SFD Report

Urlabari Municipality
Nepal

Final Report

This SFD Report - SFD level 2 - was prepared by:

Environment and Public Health Organization (ENPHO)

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SFD Report Urlabari Municipality, Nepal, 2023

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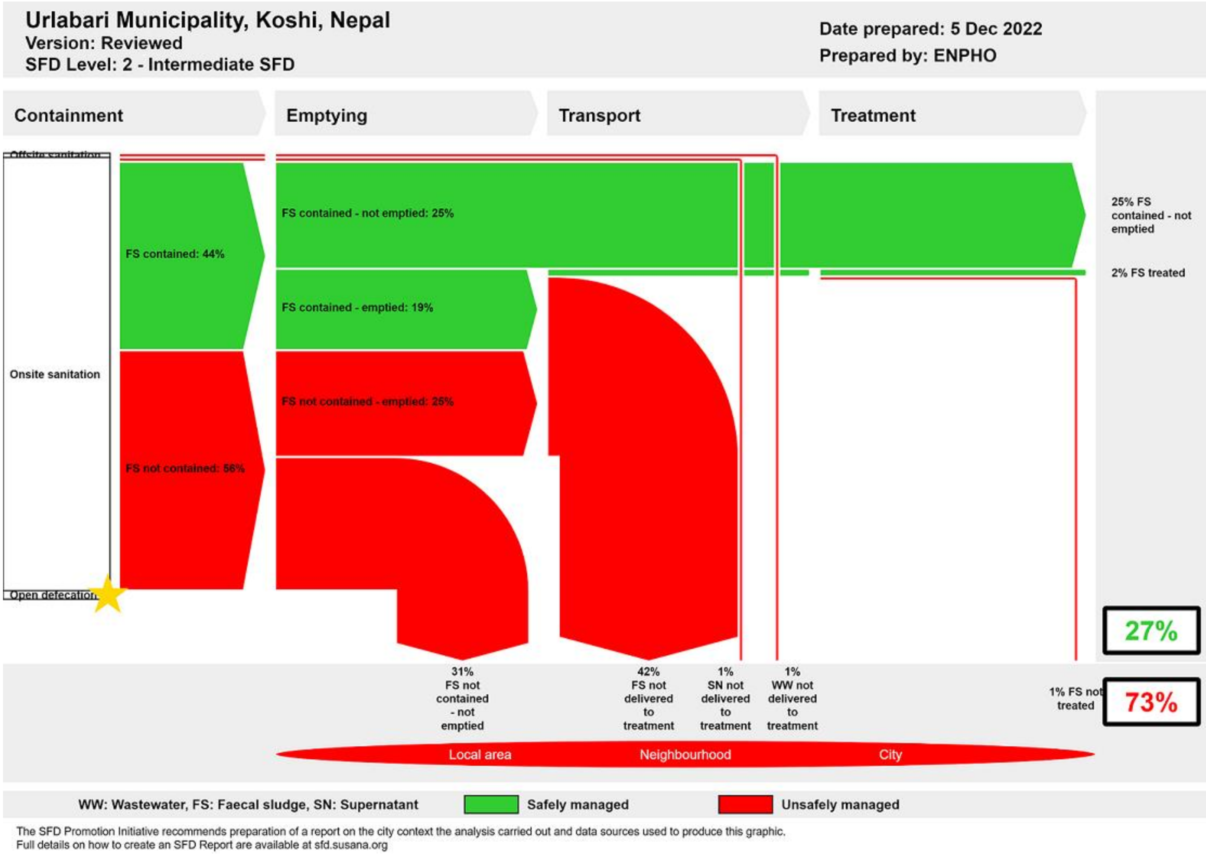
1. The SFD Graphic



2. Diagram information

SFD Level:

This SFD is a level 2- Intermediate report.

Produced by:

Environment and Public Health Organization (ENPHO).

Collaborating partners:

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

Status:

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3. General city information

Urlabari Municipality was declared as municipality on 8th May 2014. The municipality is located in Morang District, Koshi Province. The municipality is divided into nine political wards.

The municipality has total 70,908 population with 33,356 males and 37,552 females. (Census 2021, n.d.) Out of total wards, ward number 7 has the largest population (10,719) while ward number 5 has the least number of populations with (5,535). The municipality has a total of 17,650 households. Ward number 7 has the most households with a total (2,600), while ward number 5 has the least number of households with a total (1390).

The districts average yearly temperature is 29.25 °C i.e., 84.65 °F which is 7.25% higher than Nepal's averages. The annual rainfall is 131.88 mm (5.19 inch (Weather and Climate, n.d.).

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 100%. 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. All the surveyed households in the municipality have access to basic toilet facilities. Among the households having their own toilets 99.74% of the households rely on onsite sanitation systems.

Containment:

Different types of containments used to store faecal sludge in onsite sanitation systems are: septic tanks (2.3%), fully lined tanks (11.8%), lined tanks with impermeable walls and open bottom (34.8%), lined pits with semipermeable walls and open bottom (50.0%) and unlined pits (0.8%). 0.26% of households rely on offsite sanitation.

Emptying and Transportation:

There are regular emptying practices of the containments. Here 48.84% of the households had emptied the containment at least once since installation. Both manual and mechanical desludging mechanism are practised.

Treatment and Disposal:

The municipality lacks a faecal sludge treatment facility. The majority of faecal sludge emptied is used in agricultural lands as well as dumped in the environment untreated. Households having a biogas digester installed utilize its energy in cooking and other purposes.

The SFD graphic shows that 27% of the excreta generated are safely managed while 73% of the excreta generated are unsafely managed. The safely managed percentage of FS generated by 25% of the population is temporary until the tanks and pits become full and the Faecal Sludge (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.

The draft Sector Development Plan (SDP) has envisioned the delineation of roles and responsibilities of federal, provincial and local government in an aim to initiate sustainability of national sanitation campaign.

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	Urlabari 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 had been collected from random household sampling (ENPHO, 2022). Altogether, 390 households and 34 institutions were surveyed from 9 wards of Urlabari municipality. Primary data on emptying, transportation and current sanitation practices in the municipality are triangulated with the data obtained from Key Informant Interviews (KIIs) with Municipal Officers, the operators of public toilets, and the sanitation, and environmental section of the municipality. Also, a data sharing and validation workshop with key stakeholders was performed.

