containment is emptied.

5. Service delivery context

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

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

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

6. Overview of stakeholders

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

Table 1: Overview of Stakeholders.

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

7. Credibility of data

The major data were collected from random household sampling (ENPHO, 2022). Altogether, 388 households and 59 institutions were surveyed from 14 wards of Phidim municipality. Primary data on emptying, transportation and current sanitation practices in the municipality were triangulated with the

data obtained from Key Informant Interviews (KIIs) with Municipal Officers, Chairperson and Manager of Phidim Water Users Committee and the operator of the public toilet. Also, a data sharing and validation workshop with key stakeholders was performed.

8. Process of SFD development

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

8. List of data sources

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

- ADB., A. D. (2021). Environmental Monitoring Report. Government of Nepal for the Asian Development Bank, Nepal: Third Small Towns Water Supply and.
- CBS. (2021). National Population and Housing Census 2021. Kathmandu, Nepal: Central Bureau of Statistics. Retrieved from chrome-extension:// https://censusnepal.cbs.gov.np/results /downloads/ward
- 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/.

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Abbreviations

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

1. City context

Phidim Municipality is in Panchthar District, Koshi Province of the eastern Nepal. It was declared as municipality on 18th May 2014. The municipality is divided into fourteen political wards. It covers 193 square kilometres of area. It is surrounded by Ilam District in the east, Tehrathum District and Kummayak Village Development Committee (VDC) in the west, Hilihang VDC and Falelung VDC in the north and Falgunanda VDC in the south (Ministry of Federal Affairs & General Administration, n.d.). Figure 1 shows the Geo-political map of Phidim Municipality.

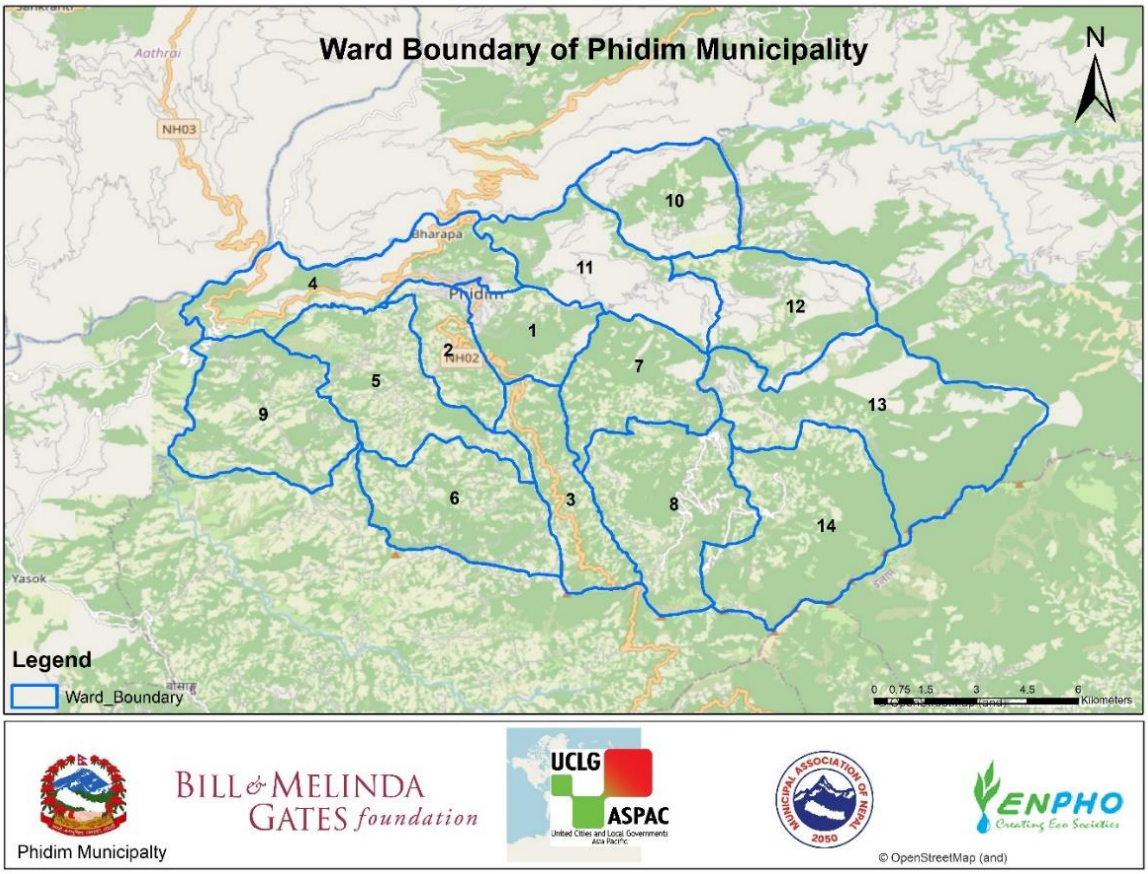

Figure 1: Map of Phidim Municipality with ward boundaries.

1.1 Population

The National housing and population census 2021 has reported 48,495 people who reside in the municipality. The total male and female population are 23,679 and 24,816 respectively (Table 1). The ward number 1 has the most residents (8,944), while ward number 9 has the fewest (1,992). The total number of households in the municipality is 12,336 (CBS, 2021).

Table 1: Ward Wise Household and Population Data.

Wards	Households	Population	Male	Female	Average Household Size
1	2,558	8,944	4,343	4,601	3.50
2	1,087	4,113	2,002	2,111	3.78
3	532	2,242	1,069	1,173	4.21
4	1,139	4,381	2,142	2,239	3.85
5	751	3,067	1,486	1,581	4.08
6	805	3,332	1,604	1,728	4.14
7	654	2,658	1,298	1,360	4.06
8	745	3,002	1,437	1,565	4.03
9	496	1,992	980	1,012	4.02
10	614	2,638	1,280	1,358	4.30
11	724	2,943	1,447	1,496	4.06
12	766	3,199	1,566	1,633	4.18
13	754	3,124	1,565	1,559	4.14
14	711	2,860	1,460	1,400	4.02
Total	**12,336**	**48,495**	**23,679**	**24,816**	**3.93**

(CBS, 2021)

1.2 Climate

The climate is warm and temperate. The precipitation during summer is significantly higher in comparison to winter. The climate is classified as Cwa according to Köppen and Geiger (Classification: Cwa: C = Mild temperate w = Dry winter a = Hot summer). The district's average yearly temperature is 28.2 °C. The precipitation level on a yearly basis amount to 3,058 mm (120.4 inch) as per meteorological records (Weather and climate, n.d.).

1.3 Topography

Phidim Municipality is located at 27.12° N latitude, 87.76° E longitude with an elevation of 1,756.48 metres above sea level (Worldwide elevation map, n.d.).

The elevation of the district ranges from 1,000 to 4,000 metres. As a result of the elevation differences, the district has two different climates: sub-tropical climate from 1,000 to 2,000 metres and temperate climate above 2,000 metres (Ministry of Science, n.d.).

2 Service Outcomes

2.1 Overview

Data on sanitation situation were collected through household and institutional surveys (ENPHO, 2022). A total of 388 households were sampled from 12,336 households distributed in 14 wards (further details are presented in section 4). The results obtained after the triangulation and validation of the data with all the data sources including literature reports, Key Informant Interviews (KIIs) and a validation workshop is presented in this section.

2.1.1 Sanitation Status

Panchthar District was declared an Open Defecation Free (ODF) zone on 24th January 2014 (ODF Declaration, 2019). It suggests that everyone has access to basic sanitation facility, basic sanitation facilities are defined as functional improved sanitation facilities separated for males and females on or near the premises. Whereas Basic Sanitation is defined as having access to facilities for the safe disposal of human waste (feces and urine), as well as having the ability to maintain hygienic conditions, through services such as garbage collection, industrial/hazardous waste management, and wastewater treatment and disposal. However, the sanitation situation assessment conducted by ENPHO in 2022 showed that the municipality's basic sanitation coverage is 98.45% (ENPHO, 2022), while the remaining households still defecate in the forests or open spaces.

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) whereas 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 a sewer technology for transport (Susana, 2018).

Onsite sanitation systems are prevalent in the municipality. 100% of surveyed households rely on onsite sanitation technologies in the municipality. Figure 2 shows the availability of basic sanitation coverage in the municipality.

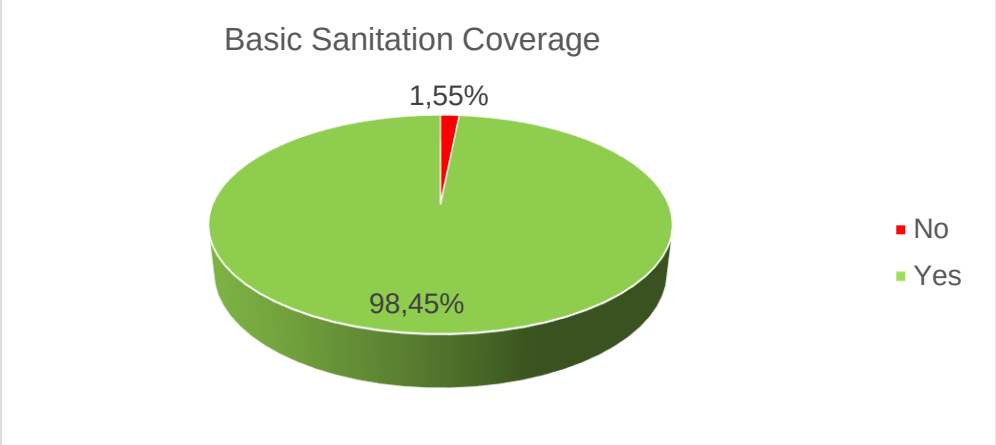

Figure 2: Availability of basic Sanitation Coverage in Phidim Municipality.

2.1.2 Types of Containment

The different types of containment installed to store faecal sludge is explained as follows.

9.16% of households use fully lined tanks in their houses that are rectangular in shape with no outlets or overflow to discharge effluent which is used to safely store faecal sludge. The walls and bottom of the tanks are totally lined and sealed. Figure 3 shows the types of fully lined tanks constructed in a household at Phidim Municipality.

Figure 3: Fully Lined Tank.

Also, 7.85% of the households in the municipality connected their toilet to a biogas digester that uses natural anaerobic decomposition of organic matter under controlled conditions. The digester is usually a large, sealed container for organic matter such as manure from livestock, green waste from agriculture, sewage or food waste which is digested by bacteria in the absence of oxygen to produce a gas containing methane and carbon dioxide. The gas is piped away from the digestor and burnt to produce heat energy. Figure 4 shows a biogas digester built in a household at Phidim Municipality.

Figure 4: Biogas Digester.

32.98% of the households in the municipality have built lined tanks with impermeable walls and open bottom, which are rectangular in shape where the walls of the tanks are lined with plaster or concrete wall and the bottom of the tanks is not lined, just left as it is or with soiling that allows infiltration of effluents.