8. Process of SFD development

Data on sanitation situations 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 data collection for the survey. Along with this, KIIs were conducted with officers and engineers of the municipality and the Water Supply and Sanitation Users Committee. Types of sanitation technologies used in various locations have been mapped using ARCGIS. For the Shit Flow Diagram (SFD) graphic production, initially, a relationship between sanitation technology used in questionnaire survey and Shit Flow Diagram Promotion 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:

- ENPHO. (2022). Sanitation Situtaion Assessment: Urlabari Municipality. Unpublished.
- 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/.
- CBS. (2021). National Population and Housing Census 2021. Kathmandu, Nepal: Central Bureau of Statistics.
- Weather and Climate. (n.d.). Retrieved from tcktcktck.org: https://tcktcktck.org/nepal/kosi/morang

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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

Urlabari Municipality is located in Morang District, Koshi Province of Nepal. Urlabari Municipality was declared as municipality on 8th May 2014. The Municipality has a total of nine political wards. It covers 75 square kilometres of area. The Municipality is enclosed by Damak Municipality in the East, Letang and Pathrishanichare Municipalities in the West, Miklajunga in the North and Ratuwamai Municipality in the South (Nepal Archives, n.d.). Figure 1 shows the geo-political map of Urlabari Municipality.

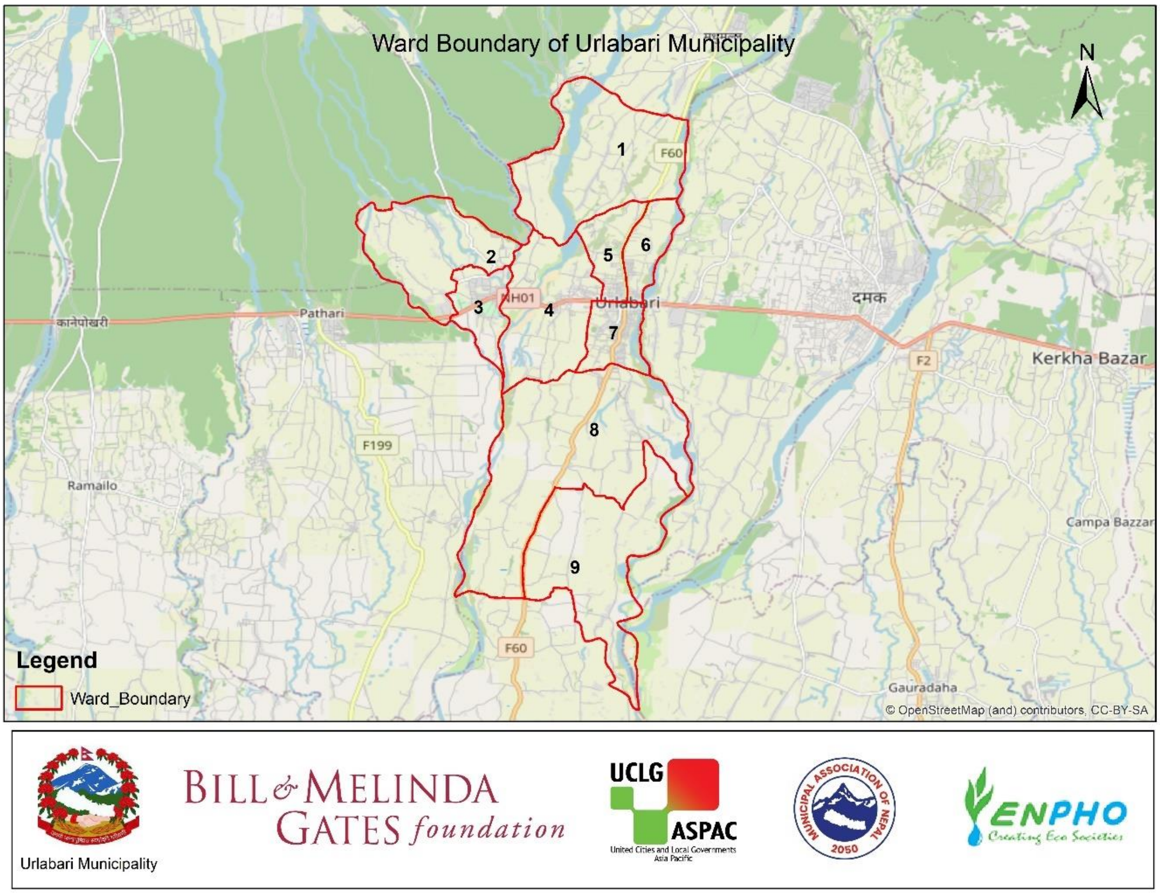


Figure 1: Map of Urlabari Municipality with ward boundaries.

1.1 Population

There are 70,908 people living in Urlabari Municipality, with 33,356 men and 37,552 women. Out of all the wards, ward number 7 has the most residents (10,719), while ward number 5 has the fewest (5,535). The number of households in Urlabari Municipality is 17,650. With a total of 2,600 households, Ward 7 had the most, while Ward 5 had the fewest, with a total of 1,390 households. Table 1 shows the total population and households in each ward (CBS, 2021).

Table 1: Ward Wise Household and Population Data.

Wards	Households	Population	Male	Female	Average Household Size
1	2,190	8,804	4,161	4,643	4.02
2	2,101	8,413	3,955	4,458	4.00
3	1,902	7,302	3,486	3,816	3.84
4	2,448	9,790	4,621	5,169	4.00
5	1,390	5,535	2,566	2,969	3.98
6	1,440	5,670	2,649	3,021	3.94
7	2,600	10,719	5,068	5,651	4.12
8	1,955	7,851	3,639	4,212	4.02
9	1,624	6,824	3,211	3,613	4.20
Total	**17,650**	**70,908**	**33,356**	**37,552**	**4.01**
					(Census 2021, n.d)

1.2 Climate

Morang district has a Tundra climate. The districts average yearly temperature is 29.25 °C i.e., 84.65 °F which is 7.25% higher than Nepal's averages. The annual rainfall is 131.88 mm (5.19 inch) (Weather and Climate, n.d.).

1.3 Topography

The municipality lies at 26.67° N latitude, 87.61° E longitude. In the Morang district, lower tropical zones are found below 300 m (1,000 ft), whereas upper tropical zones are found between 300 to 1,000 m (1,000 to 3,300 ft). Subtropical zone ranges from 1,000 to 2,000 m and temperate zone ranges from 2,000 to 3,000 m (6400 to 9800 ft) (wikipedia, n.d.).

2 Service Outcomes

2.1 Overview

Data on sanitation situation were collected through household and institutional surveys (ENPHO, 2022). A total of 390 households were sampled from 17,650 households distributed in 9 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

Morang District was declared as an Open Defecation Free (ODF) zone on 6th July 2019. It suggests that everyone has access to basic sanitation facilities, where it 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 sanitation situation assessment conducted by ENPHO in 2022 showed that 100% of surveyed households in the municipality have access to basic sanitation coverage (ENPHO, 2022).

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), whereas 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).Figure 2 shows the types of sanitation systems in the municipality.