Figure 5 shows an unlined pit installed at household level. 50.00% of the households in the municipality use unlined pits. An unlined pit is a containment constructed with mud mortar stone or brick wall or dry-stone walls and open bottom or could be of no lining. An unlined pit with dry stone wall is popular in the rural areas of the municipality.

Figure 5: Unlined Pit installed in the household at Phidim Municipality.

Table 2 shows the percentage of households with different types of containments in the municipality.

Table 2: Types of containments in households of Phidim Municipality (ENPHO, 2022).

Containments	Percentage of Households
Fully lined tank	9.16%
Biogas Digester	7.85%
Lined tank with impermeable walls and open bottom	32.98%
Unlined Pit	50.00%
Total	**100.00%**

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

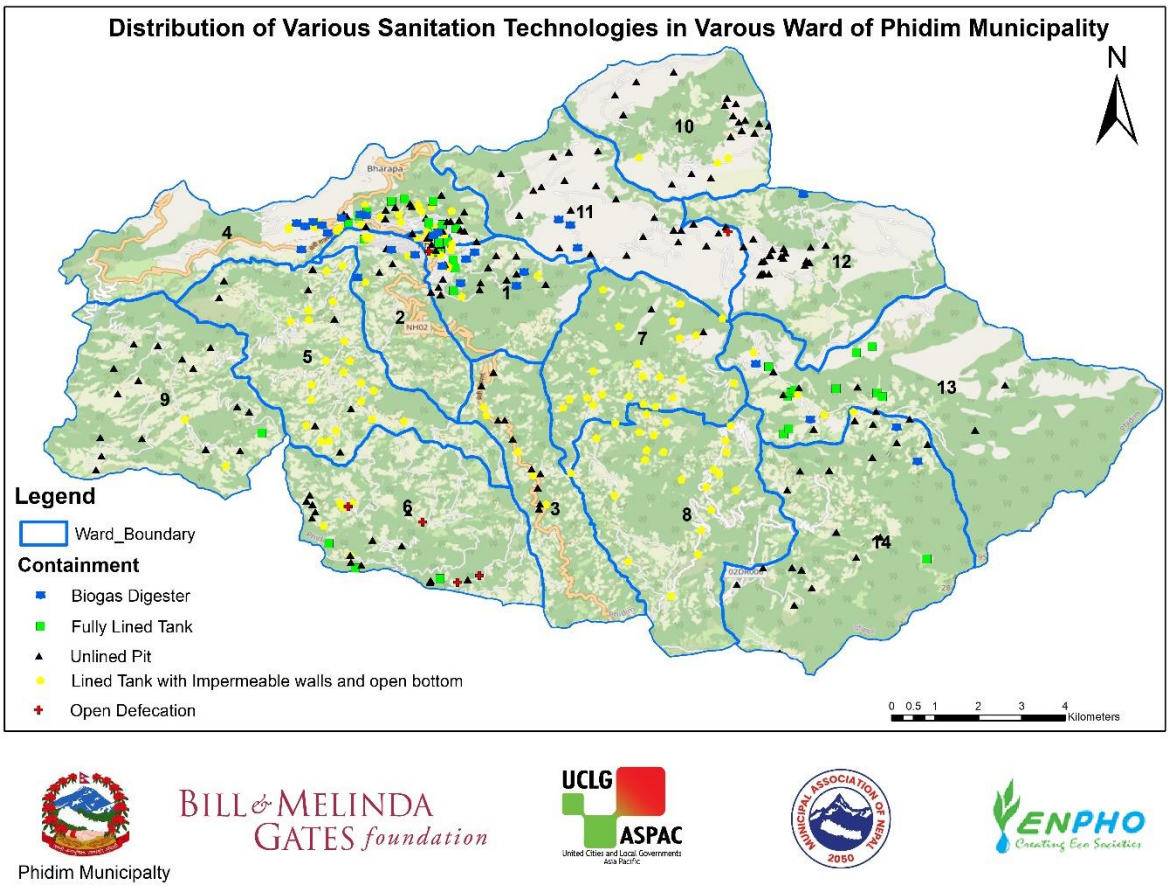

Figure 6: Sanitation Technologies installed in household levels (ENPHO, 2022).

The types of household containments in the municipality are re-categorized to match the containments defined by Shit Flow Diagram Promotive Initiative (SFD PI). The anaerobic biogas digester used to treat household organic waste is also utilized by households to store and treat their faecal sludge. For the purpose of generating the SFD graphic, the biogas digester is modelled as a fully lined tank. Table 3 shows types of containment re-categorized according to the SFD PI.

Table 3: Types of containment re-categorized according to Shit Flow Diagram Promotive Initiative (SFD PI) (ENPHO, 2022).

Types of Containments	Percentage of Households
Fully Lined Tank	16%
Lined Tank with Impermeable walls and open bottom	33%
Unlined pit	49%
Open Defecation	2%
Total	**100%**

2.1.3 Emptying and Transportation

Emptying is one of the major components of the sanitation value chain. It ensures proper functioning of containment basically for septic tank which functioned well until the volume of sludge is one-third of the total column of the tank. Also, in other containments, regular emptying prevents overflow of the sludge and blockages (Linda Strande, 2014).

10.57% of the surveyed households have emptied the containment at least once since installation through manually or mechanical emptying services, whereas 87.89% of the households did not empty their containment as it has not been filled yet. Table 4 represents the overall emptying percentage of containment at least once since installation.

Table 4: Overall Emptying percentage of Containment at least once since installation (ENPHO, 2022).

Containment	Never emptied	Emptied at least once	Not applicable
Biogas Digester	0.00%	7.73%	0.00%
Fully Lined Tank	8.25%	0.77%	0.00%
Lined Tank with Impermeable walls and open bottom	30.93%	1.55%	0.00%
Open Defecation	0.00%	0.00%	1.55%
Unlined Pit	48.71%	0.52%	0.00%
Total	**87.89%**	**10.57%**	**1.55%**

Figure 7 represents the map of Phidim Municipality showing the status of sanitation technology that has been emptied at least once.

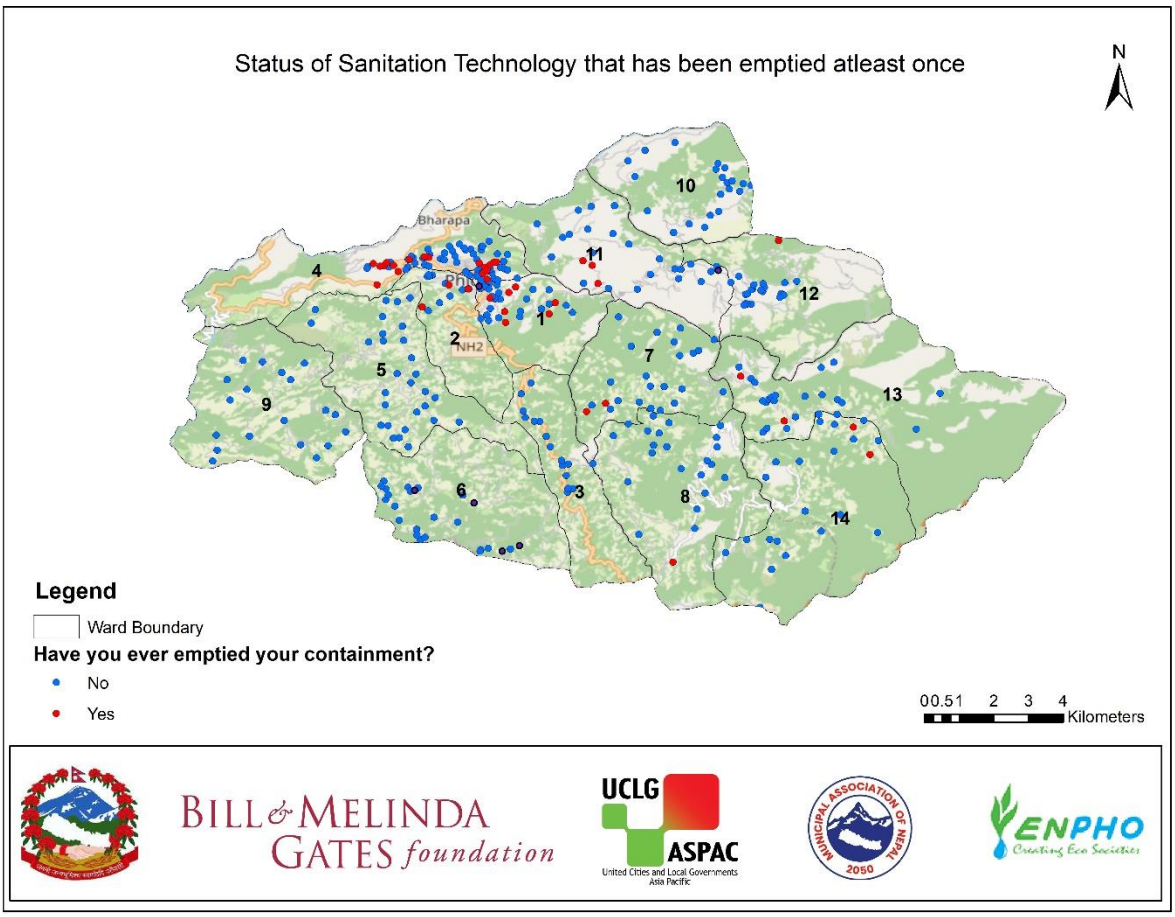

Figure 7: Status of household which have emptied their containment at least once.

The municipality has its own desludging vehicle with a capacity of 5,000 litres. It has been providing services since 2018 in urban areas of Phidim Municipality as well as other municipalities. One driver and one helping staff works in the desludging vehicle. The staff do not have any uniforms but are equipped with gloves, boots and masks for safety during work. It charges NPR 6,000 to 7,000 (USD 45 to 53) per trip for the rectangular or circular containments which also varies according to travel distance (KII-5, 2022). Figure 8 shows the desludging vacuum truck available in Phidim Municipality.

Figure 8: Mechanical Desludging Vehicle available in Phidim Municipality.

2.1.4 Treatment and Disposal/Reuse

Phidim Municipality does not have any form of treatment plant for faecal sludge. However, the municipality has its own dumping site far from the human settlement where all collected Faecal Sudge (FS) is dumped through Trenching Method. Trenching is a simple technology used to dispose of the waste removed from onsite sanitation systems in the absence of, or while awaiting more appropriate treatment facilities. It enables disposal of such waste in a controlled manner, while mitigating and minimizing odours, nuisances, and risk of exposure to pathogens. It is a preferred method when offered as an alternative to disposing of wastes in an open environment or water bodies.

After the manual emptying, the majority of FS emptied is disposed of through dig and dump method, while the remaining percentage of FS emptied is applied in farmlands, which are both considered as an unsafely managed practice. Figure 9 shows the percentage of disposal practice of FS after manual emptying in the municipality.

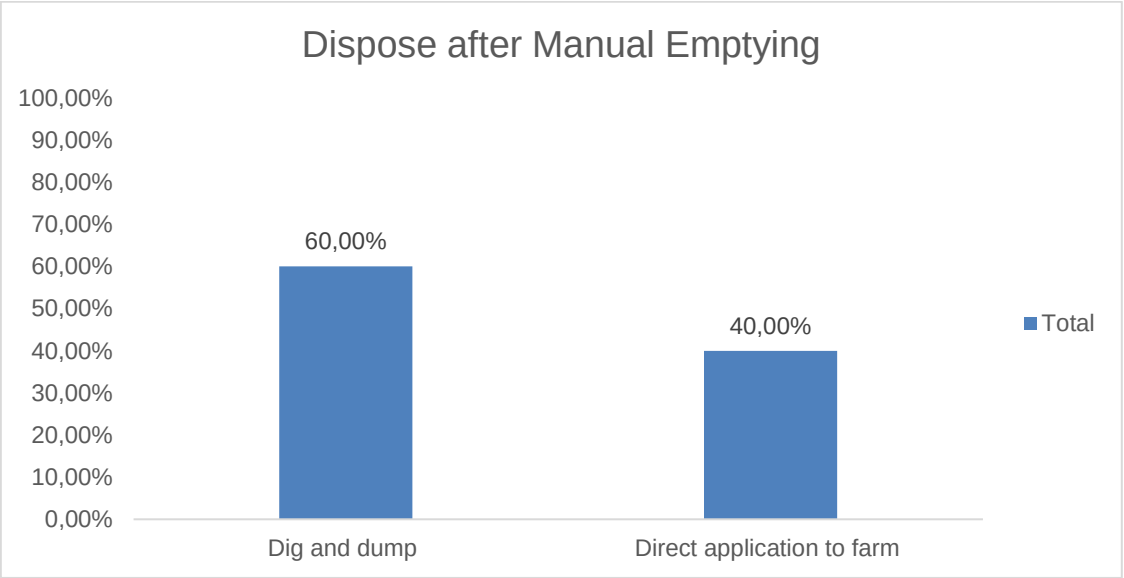

Figure 9: Disposal of manually emptied faecal sludge (ENPHO, 2022).

2.1.5 Sanitation System at Institutional Level

Altogether 59 institutions from educational institutions, governmental and non-governmental offices, health care centres and hotels were assessed randomly. It was revealed that 100% of such buildings had connected their toilet to onsite sanitation technologies. The percentage of types of onsite sanitation technologies in these buildings are shown in figure 10.

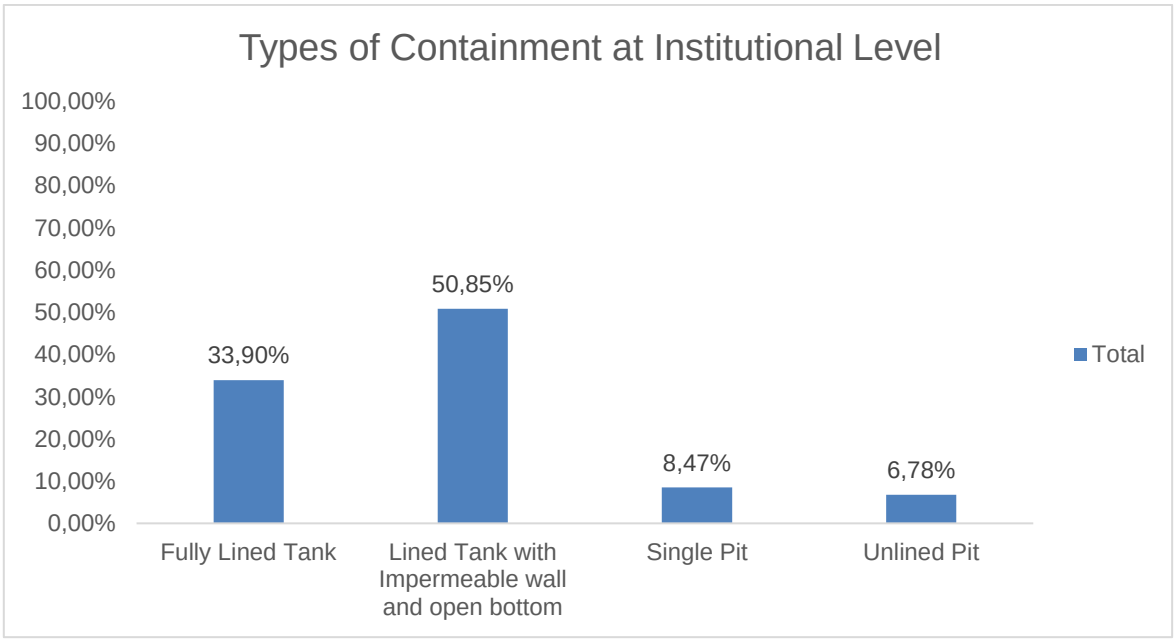

Figure 10: Types of containment in institutions of Phidim Municipality (ENPHO, 2022).

All the surveyed institutions have not emptied their containments as they were not filled yet. Distribution of different types of onsite sanitation technologies of institutions in various wards of Phidim Municipality is shown in figure 11.

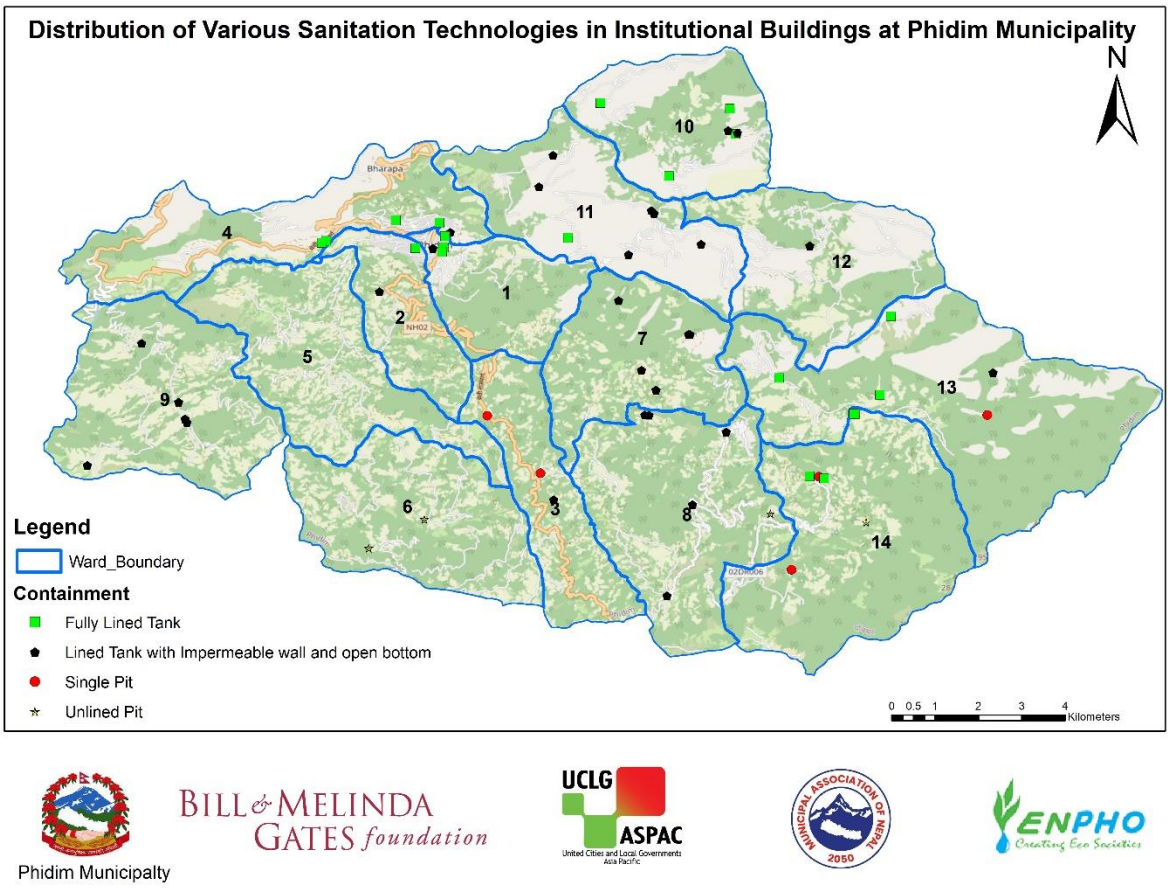

Figure 11: Types of onsite sanitation systems in institutions of Phidim Municipality (ENPHO, 2022).

2.1.6 Public Toilets

Phidim Municipality has three public toilets, two of them are operated by the local community and one public toilet that lies near the bus park is operated by the municipality.

Public toilet 1 is located near the temple area which is used by devotees which is constructed by Second Small Town Water Supply and Sanitation Sector Project. Public Toilet 2 is located at the side of highway near the Laxminarayan Temple near highway which is mostly used by the travellers and devotees. Both toilets were not in good condition during the time of monitoring.

Public toilet 3 lies near the bus park which is operated by the municipality through an operator who runs a small business in the same building. The toilet consists of one female and one male compartment with one bathroom. The toilet is mostly used by passengers, drivers and local shopkeepers (KII-1, 2022).

Figure 12: Public Toilets available in Phidim Municipality.

2.1.7 Risk 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 the aquifer with regards to lateral spacing between sanitation system and groundwater sources.

2.1.8 Source of Drinking Water and Water Production

a) Water Supply:

For the past 25 years, Phidim Drinking Water Supply Users Committee has been providing piped drinking water in urban areas of the municipality, which are wards 1, 2, and 4. The water is collected from four spring sources i.e., Atawa Khola, Nandu Khola, Barmeli and Sisne Khola. The system consists of a conventional treatment plant equipped with a grit chamber, a sedimentation tank, an slow sand filter and a chlorination unit. The water is collected in one 400 m^3 reservoir tank, three 50 m^3 reservoir tanks and one 30 m^3 reservoir tank for distribution (Bhattarai, 2022). Altogether 2,400 households have piped drinking water supply from this system and it is planned to distribute this system to more households. The User's Committee

is supported technically and financially by the Second Small Town Water Supply and Sanitation Sector Project (ADB., 2021) Figure 13 shows the conventional water treatment plant.

Figure 13: Conventional Water Treatment Plant available in the Municipality.

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

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

However, most households in the municipality rely on spring sources for drinking water supply. 62.37% of the households in the municipality depend on spring water source for drinking and other daily activities. The remaining households depend on private and public taps for drinking and a small percentage of the population depend on groundwater as well. Figure 14 shows the various sources of drinking water available in the municipality.