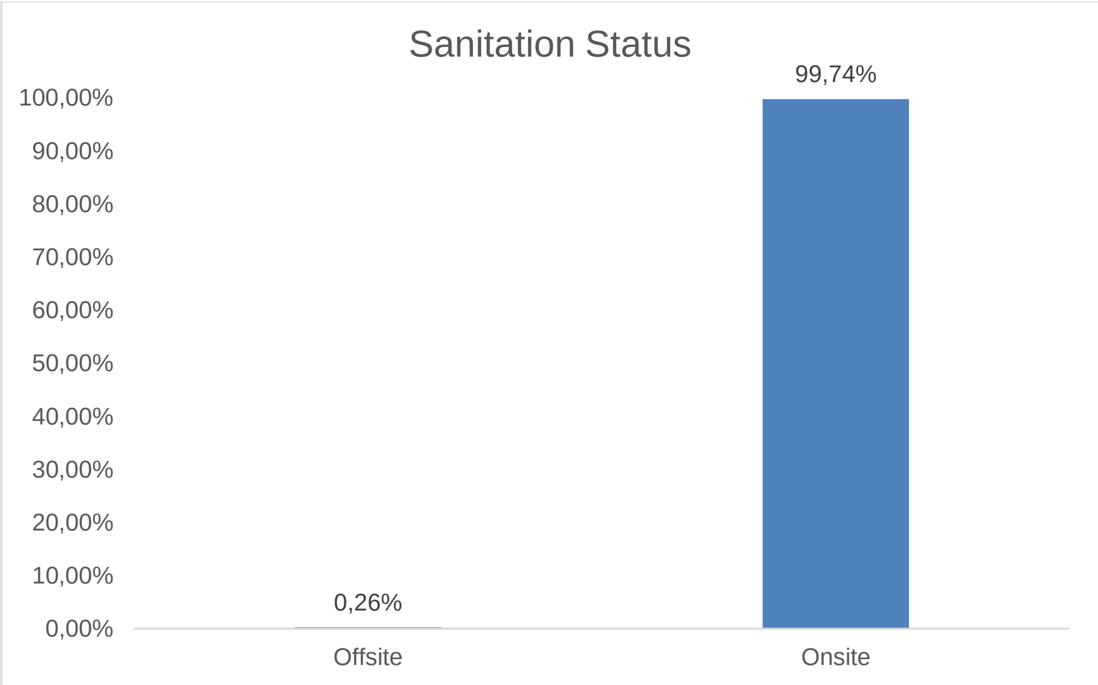


Figure 2: Household sanitation status of Urlabari Municipality (ENPHO, 2022).

Onsite sanitation systems are prevalent in the municipality. 99.74% households rely on onsite sanitation technologies in the municipality. Although there is a lack of a sewerage network, the remaining households have connected their toilet to open drain and water bodies near their houses.

2.1.2 *Types of Containment*

99.74% of the households in the municipality use an onsite sanitation system. The different types of containment installed to store faecal sludge is explained as follows.

A well-designed septic tank is installed in only 2.31% of the households. 9.77% of households use fully lined tanks in their houses which is a rectangular onsite sanitation technology which is used to safely store faecal sludge. There are no outlets or overflow to discharge effluent. The walls and bottom of tank are totally lined and sealed. Figure 3 shows the types of fully lined tank constructed at household level in Urlabari Municipality.

Figure 3: Fully Lined Tank.

Also, 2.06% of the households in the municipality are connected to a biogas digester that uses natural anaerobic decomposition of organic matter under controlled conditions. Figure 4 shows the types of biogas digesters built at household level in Urlabari Municipality.

Figure 4: Biogas Digester.

34.96% of the households in the municipality have built lined tanks with impermeable walls and open bottom, which is a rectangular onsite technology where the walls of the tank are lined and the bottom of tank is not lined and allows infiltration of effluents.

Twin pits and single pits are popular in the municipality. Together, 50.13% of the households have such types of pits installed by assembling pre-cast concrete rings one after another. Figure 5 shows the design of twin pits installed at household level.

0.77% of 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.

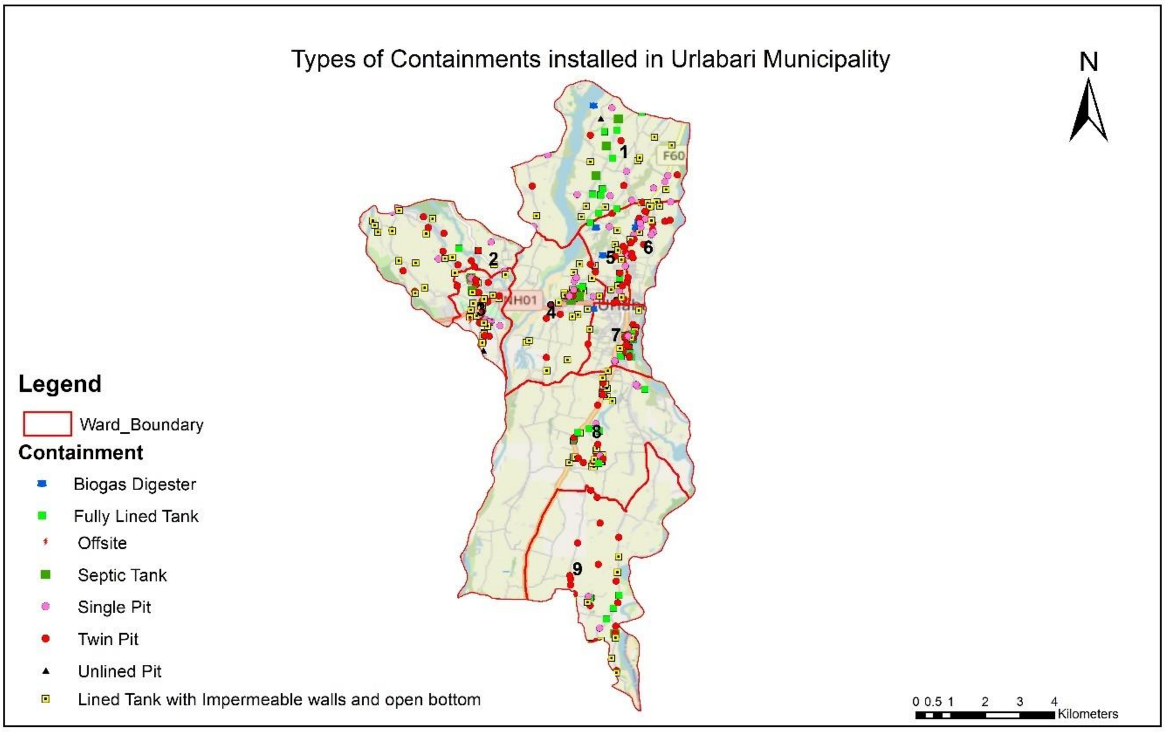
Figure 5 : Inappropriate design of the twin pits, where the distance between two pits is less than 1 m.