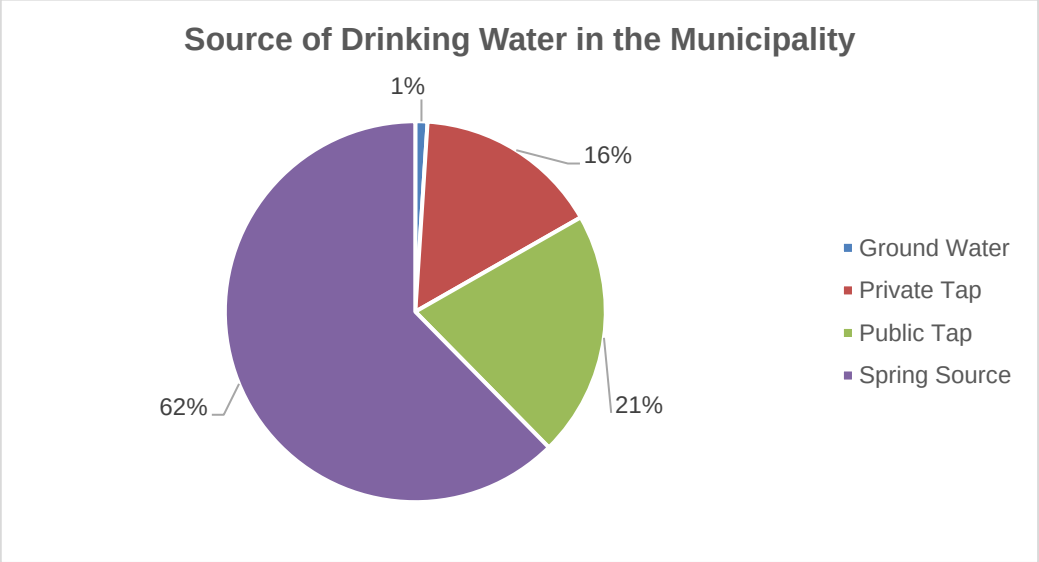

Figure 14: Types of Sources of Drinking Water in the Municipality (ENPHO, 2022).

Nevertheless, population using spring sources (located near residential areas with high percentage of households having lined tanks with open bottom and unlined pits) as major source of drinking water without using any form of point of use options are considered at significant risk. Therefore, 21% of the population use lined tanks with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution (T2A4C10) and 16% of the population relying on unlined pits, no outlet or overflow, where there is a 'significant risk' of groundwater pollution (T2A6C10).

2.2 SFD Selection Grid

Types of sanitation technologies selected in the SFD selection grid in the municipality are shown in Figure 15. The vertical column in the left side of the SFD selection grid has a list of technologies to which the toilet is connected to and open defecation in case of households without toilet. Similarly, horizontal row at the top of the selection grid shows options for connection for outlet or overflow discharge from toilet.

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

Figure 15: SFD selection grid for Phidim Municipality.

A brief explanation of terms used to indicate different frames selected in the SFD selection grid in Figure 15 is explained in Table 5.

Table 5: Explanation of terms used to indicate different frame selected in the SFD selection grid in Figure 15.

T1A3C8	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults (consequently the excreta are potentially more toxic than the excreta in a septic tank). Since the tank is fitted with a supernatant/effluent overflow connected to open ground the excreta in this system are considered NOT contained.
T1A3C10	A correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. Since the tank is not fitted with a supernatant/effluent overflow this system is considered contained.
T1A4C6	This is a correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. 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 are 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 are considered not contained.
T1A4C10 (Low Risk)	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. However, since the tank is not fitted with a supernatant/effluent overflow this system is considered contained.

T2A4C10 (High Risk)	This is a correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta are 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. The tank is NOT fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered NOT contained.
T1A6C10 (Low Risk)	This is a correctly designed, properly constructed and well-maintained unlined pit with permeable walls and base, through which infiltration can occur. The tank is NOT fitted with a supernatant/effluent overflow so this system is considered contained.
T2A6C10 (High Risk)	This is a correctly designed, properly constructed and well-maintained unlined pit with permeable walls and base, through which infiltration can occur. The tank is NOT fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered NOT contained.

2.2.1 SFD Matrix

SFD matrix is the second step to generate SFD graphics. The 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:

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

Here, data for each selected sanitation system on the SFD Matrix is entered. The proportion of the contents of each type of onsite container (either septic tanks; or fully lined tanks (sealed); or lined tanks with impermeable walls and open bottom and all types of pits), is shown in Figure 16. The proportion of FS emptied (F3) is obtained from KIIs. The FS delivered to treatment and treated is shown in columns F4 and F5, respectively.

The municipality does not have any form of treatment plant to treat faecal sludge. The FS emptied from the containments is dumped of openly in farmlands or water bodies. Thus, values for variables F4 and F5 for all sanitation systems are set to 0%. However, FS from anaerobic biogas digesters, classified as fully lined tanks (system T1A3C10) that accounts for 91% of the total fully lined tanks, is considered as transported and treated with a treatment efficiency estimated at 95% (F5=95%). Values for supernatant (S4e and S5e) were also set to 0% in lined tanks connected to drains (T1A4C6). Figure 16 shows the SFD matrix of Phidim Municipality.

Phidim Municipality, Koshi, Nepal, 30 May 2023. SFD Level: 2 - Intermediate SFD
Population: 48495
Proportion of tanks: septic tanks: 100%, fully lined tanks: 100%, lined, open bottom tanks: 100%

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
T1A3C10 Fully lined tank (sealed), no outlet or overflow	15.0	51.0	91.0	95.0		
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	7.0	7.0	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	4.0	6.0	0.0	0.0		
T1A6C10 Unlined pit, no outlet or overflow	33.0	1.0	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	21.0	3.0	0.0	0.0		
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	16.0	0.0	0.0	0.0		

Figure 16: SFD Matrix of Phidim Municipality.

2.2.2 SFD Matrix Explanation

The sanitation technologies and the corresponding percentage of the population using such technologies are shown in Figure 16 (SFD Matrix). These values are derived from the household survey (ENPHO, 2022).

2.2.3 Proportion of FS Emptied and Transported

The proportion of faecal sludge emptied (F3) is calculated based on percentage containment emptied (ENPHO, 2022) and amount of FS emptied during the process (KII-5, 2022). The information on FS emptied from containment is obtained from Key Informant Interviews (KIIs) with desludging service providers. As per the desludging service provider portion of liquid in the FS is high which can be easily pumped out by the desludging vehicle. So, almost 90% of the FS content in the containment is removed during emptying. Hence, actual proportion of FS emptied from each containment is calculated as:

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

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

Table 6: Sanitation Technologies and Proportion of Faecal Sludge Emptied (ENPHO, 2022[(1)]; KII-5, 2022[(2)]).

S.N.	Sanitation Technologies	SFD Reference Variable	Percentage of Emptied Containment [(1)]	Proportion of FS emptied during emptying [(2)]	F3
1	Fully lined tank (sealed) connected to open ground	T1A3C8	0.00%	90%	0%
2	Fully lined tank (sealed), no outlet or overflow	T1A3C10	56.73%	90%	51%
3	Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	T1A4C6	0.00%	90%	0%
4	Lined tank with impermeable walls and open bottom, connected to open ground	T1A4C8	6.50%	90%	6%
5	Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	7.43%	90%	7%
6	Unlined pit, no outlet or overflow	T1A6C10	1.58%	90%	1%
7	Open defecation	T1B11 C7 TO C9	0.00%	90%	0%
8	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A4C10	3.67%	90%	3%
9	Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A6C10	0.00%	90%	0%

2.3 Summary of Assumptions

Onsite Sanitation System:

- ✓ The proportion of FS in septic tanks was set to 100%, the proportion of FS in fully lined tanks was set to 100% and the proportion of FS in lined tanks with impermeable walls and open bottom and all types of pits was set to 100% according to the relative proportions of the systems in the municipality, as per the guidance given in the Frequently Asked Question (FAQs) in the sustainable Sanitation Alliance (SuSanA) website.
- ✓ Variables F3, F4 and F5 for all onsite sanitation systems were derived from the HH survey and cross-checked with KIIs conducted.
- ✓ The municipality does not have any form of treatment plant to treat faecal sludge. The FS emptied from the containments is dumped openly in farmland or water bodies. Thus, variables F4 and F5 for all sanitation systems are set to 0%. However, FS from anaerobic biogas digesters, classified as fully lined tanks (system T1A3C10), is considered as transported (F4 = 91%) and treated with a treatment efficiency estimated at 95% (F5 = 95%). Values for supernatant (S4e and S5e) were set to 0% in lined tanks connected to drains (T1A4C6).

2.4 SFD Graphic

Figure 17 shows the SFD graphic for Phidim Municipality. In the graphic, the percentage of FS and wastewater (WW) indicated by colour green represents safely managed excreta (53%) whereas the percentage in colour red represents unsafely managed excreta (47%). Figure also represents the sanitation value chain going from left to right.

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

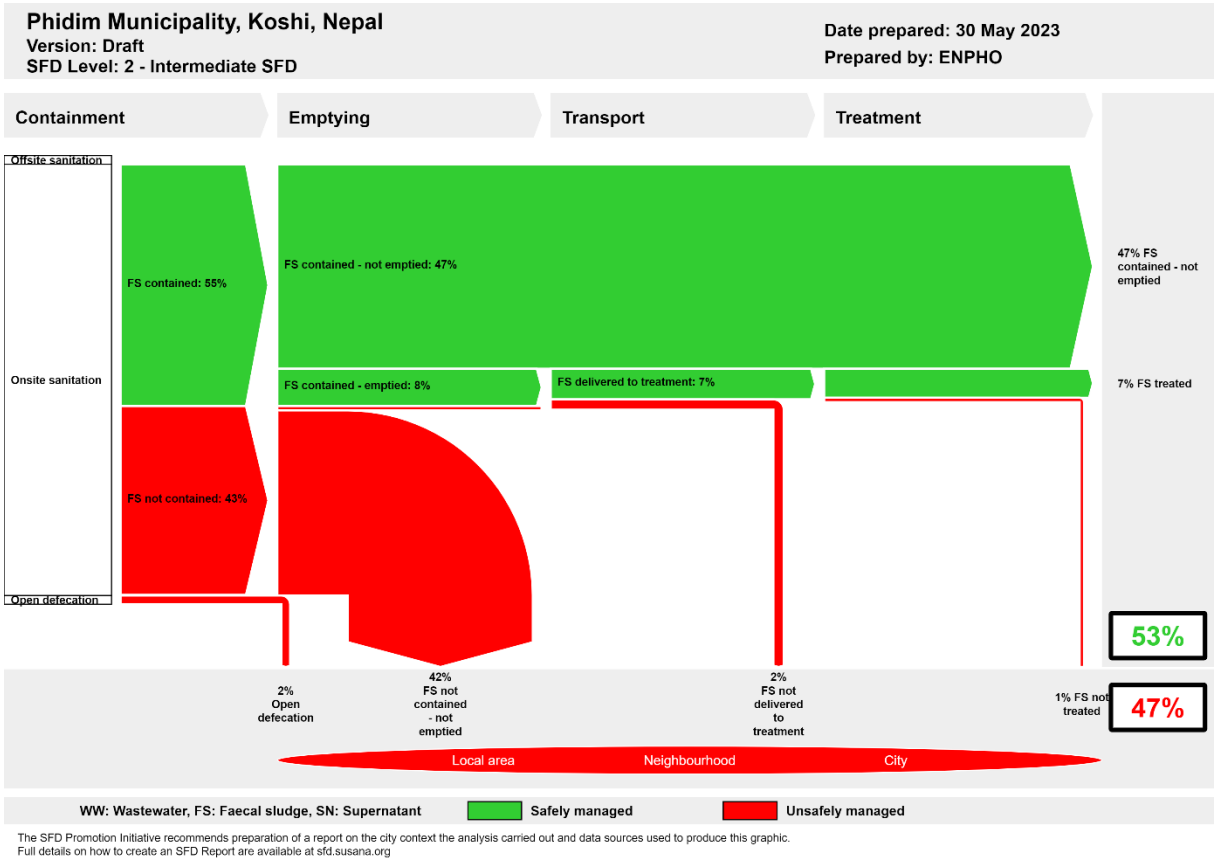

Figure 17: SFD graphic of Phidim Municipality.

The faecal sludge that is safely managed is further segregated as 47% of FS which is safely collected in the containment which has not been emptied. This 47% of safely managed FS should be considered as only temporary, as most of the pits and tanks have not yet filled up and the FS generated remains 'not emptied'. Therefore, these systems will require emptying services in the short and medium term as they fill up. The remaining 7% corresponds to FS safely treated and managed in the biodigesters.

The FS that is unsafely managed is divided into: FS emptied but not delivered to treatment (2%) which is unsafely disposed of into the environment and FS not contained - not emptied (42%), having a risk of groundwater contamination through seepage. A further 1% corresponds to FS not treated from the biodigesters.

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

Off-site Sanitation

Nepal Multiple Indicator Survey (MICS) reported that among the total households in Nepal, 10.7% of households has a toilet connected to sewer network and in Koshi province it is only 2% (CBS, 2020). However, there is no sewer network available in the municipality. All the surveyed households depend on onsite sanitation systems.

Onsite Sanitation

100% of the population relies on onsite sanitation systems. Among them, 55% are using technically effective containment that safely stores faeces and 43% use unsafe containment. Phidim Municipality does not have a treatment plant, but there is a designated land for disposal of the FS after mechanical emptying, which was confirmed by the information collected during the KII with the municipal officer (KII-1, 2022). The majority of FS emptied is delivered to the designated dumping site after mechanical emptying whereas manual emptied FS is disposed to open land or farmlands. The description on the fate of FS from the onsite sanitation systems as shown in the SFD graphic is explained in Table 7.

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

Variables	Description	Percent
FS contained	Faecal sludge that is contained within an onsite sanitation technology which is technically effective.	55%
FS not contained	Faecal sludge that is stored in an unsafe onsite sanitation technology.	43%
FS contained - not emptied	FS that is contained within an onsite sanitation technology and not removed where there is no significant risk to groundwater pollution. These containments are fully lined tanks (sealed), no outlet or overflow (T1A3C10), fully lined tanks with impermeable walls and open bottom without outlet or overflow (T1A4C10) and unlined pits (T1A6C10) without significant risk to groundwater.	47%
FS contained - emptied	FS that is contained in onsite sanitation technology and emptied either mechanically or manually.	8%
FS not contained - emptied	FS that is not contained within an onsite sanitation technology and not removed which may either remain in the containment or infiltrate to ground polluting groundwater.	42%
FS - treated	FS treated in a well functioned anaerobic biogas digester.	7%
FS not delivered to treatment	FS emptied from an onsite sanitation system is either FS contained or not but is not delivered to the treatment plant.	2%
FS not treated	FS emptied from an onsite sanitation system but is not delivered to the treatment plant.	1%

Open Defecation

Nepal Multiple Indicator Survey (MICS) reported that among the total households in Nepal, 5% of households still practice open defecation and only in Koshi Province it is 3% (CBS, 2020). Despite ODF status, people residing in 2% of households still go for open defecation outside in the vicinity of forests and other open spaces. This population with a high defecation rate is economically underdeveloped (ENPHO, 2022).

3 Service delivery context

3.1 Policy, legislation, and regulation

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

Local Government Operation Act, 2017

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

Environment Protection Act, 2019

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

Water Supply and Sanitation Act, 2022

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

Environment Friendly Local Governance Framework 2013

The environment-friendly local governance framework 2013 has been issued to add value to environment-friendly local development concept encouraging environmental protection through local bodies. The framework has set basic and advanced indicators for households, settlement, ward, village, municipality, and district levels for declaration of environment friendly. The use of water sealed toilets in households as basic indicators for sanitation and health. Provision of toilet with safety tank and use as advanced indicators for sanitation. Provision of gender, children and disabled friendly public toilets in parks, petrol pumps and

main market as basic indicator for municipal level. Advance indicators such as drainage discharged only after being processed through biological or engineering technique. While it has failed to identify the necessity of faecal sludge treatment plants as it has assumed safety tank in the households is sufficient for treating faecal sludge.

Institutional and Regulatory Framework for Faecal Sludge Management, 2017

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

Total Sanitation Guideline, 2017

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

3.1.1 Policies

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

challenges and issues with the adoption of new approaches and resolve the inconsistency in RWSSNP and NUWSSSP.

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

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

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

3.1.2 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, 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 18.

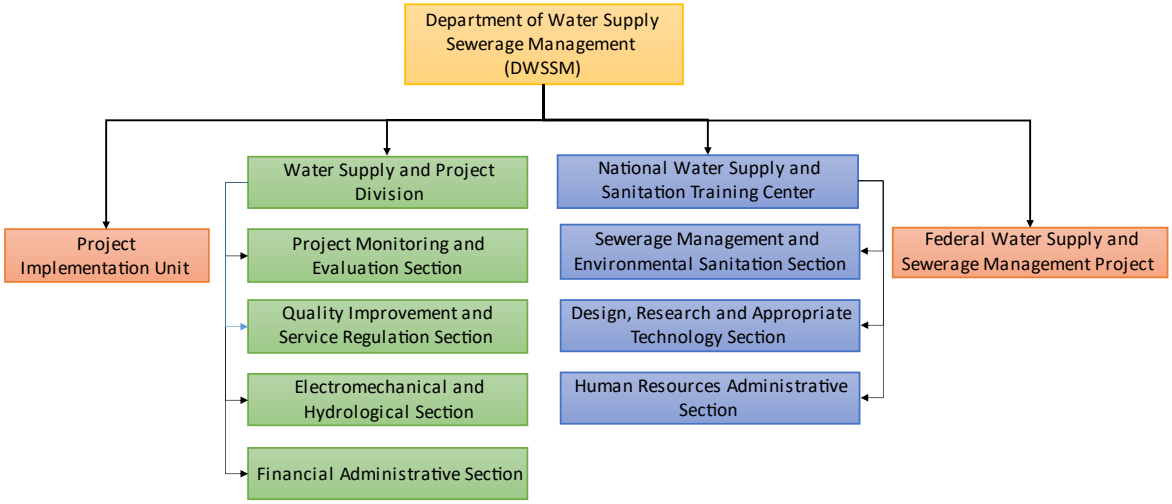

Figure 18: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).

At Provincial Level

Ministry of Physical Infrastructure: Ministry of physical infrastructure of provincial government in Madesh Province is major executing body in the province. Planning and implementation of water supply and sanitation infrastructure 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 the terai region, 3,000 to 5,000 in hilly region and 500 to 1,000 in Himalayan region.

3.1.3 Service Provision

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

3.1.4 Service Standards

The sanitation service standards have set by Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (2016-2030). It classifies sanitation services as high, medium, and basic based on sanitation facilities in place. The sanitation service levels with indicators are shown in Table 8. However, FSM specific standards have yet to be developed and implemented.

Table 8: Sanitation Service Level and its Components.

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

3.2 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 SDGs which has been reaffirmed in key documents such as the current 15th development plan and the 25-year long-term vision 2100 that internalizes the sustainable development goals (NPC, 2020). The SDGs codes are assigned for all national development programs through the Medium-Term Expenditure Framework (MTEF). The MTEF sets out three-year spending plans of the national and provincial governments which aims to ensure that budgets reflect social and economic priorities and give substance to reconstruction and development commitments (NPC, 2020). Further, Nepal has prepared the SDG status and roadmap to localize the SDG indicators with baselines and targets for 2030. Nepal has set the following target and indicator focused on sanitation based on global SDGs as shown in Table 9.

Table 9: National SDG target and indicator on sanitation.

National SDG Target and Indicator	2015	2019	2022	2025	2030

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

4 Stakeholder Engagement

4.1 Key Informant Interviews (KIIs)

KIIs and objective sharing of the study were conducted with the major stakeholders of sanitation sector of the municipality. Interviews were performed with Mr. Bhim Karki and Mr. Hang Narayan Hangsarumba, Assistant of Phidim Municipality for sanitation and desludging activities, planning and other activity that is going on sanitation sector and Mr. Gajadhar Bhattarai and Mr. Chabi Karki, Chairpeson and Manager of Phidim Drinking Water Uses Committee. Table 10 shows the KIIs with the Municipal officers, Water Users committee and Desludgers (Figure 19).

Table 10: List of Key Informant Interviewed personnel.

S.N.	Name	Designation	Organization	Purpose of KII	Date
1.	Bhim Kari (KII-1)	Assistant	Phidim Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	14th October, 2022
2.	Hang Narayan Hangsarumba (KII-2)	Assistant Officers	Phidim Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	14th October, 2022
3.	Gajadhar Bhattarai (KII-3)	Chairperson and Manager	Phidim Water Users Committee	Supply and demand of water, water sources, groundwater contamination risk	14th October, 2022
4.	Chabi Karki (KII-4)	Manager	Phidim Water Users Committee	Supply and demand of water, water sources, groundwater contamination risk	14th October, 2022
5.	Mr. Man Bahadhur Darji, (KII-5)	Driver (Desludger)	Phidim Municipality	Emptying practices, finances, requirement, disposal and treatment	14th October, 2022

Figure 19: KII with member of Private Desludging Service Provider.

4.2 Household Survey

Household survey was conducted in all wards of the municipality through mobilization of enumerators selected by the municipality. The enumerators were given two days orientation about sanitation and methods for conducting HH survey. The household survey was conducted using mobile application “KOBOCOLLECT” after orientation. SFD team members along with municipal focal person went on field visits 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= no/(1+ (no-1)/N).

Where,

Z^2	1.96	At the confidence level of 95%
p	0.5	Assuming that about 50% of the population should have some sanitation characteristics that need to be studied (this was set at 50% since this percentage would yield the maximum sample size as the percentage of the population practising some form of sanitation is not known at the intervention sites).
q	1-p	
e	+/-5%	Level of precision or sampling error.
N		A total number of population (households in the municipality).

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

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

Thus, a total of 388 households were sampled from 12,336 households distributed in 14 wards with proportionate stratification random sampling which is shown in Figure 20.