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

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

Containments	Percentage of Households
Septic tank	2.31%
Fully lined tank	9.77%
Biogas digester	2.06%
Lined tank with impermeable walls and open bottom	34.96%
Single pit	14.91%
Twin pit	35.22%
Unlined Pit	0.77%
Total	**100.00%**

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



Urlabari 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 Promotion Initiative (SFD PI). The 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. Similarly, twin pits and single pits constructed by assembling pre-cast concrete rings one above another are classified as lined pits with semipermeable walls and open bottom. Table 3 shows the types of containment re-categorized according to Shit Flow Diagram Promotion Initiative (SFD PI).

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

Types of Containments	Percentage of Households
Fully lined tank	11.8%
Lined pit with semi-permeable walls and open bottom	50.0%
Lined tank with Impermeable walls and open bottom	34.8%
Offsite	0.3%
Septic tank	2.3%
Unlined pit	0.8%
Total	**100.0%**

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

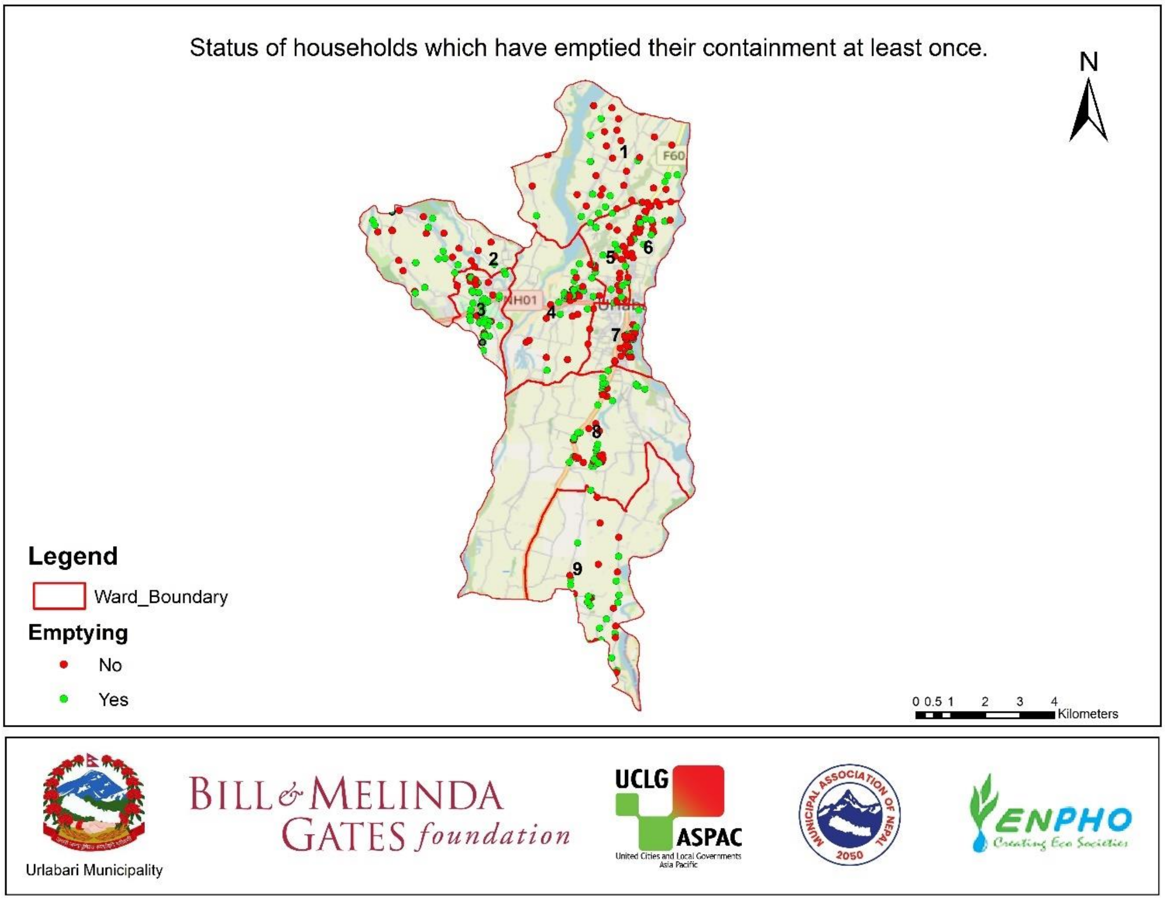


Figure 7: Status of household which have emptied their containment at least once.

48.84% of the households have emptied the containment at least once since installation through manually or mechanical emptying services, whereas 51.16% of the households have not emptied their containment as it has not been filled yet.

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

Containment	Never emptied	Emptied at least once
Biogas digester	0.00%	2.06%
Fully lined tank	7.97%	1.80%
Lined tank with Impermeable walls and open bottom	25.96%	9.00%
Septic tank	2.06%	0.26%
Single pit	5.40%	9.51%
Twin pit	9.00%	26.22%
Unlined pit	0.77%	0.00%
Total	**51.16%**	**48.84%**

Urlabari Septic Tanky, a private desludging service provider, is the major emptying service provider in the municipality. The service provider is equipped with a vacuum truck with a tank capacity of 8,000 litres. One driver and two helping staff works in the vacuum truck. The staff do not wear any uniforms, gloves, boots or masks for safety during work. It charges NPR 200 to 500 (USD 1.5 to 3.7) per ring for circular containments and NPR 2,500 to 3,000 (USD 18.8 to 22.6) per trip for the rectangular containments which also varies according to travel distance (KII-3, 2022).

Figure 8: Mechanical Emptying of Containments in Urlabari Municipality.

2.1.4 *Treatment and Disposal/Reuse*

Urlabari Municipality does not have any form of treatment plant for Faecal Sludge (FS). The majority of FS emptied is disposed of through the dig and dump method, with some small percentage of FS emptied which is applied in farmlands. Both disposal methods are considered as an unsafely managed practice. Fewer households in the city have an illegal connection of the toilet to open drainage where the wastewater generated ends up untreated in water bodies.

Figure 9 shows the percentage of perception of people residing in the municipality about disposal of FS after the onsite sanitation system is emptied. Dig and dump method, considered as an unsafely managed option, is the most practised way for disposal of FS in the municipality.