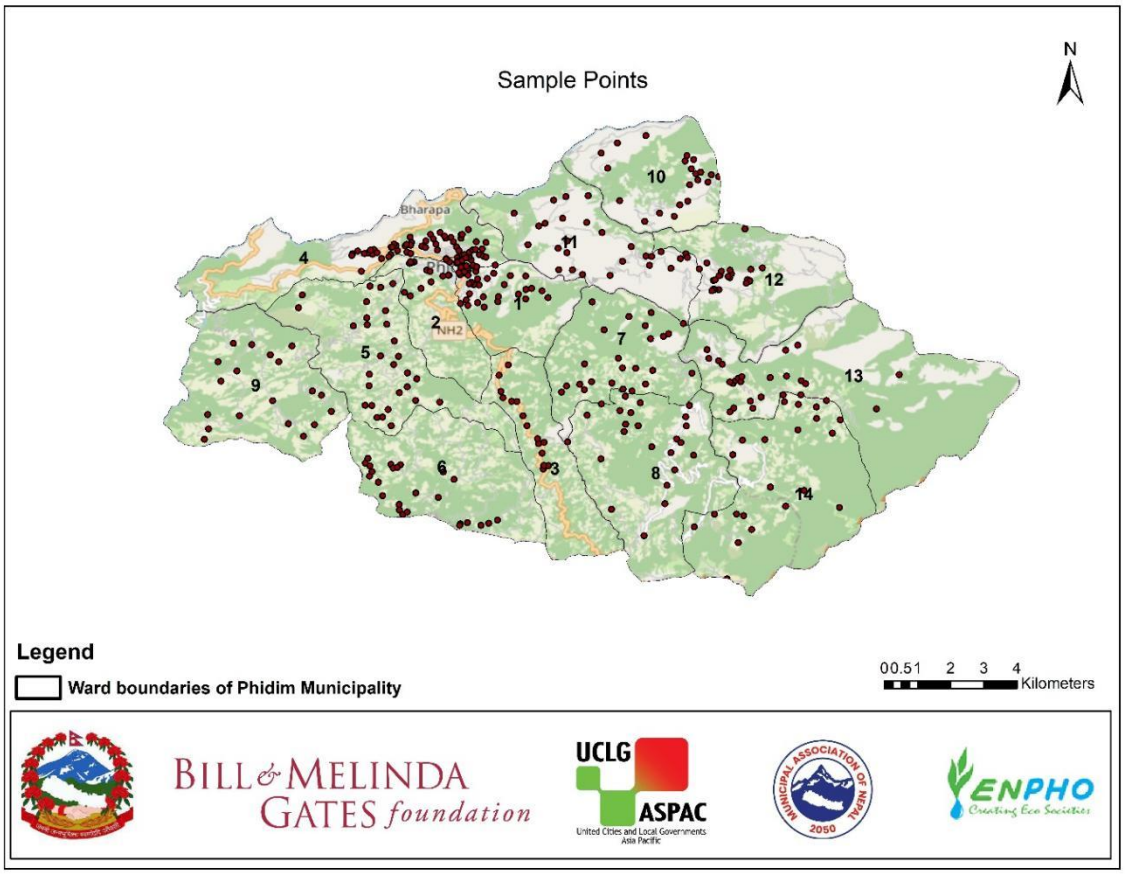

Figure 20: Distribution of sampling points in different wards of Phidim Municipality.

4.2.2 Direct Observation

Various sanitation technologies in the households in all the wards were observed and visual references were kept in Figure 21. Also, observation of the toilets, water sources, strom water drainage, containments and transportation of faecal sludge were carried out.

Figure 21: Direct Observation Survey in the Municipality.

4.3 Sharing and Validation of Data

The sharing and validation of findings on sanitation status were conducted in the municipality hall in participation of the Mayor, Deputy Mayor, Ward Chairpersons, Municipal Officers, General members of the municipal council and other relevant stakeholders. The participants agreed upon the findings of this study that showed the current sanitation status of the municipality and provided valuable suggestions (Figure 22). The list of participation with their designation is attached in Appendix 2.

Figure 22: Sharing and Validation at Phidim Municipality.

5 Acknowledgements

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

We offer our sincere gratitude to Mr. Mitra Prasad Kafle, Mayor, Mr. Radha Krishna Neupane, Deputy Mayor, Mr. Prabinhang Yonghang, Chief Administrative Officer of Phidim Municipality. We would also like to thank Mr. Bhim Karki, Assistant and Mr. Hang Narayan Hangsarumba, Assistant Officers and staff of Phidim Municipality for their remarkable support during the study.

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

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We are grateful to the enumerators, Mr Binod Kafle, Mrs Dharana Nembang, Mrs Santoshi Tamang, Mrs Samiksha Bajgain, Mrs Puspa Gautam, Mr Hari Khanal, Mrs Nilu Ghimire, Mr Rajan Neupane, Mrs Ishara Limbu, Mr Mausam Nembang, Mrs Yam Maya Kepchhaki, Mrs Sunita Magar, Mrs Sarada Rai and Mrs Jusmi Shrestha.

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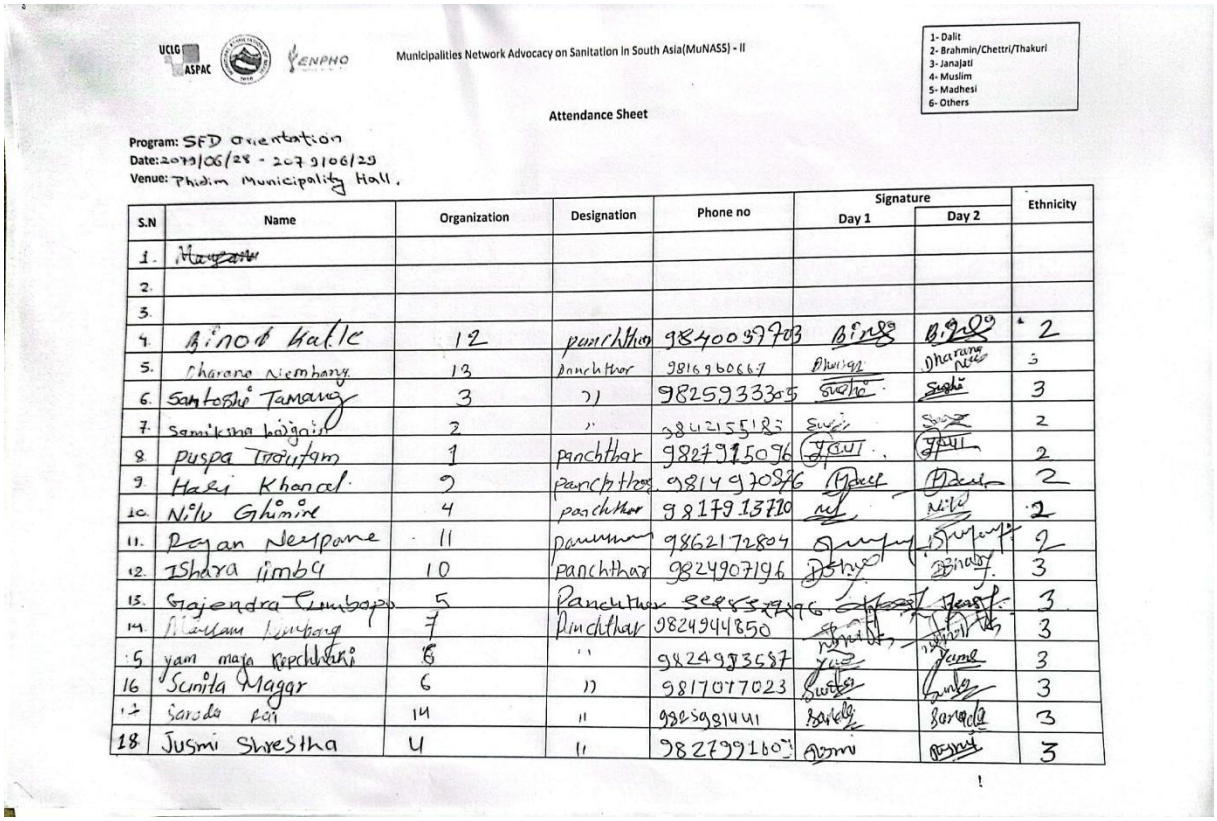
7 Appendix

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



UCLG ASPAC | ENPHO

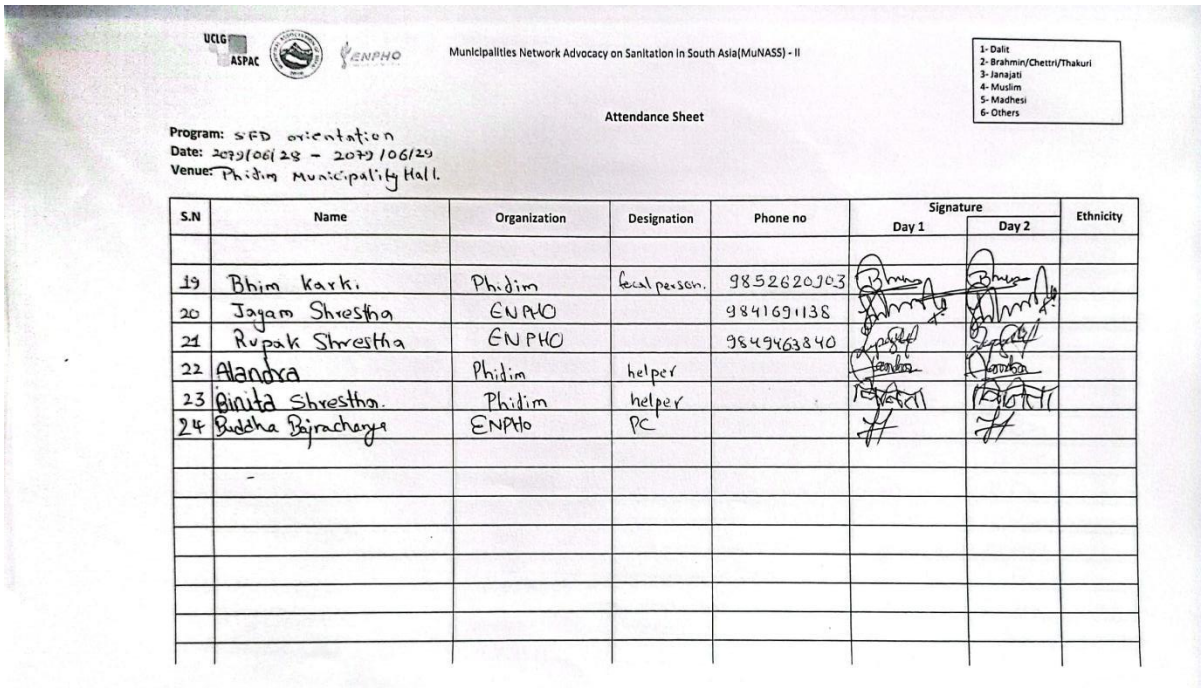
Municipalities Network Advocacy on Sanitation in South Asia(MuNASS) - II

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

Attendance Sheet

Program: SFD Orientation
Date: 2079/06/28 - 2079/06/29
Venue: Phidim Municipality Hall.