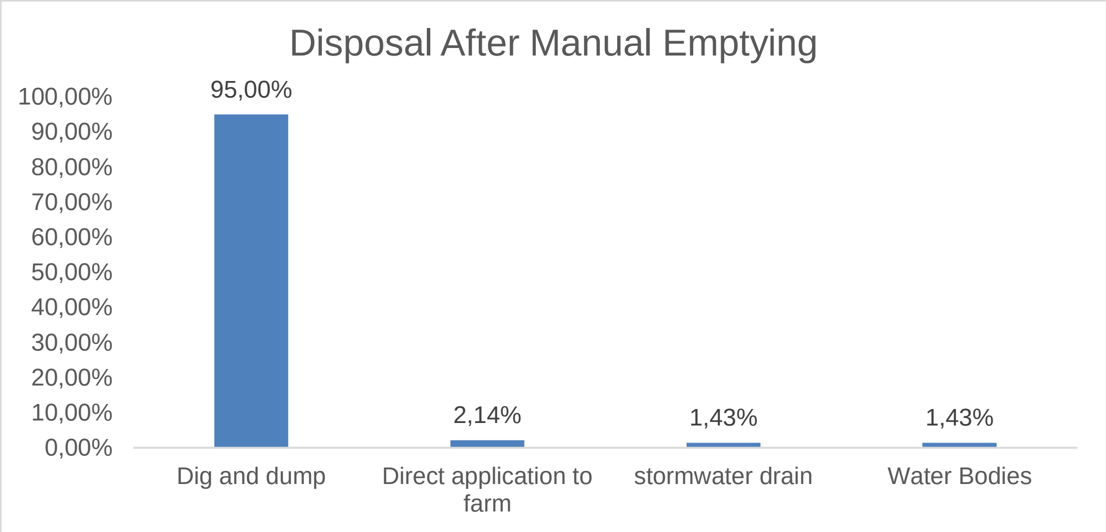


Figure 9: Disposal of manually emptied faecal sludge (ENPHO, 2022).

2.1.5 Institutional Level Sanitation System

Altogether, 34 institutions from commercial buildings, 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.

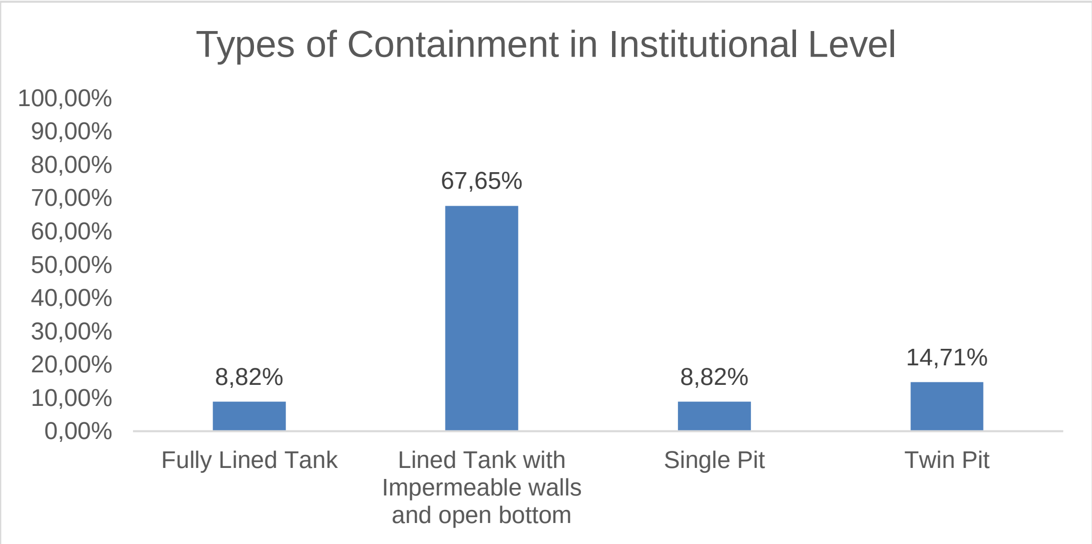


Figure 10: Types of containment in institutions of Urlabari Municipality (ENPHO, 2022).

From the institutional survey, here only 39.39% of institutions in Urlabari Municipality have emptied their containments and 60.61% of institutions have not emptied because they were never filled. Distribution of different types of onsite sanitation technologies of institutions in various wards of Urlabari Municipality is shown in Figure 11.

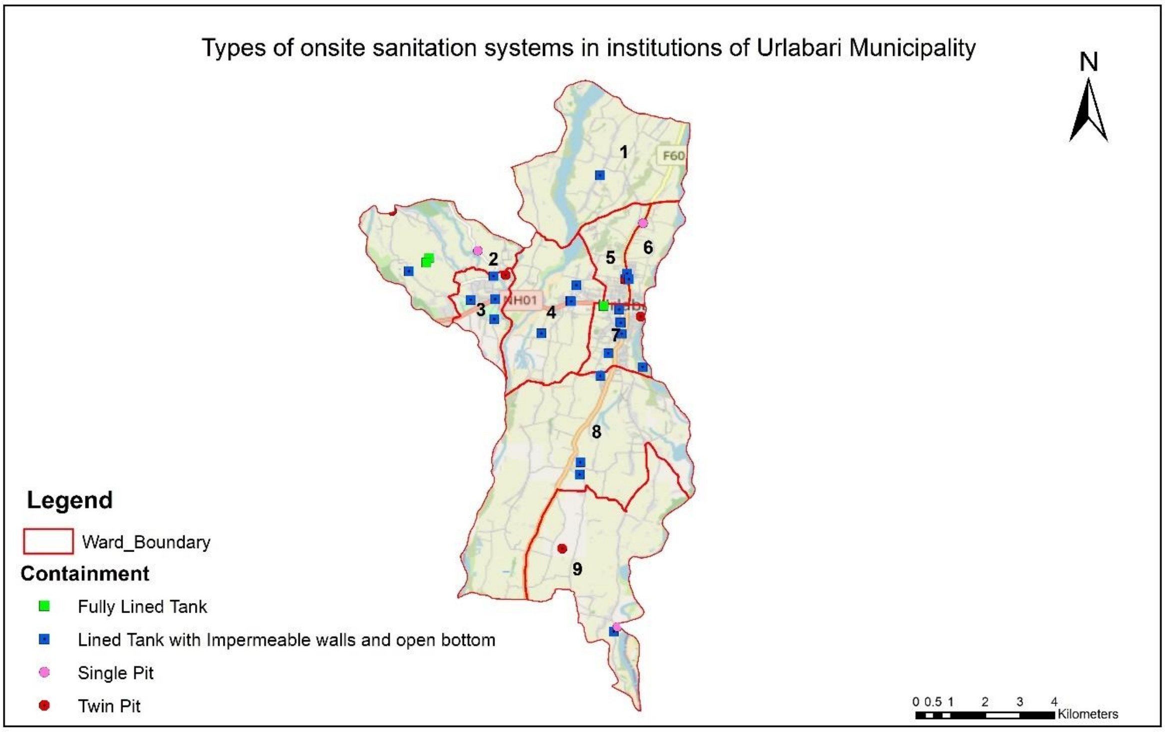


Figure 11: Types of onsite sanitation systems in institutions of Urlabari Municipality (ENPHO, 2022).

2.1.6 *Public Toilets*

The municipality does not have any public toilets, however one community toilet which lies in ward 5 is run and operated by the local community. The municipality is planning the construction of one public toilet near the bus park (KII-1, 2022).

2.1.7 *Risk of Ground Water 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:

Urlabari Water Users Committee has been providing piped drinking water since 2012 in ward-7 and ward-3. The major source of water is deep tube wells with two numbers. The water is collected in a 4.50 lakh[1] litres overhead reservoir tank. Altogether 6,330 households have been connected to a piped drinking water supply so far from the system and there is a plan to connect more households in ward 3. Figure 12 shows the piped drinking water supply system of Urlabari Municipality.

Figure 12: Overhead Tank for Piped Drinking Water Supply System in Urlabari Municipality.

However, most households in the municipality rely on hand pumps for drinking water supply. 67.69% of the households in the municipality depend on groundwater sources for drinking and other daily activities. The remaining households depend on private and public taps for drinking purposes. Figure 13 shows the various mediums to extract the groundwater in the municipality.

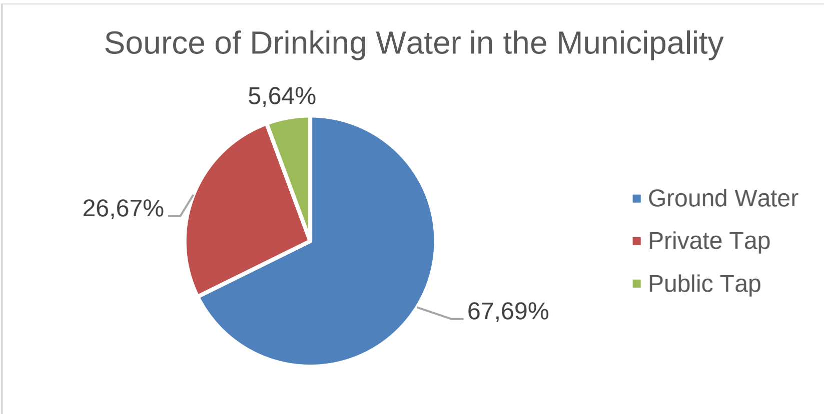


Figure 13: Types of Ground Water in the Municipality (ENPHO, 2022).

[1] One lakh = 10^5

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.

A key determinant of risk variation is the soil and geological setting. Especially for consolidated hard rock sediments with poor soil cover and shallow water tables, the risk is higher. According to WHO criteria, if the travel time of pollutant to groundwater source is less than 25 days, there is significant risk to contamination; low risk, if the travel time is between 25 and 50 days; and very low risk if the travel time is greater than 50 days (Krishnan, 2011). The size of pores in the soil determines the infiltration rate. In the sandy loam soil, the permeability is approximately 2.5 cm per hour. Thus, between 25 and 50 days the pollutant could travel to the depth of approximately 30 metres (98.67 feet) in sandy loam soil. Hence, the people using open bottom tanks and consuming water from the hand pumps with the depth up to 98.67 feet (30 m) and horizontal distance of the pump within 25 feet (7.62 m) from the source of pollutants are assumed at significant risk to groundwater pollution.

Figure 14 demonstrates the depth of hand pumps and horizontal distance of it from source of pollutant by lined tanks with impermeable walls and open bottom. Here, the total percentage of households using lined tanks with impermeable walls and open bottom is 34.3%. Among these, 59.7% of households depend on groundwater. So, the percentage of these households with significant risk to consumption of contaminated groundwater is 94% out of 59.7% (i.e., T2A4C10 = 34.3% x 59.7% x 94% = 19.2%) is at risk of consumption of groundwater pollution from their containment. The remaining 15.1% of lined tanks (T1A4C10) are located in households with low risk of groundwater pollution.

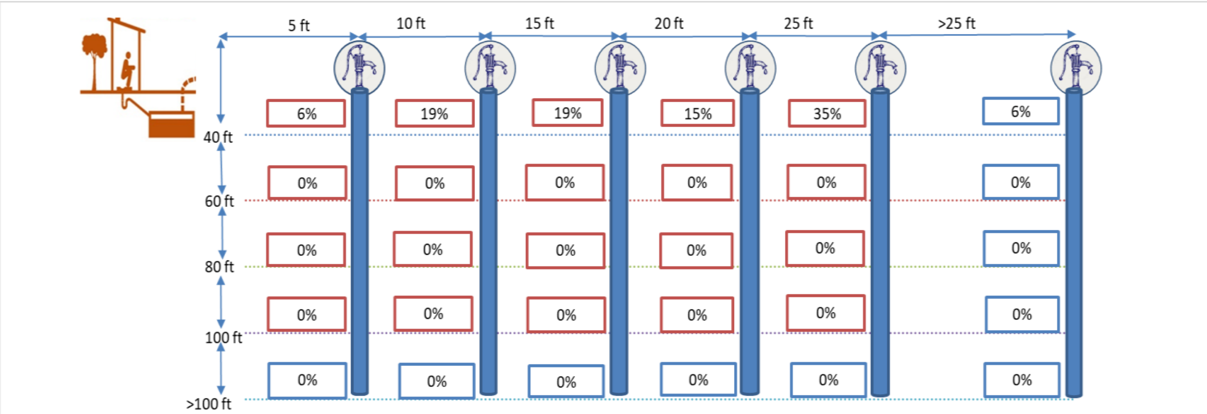


Figure 14: Depth of hand pumps and lateral spacing of it with containment type of a lined tank with impermeable walls and open bottom (ENPHO, 2022).

Similarly, Figure 15 demonstrates the depth of hand pumps and horizontal distance of it with the containment type of a lined pit with semi-permeable walls and open bottom. Here, the total percentage of households using lined pits with semi-permeable walls and open bottom is 50.0%. Among these, 78.46% of households depend on groundwater. So, the percentage of these households with significant risk to consumption of contaminated groundwater is 78% out of 78.46% (i.e., T2A5C10 = 50.0% x 78.46% x 78% = 30.6%) is at risk of consumption of groundwater pollution from their containment. The remaining 19.4% of lined pits (T1A5C10) are located in households with low risk of groundwater pollution.