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Ethnicity
1.	[illegible]						
2.							
3.							
4.	Binod Kafle	12	panchthar	9840039703	Binod	Binod	2
5.	Dharana Niembang	13	Panchthar	9816960667	Dharana	Dharana Nie	3
6.	Santoshi Tamang	3	"	9825933305	Santoshi	Santoshi	3
7.	Samiksha Baigain	2	"	9842155183	Samiksha	Samiksha	2
8.	Puspa Tamrakar	1	panchthar	9827915096	Puspa	Puspa	2
9.	Hari Khanal	9	panchthar	9814970896	Hari	Hari	2
10.	Nilu Ghimire	4	panchthar	9817913710	Nilu	Nilu	2
11.	Rajan Nembang	11	panchthar	9862172804	Rajan	Rajan	2
12.	Ishara Limbu	10	panchthar	9824907196	Ishara	Ishara	3
13.	Rajendra Limbapo	5	Panchthar	[illegible]	Rajendra	Rajendra	3
14.	Nirman Limbang	7	Panchthar	9824944850	Nirman	Nirman	3
15.	yam maya Rophakheti	8	"	9824933587	Yam	Yam	3
16	Sunita Magar	6	"	9817077023	Sunita	Sunita	3
17	Sarada Rai	14	"	9852981441	Sarada	Sarada	3
18	Jusmi Shrestha	4	"	9827991603	Jusmi	Jusmi	3



UCLG ASPAC | ENPHO

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

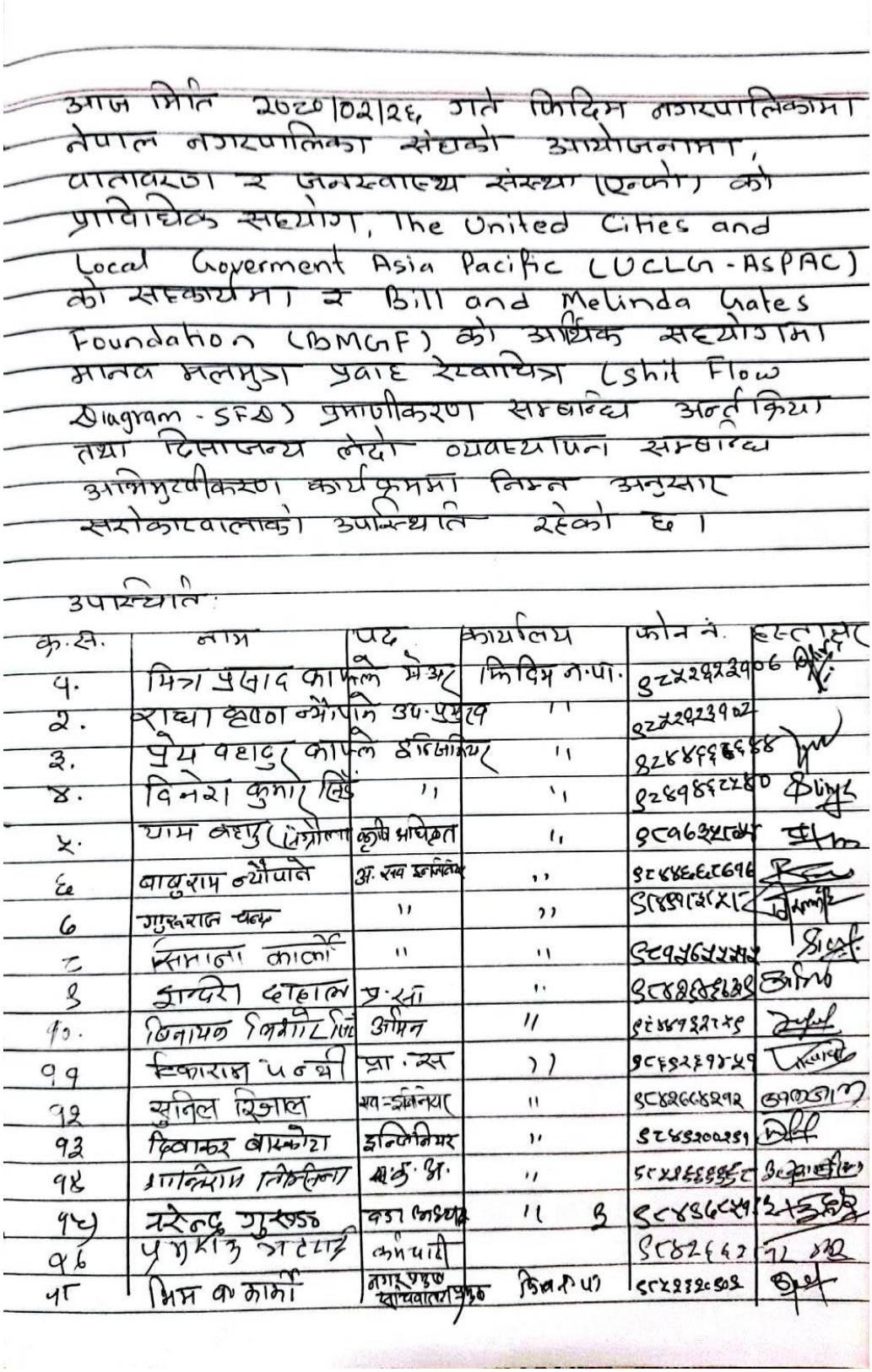
1- Dalit
2- Brahmin/Chettri/Thakuri
3- Janajati
4- Muslim
5- Madhesi
6- Others

Attendance Sheet

Program: SFD orientation
Date: 2079/06/28 - 2079/06/29
Venue: Phidim Municipality Hall.

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Ethnicity
19	Bhim Karki	Phidim	focal person	9852620103	Bhim	Bhim	
20	Jagam Shrestha	ENPHO		9841691138	Jagam	Jagam	
21	Rupak Shrestha	ENPHO		9849463840	Rupak	Rupak	
22	Alandra	Phidim	helper		Alandra	Alandra	
23	Binita Shrestha	Phidim	helper		Binita	Binita	
24	Buddha Bajracharya	ENPHO	PC				

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



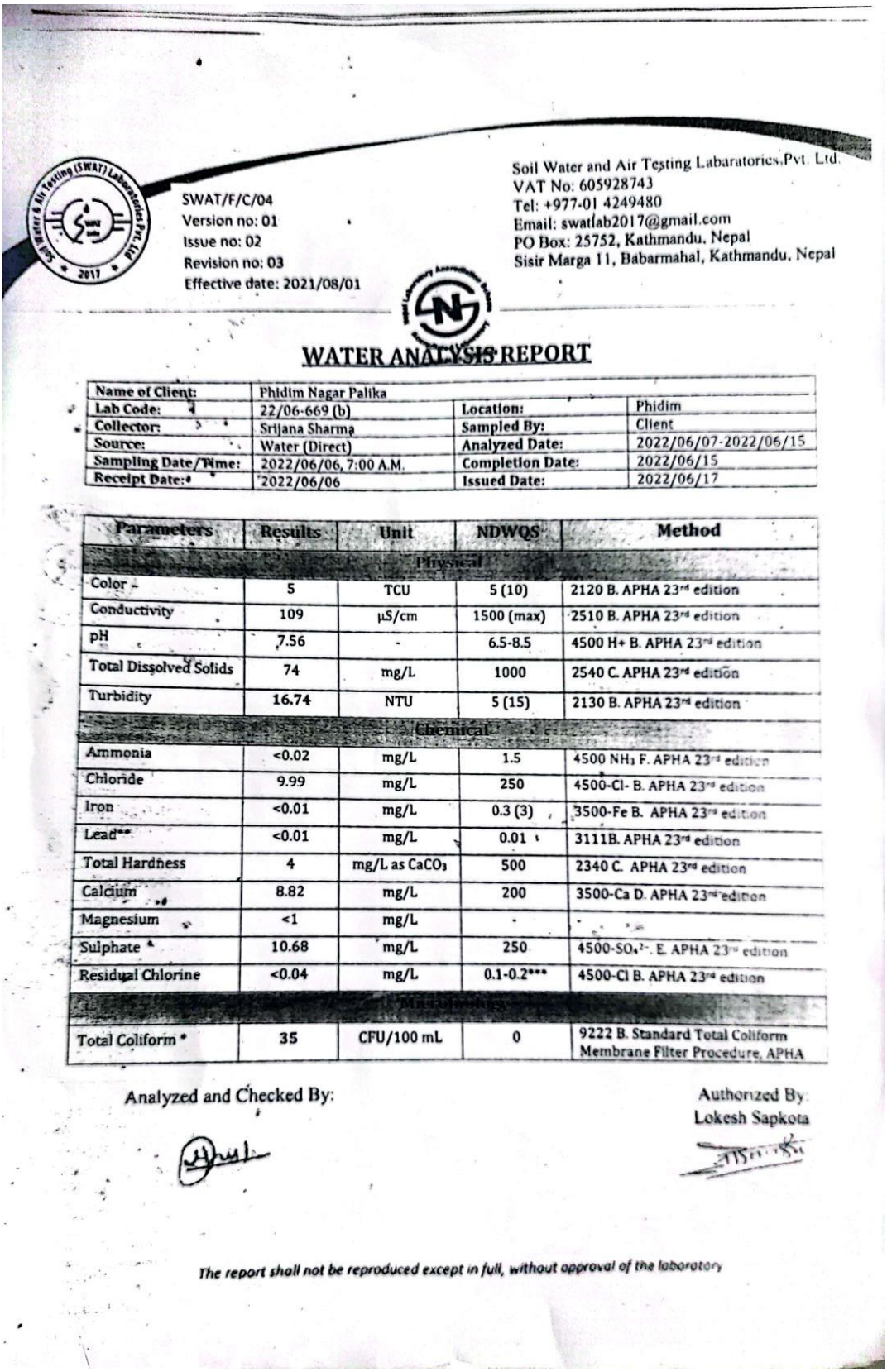
आज मिति २०८०/०२/२६ गते फिदिम नगरपालिकामा नेपाल नगरपालिका संघको आयोजनामा, वातावरण र जनस्वास्थ्य संस्था (एन्को) को प्राविधिक सहयोग, The United Cities and Local Goverment Asia Pacific (UCLG-ASPAC) को सहकार्यमा र Bill and Melinda Gates Foundation (BMGF) को आर्थिक सहयोगमा मानव मलमुत्र प्रवाह रेखाचित्र (Shit Flow Diagram - SFD) प्रमाणीकरण सम्बन्धी अन्तर्क्रिया तथा दिसाजन्य लेदो व्यवस्थापन सम्बन्धी अभिमुखीकरण कार्यक्रममा निम्न अनुसार सरोकारवालाको उपस्थिति रहेको छ ।

उपस्थिति:

क.सं.	नाम	पद	कार्यालय	फोन नं.	हस्ताक्षर
१.	मित्र प्रसाद काफ्ले	मेयर	फिदिम न.पा.	९८४२४३४०६	
२.	राधा कृष्ण न्यौपाने	उप-प्रमुख	"	९८४२०२३९०२	
३.	प्रेम बहादुर काफ्ले	प्रविजनियर	"	९८४४९६६६४४	
४.	विनोद कुमार लिम्बु	"	"	९८४९४९८४८०	
५.	राम बहादुर लिम्बोला	कृषि अधिकृत	"	९८९६३४८४४	
६	बाबुराम न्यौपाने	अ. स्वा इन्जिनियर	"	९८४४६.८८६९६	
७	गुरुवराज पन्त	"	"	९८४९४८४८२	
८	सिमाना काकी	"	"	९८९४६४४४४	
९	सुन्दरी दाहाल	प्र.सं	"	९८४४६६६३९	
१०.	विनायक सिम्खाडा लिम्बु	अमिन	"	९८४४९२२८९	
११	विकाराम पन्थी	प्रा.स	"	९८९२६९४५९	
१२	सुनिल घिमिरे	अ.इन्जिनियर	"	९८४२६८४२९२	
१३	दिवाकर बोस्कोटा	इन्जिनियर	"	९८४९२००३९१	
१४	प्रान्सिस लिम्बुला	अ.कृ.अ.	"	९८४४६६६६८८	
१५	नरेन्द्र गुरुङ	वडा सदस्य	"	९८४९६८४९	
१६	प्रमिला [illegible]	कार्यालय		९८४२६४२	
१८	मित्र का मार्को	नगरप्रमुख स्वास्थ्यवालासुरक्षा	फिदिम न.पा.	९८४२३३८९०९	

क्र.स	नाम	पद	कार्यालय	फोन नं.	हस्ताक्षर
१९	डिल्लीराज विश्वकर्मा	का.पा.ए	फिदीम न.पा.	[illegible]	
२०	सोम बहादुर गुरुङ	वडा अध्यक्ष	फिदिम वडा नं. ८	9826991388	
२१	चन्द्र ब. खुवा	[illegible]	फिदिम न.पा.	[illegible]	
२२	[illegible] अधिकारी	वडा ३	फिदिम २	[illegible]	
२३	भुवन कुमार शाही	[illegible]	फिदिम न.पा.	[illegible]	
२४	शारदा पोख्रेल	का.पा.स	फिदिम ४	[illegible]	
२५	उपेन्द्र [illegible]	वडाअध्यक्ष	.. .. ४	[illegible]	
२६	विपन [illegible]	वडाअध्यक्ष	फिदिम - ६	[illegible]	
२७	ममता राई	का.पा.स	फिदिम - ६	[illegible]	
२८	कमल प्र. चापागाई	वडाअध्यक्ष	" -१२	[illegible]	
२९	रमेश गुरुङ	कर्मचारी	न.पा.	[illegible]	
३०	राजेन्द्र कुमार थापा	वडाअध्यक्ष	फिदिम -११	[illegible]	
३१	सुजन पुरी	-	PEEC फिदिम	[illegible]	
३२	[illegible]	का.स.	फिदिम		
३३	रूपक गौतम	इन्जिनियर	एन्फो	9849463840	

7.3 Lab report of Phidim Drinking Water Users Committee and Sanitation Organization



Soil Water and Air Testing Labaratories,Pvt. Ltd.
VAT No: 605928743
Tel: +977-01 4249480
Email: swatlab2017@gmail.com
PO Box: 25752, Kathmandu, Nepal
Sisir Marga 11, Babarmahal, Kathmandu, Nepal

SWAT/F/C/04
Version no: 01
Issue no: 02
Revision no: 03
Effective date: 2021/08/01

WATER ANALYSIS REPORT

Name of Client:	Phidim Nagar Palika		
Lab Code:	22/06-669 (b)	Location:	Phidim
Collector:	Srijana Sharma	Sampled By:	Client
Source:	Water (Direct)	Analyzed Date:	2022/06/07-2022/06/15
Sampling Date/Time:	2022/06/06, 7:00 A.M.	Completion Date:	2022/06/15
Receipt Date:	2022/06/06	Issued Date:	2022/06/17

Parameters	Results	Unit	NDWQS	Method
Physical				
Color	5	TCU	5 (10)	2120 B. APHA 23rd edition
Conductivity	109	µS/cm	1500 (max)	2510 B. APHA 23rd edition
pH	7.56	-	6.5-8.5	4500 H+ B. APHA 23rd edition
Total Dissolved Solids	74	mg/L	1000	2540 C. APHA 23rd edition
Turbidity	16.74	NTU	5 (15)	2130 B. APHA 23rd edition
Chemical				
Ammonia	<0.02	mg/L	1.5	4500 NH_3 F. APHA 23rd edition
Chloride	9.99	mg/L	250	4500-Cl- B. APHA 23rd edition
Iron	<0.01	mg/L	0.3 (3)	3500-Fe B. APHA 23rd edition
Lead**	<0.01	mg/L	0.01	3111B. APHA 23rd edition
Total Hardness	4	mg/L as $CaCO_3$	500	2340 C. APHA 23rd edition
Calcium	8.82	mg/L	200	3500-Ca D. APHA 23rd edition
Magnesium	<1	mg/L	-	-
Sulphate	10.68	mg/L	250	4500-SO_4^{2-}. E. APHA 23rd edition
Residual Chlorine	<0.04	mg/L	0.1-0.2***	4500-Cl B. APHA 23rd edition
Microbiological				
Total Coliform *	35	CFU/100 mL	0	9222 B. Standard Total Coliform Membrane Filter Procedure, APHA

Analyzed and Checked By:

Authorized By:
Lokesh Sapkota

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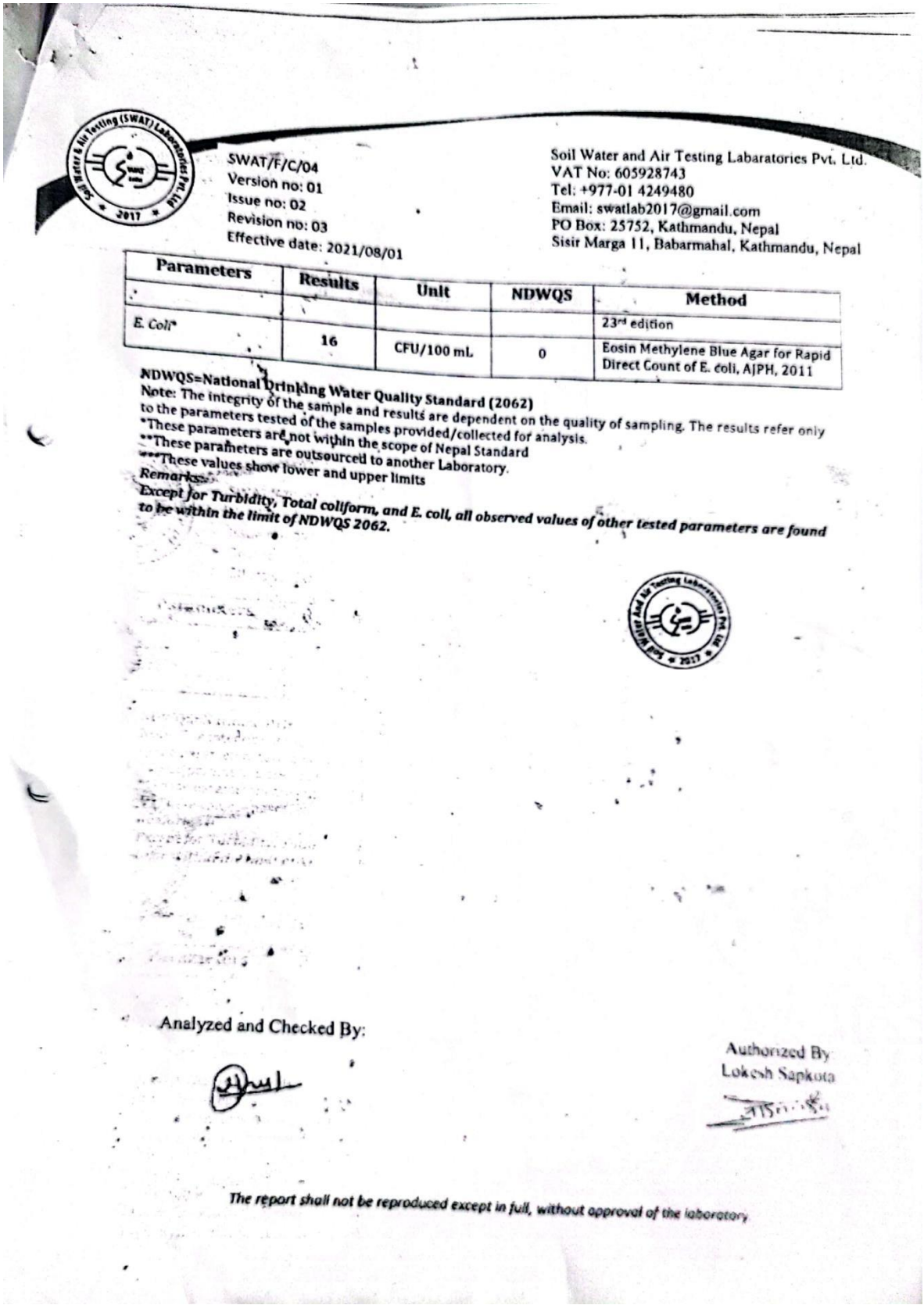

SWAT/F/C/04
Version no: 01
Issue no: 02
Revision no: 03
Effective date: 2021/08/01

Soil Water and Air Testing Labaratories Pvt. Ltd.
VAT No: 605928743
Tel: +977-01 4249480
Email: swatlab2017@gmail.com
PO Box: 25752, Kathmandu, Nepal
Sisir Marga 11, Babarmahal, Kathmandu, Nepal

Parameters	Results	Unit	NDWQS	Method
E. Coli*	16	CFU/100 mL	0	23rd edition Eosin Methylene Blue Agar for Rapid Direct Count of E. coli, AJPH, 2011

NDWQS=National Drinking Water Quality Standard (2062)
Note: The integrity of the sample and results are dependent on the quality of sampling. The results refer only to the parameters tested of the samples provided/collected for analysis.
*These parameters are not within the scope of Nepal Standard
**These parameters are outsourced to another Laboratory.
***These values show lower and upper limits
Remarks:
Except for Turbidity, Total coliform, and E. coli, all observed values of other tested parameters are found to be within the limit of NDWQS 2062.

Analyzed and Checked By:

Authorized By
Lokesh Sapkota

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SFD Phidim Municipality, Nepal, 2023

Produced by:

Rupak Shrestha, ENPHO
Jagam Shrestha, ENPHO
Buddha Bajaracharya, ENPHO
Sabuna Gamal, ENPHO
Anita Bhuju, ENPHO
Shreeya Khanal, ENPHO

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www.sfd.susana.org

SFD Promotion Initiative