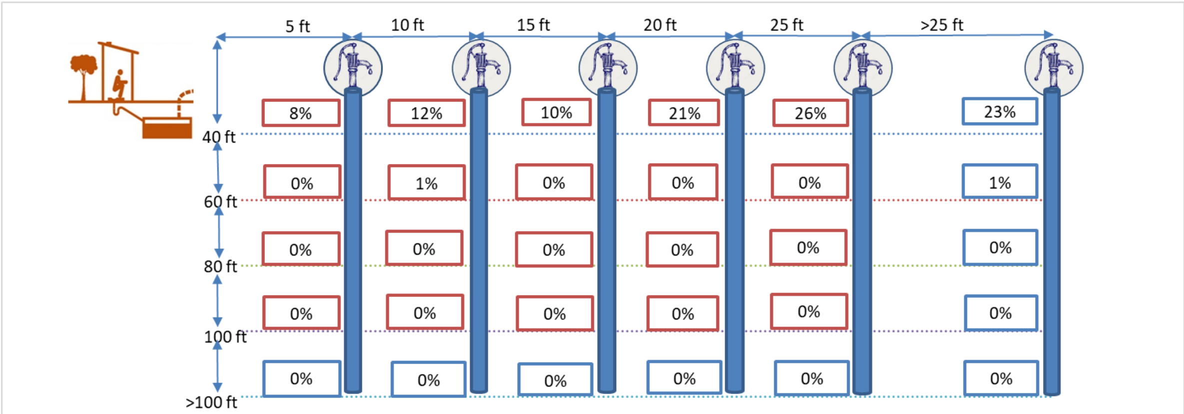


Figure 15: Depth of hand pumps and lateral spacing of it with containment type of a lined pit with semi-permeable walls and open bottom (ENPHO, 2022).

2.2 SFD Selection Grid

Types of sanitation technologies selected in the SFD selection grid in the municipality are shown in Figure 16. 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.

The types of household containments in the municipality are re-categorized to match the containments defined by Shit Flow Diagram Promotion 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. Similarly, single pits constructed by assembling pre-cast concrete rings one above another are classified as lined pits with semipermeable walls and open bottom.

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.

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			Not Applicable
Septic tank					Significant risk of GW pollution Low risk of GW pollution	T1A2C6		T1A2C8		
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	Significant risk of GW pollution Low risk of GW pollution			T1A4C8		T2A4C10 T1A4C10
Lined pit with semi-permeable walls and open bottom	Not Applicable									T2A5C10 T1A5C10
Unlined pit										T2A6C10 T1A6C10
Pit (all types), never emptied but abandoned when full and covered with soil										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil										
Toilet failed, damaged, collapsed or flooded										
Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded										
No toilet. Open defecation	Not Applicable									Not Applicable

Figure 16: SFD selection grid for Urlabari Municipality.

Brief explanation of terms used to indicate different frames selected in the SFD selection grid in Figure 16 is explained in Table 5.

Table 5: Explanation of terms used to indicate different frame selected in the SFD selection grid in Figure 16.

T1A1C7	This is a fully functioning toilet discharging directly to a water body. The excreta is raw, untreated and hazardous and since it discharges directly to a water body, all the excreta in this system is considered NOT contained.
T1A2C6	This is a correctly designed, properly constructed, fully functioning septic tank with an outlet connected to an open drain or storm sewer. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, therefore all the excreta in this system is considered NOT contained.
T1A2C8	This is a correctly designed, properly constructed, fully functioning septic tank with an outlet connected to open ground. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, therefore all the excreta in this system is considered NOT contained.
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.
T1A3C6	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 an open drain or storm sewer the excreta in this system are considered NOT contained.

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.
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.
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 (Low 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, so this system is considered contained.
T2A6C10	This is a correctly designed, properly constructed and well-maintained unlined pit with permeable walls and base, through which infiltration can occur. The tank is NOT fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered NOT contained.
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.

2.2.1 SFD Matrix

The SFD matrix is the second step to generate the SFD graphic. The SFD matrix shows 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 the proportion of the contents of each type of onsite container which is faecal sludge was used. As stated on the 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% of 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 as 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 column Population (Pop) of Figure 17. The proportion of FS emptied (F3) is obtained from KIIs. The FS and supernatant delivered to treatment and treated is shown in columns F4, S4e, F5 and S5e, respectively.

The municipality does not have any form of treatment plant to treat faecal sludge. The FS emptied from the containments is dumped openly in farmlands or water bodies. Thus, values for variables F4, S4e, F5 and S5e 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 = 53%) and treated with a treatment efficiency estimated at 95% (F5 = 95%). Figure 17shows the SFD matrix of Urlabari Municipality.

Urlabari Municipality, Koshi, Nepal, 5 Dec 2022. SFD Level: 2 - Intermediate SFD
Population: 70908
Proportion of tanks: septic tanks: 94%, fully lined tanks: 99%, 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
T1A1C7 Toilet discharges directly to water body	0.3					
T1A2C6 Septic tank connected to open drain or storm sewer	0.3	0.0	0.0	0.0	0.0	0.0
T1A2C8 Septic tank connected to open ground	2.0	12.0	0.0	0.0		
T1A3C10 Fully lined tank (sealed), no outlet or overflow	9.0	39.0	53.0	95.0		
T1A3C6 Fully lined tank (sealed) connected to an open drain or storm sewer	0.3	0.0	0.0	0.0	0.0	0.0
T1A3C8 Fully lined tank (sealed) connected to open ground	2.5	0.0	0.0	0.0		
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	15.1	11.0	0.0	0.0		
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	0.5	0.0	0.0	0.0		
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	19.4	71.0	0.0	0.0		
T1A6C10 Unlined pit, no outlet or overflow	0.3	0.0	0.0	0.0		
T2A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	19.2	34.0	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	30.6	59.0	0.0	0.0		
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	0.5	0.0	0.0	0.0		

Figure 17: SFD Matrix of Urlabari Municipality.

2.2.2 SFD Matrix Explanation

The sanitation technologies and the corresponding percentage of the population using such technologies are shown in Figure 17 (SFD Matrix). These values are derived from the household survey (ENPHO, 2022).

2.2.3 A 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 (KII-3, 2022) during the process. 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-3, 2023[2]).

S.N.	Sanitation Technologies	SFD Reference Variable	Percentage of Emptied Containment [1]	Proportion of FS emptied during emptying. [2]	F3
1	Toilet discharges directly to water body	T1A1C7	0.00%	90%	0%
2	Septic tank connected to open drain or storm sewer	T1A2C6	0.00%	90%	0%
3	Septic tank connected to open ground	T1A2C8	13%	90%	12%
4	Fully lined tank (sealed) connected to an open drain or storm sewer	T1A3C6	0.00%	90%	0%
5	Fully lined tank (sealed) connected to open ground	T1A3C8	0.00%	90%	0%
6	Fully lined tank (sealed), no outlet or overflow	T1A3C10	42.78%	90%	39%
7	Lined tank with impermeable walls and open bottom, connected to open ground	T1A4C8	0.00%	90%	0%

8	Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	11.85%	90%	11 %
9	Lined pit with semi-permeable walls and open bottom, no outlet or overflow	T1A5C10	79.39%	90%	71%
10	Unlined pit, no outlet or overflow	T1A6C10	0.00%	90%	0%
11	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A4C10	37.40%	90%	34%
12	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A5C10	66.01%	90%	59%
13	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:

Offsite sanitation System:

- ✓ 0.3% of the toilets discharge directly to a water body (T1A1C7). Since there is no wastewater treatment plant, all wastewater is disposed of untreated into the environment.

Onsite Sanitation System:

- ✓ The proportion of FS in septic tanks was set to 94%, 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 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 household survey and cross-checked with KIIs conducted.
- ✓ The municipality does not have any form of treatment plant to treat faecal sludge. Also, the people using twin pits reclassified as lined pits with semi-permeable walls and open bottoms are not using them properly. The FS emptied from the containments is dumped openly in farmland or water bodies. Thus, values for variables F4 and F5 for all sanitation systems are set to 0%. In addition, values for supernatant delivered to

treatment (S4e) and treated (S5e) were both set to 0% in septic tanks and fully lined tanks connected to open drains (T1A2C6 and T1A3C6).

- ✓ FS from anaerobic biogas digesters, classified as fully lined tanks (system T1A3C10), is considered as transported (F4 = 53%) and treated with a treatment efficiency estimated at 95% (F5 = 95%).

2.4 SFD Graphic

Figure 18 shows the SFD graphic for Urlabari Municipality. In the graphic, the percentage of FS and wastewater (WW) indicated by colour green represent safely managed or stored (27%) whereas the percentage in colour red represents unsafely stored or managed (73%).

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 Wastewater Treatment Plant (WWTP) or Faecal Sludge Treatment Plant (FSTP) in the Municipality leads to disposal of FS in farmlands and water bodies.

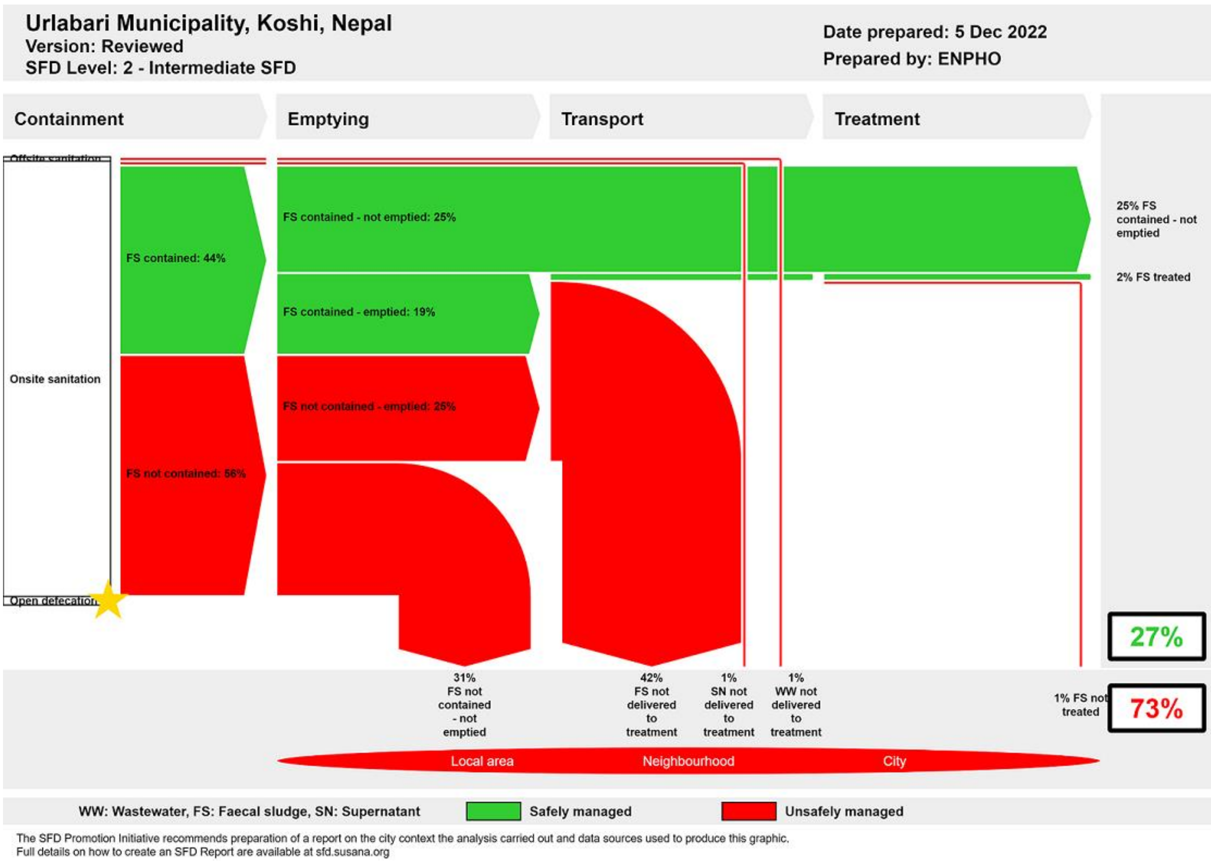


Figure 18: SFD graphic of Urlabari Municipality.

The faecal sludge that is safely managed is further segregated as 25% of FS which is safely collected in the containment which has not been emptied. This 25% 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 2% corresponds to FS safely treated and managed in the biodigesters.

The unsafely managed excreta are divided into: WW not delivered to treatment (1%), FS emptied but not delivered to treatment (42%) which is unsafely disposed of into the environment and FS not contained - not emptied (31%), 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.

Offsite 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, 1% of the population has a connection of their toilet to water bodies near their houses.

Onsite Sanitation

The population relying on onsite sanitation systems is 99.74%. Among them, 44% are using technically effective containment that safely stores faeces and 56% with unsafe containment. Urlabari Municipality does not have treatment plant or land separated for disposal of FS, 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 open land or farmlands for unsafe disposal. 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.	44%
FS not contained	Faecal sludge that is stored in an unsafe onsite sanitation technology.	56%
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 lined pits with semi-permeable walls and open bottom, no outlet or overflow (T1A5C10) and unlined pits without significant risk to groundwater (T1A6C10).	25%
FS contained – emptied	FS that is contained in onsite sanitation technology and emptied either mechanically or manually.	19%

FS not contained – not 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.	31%
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.	42%
WW not delivered to treatment	All wastewater from toilets going directly to water bodies.	1%
FS not treated	FS emptied from an onsite sanitation system, delivered to treatment but not treated.	1%
SN not delivered to treatment	SN not contained from septic tanks and fully lined tanks connected to open drains or storm sewer	1%

Open Defecation

Nepal Multiple Indicator Survey (MICS) reported that among the total households in Nepal, 5% of households still practices open defecation and only in Koshi Province it is 3% (CBS, 2020). The sanitation situation assessment conducted by ENPHO in 2022 showed that 100% of surveyed households in the municipality have access to basic sanitation coverage (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.

3.2 Policies

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

3.2.1 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 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 19.

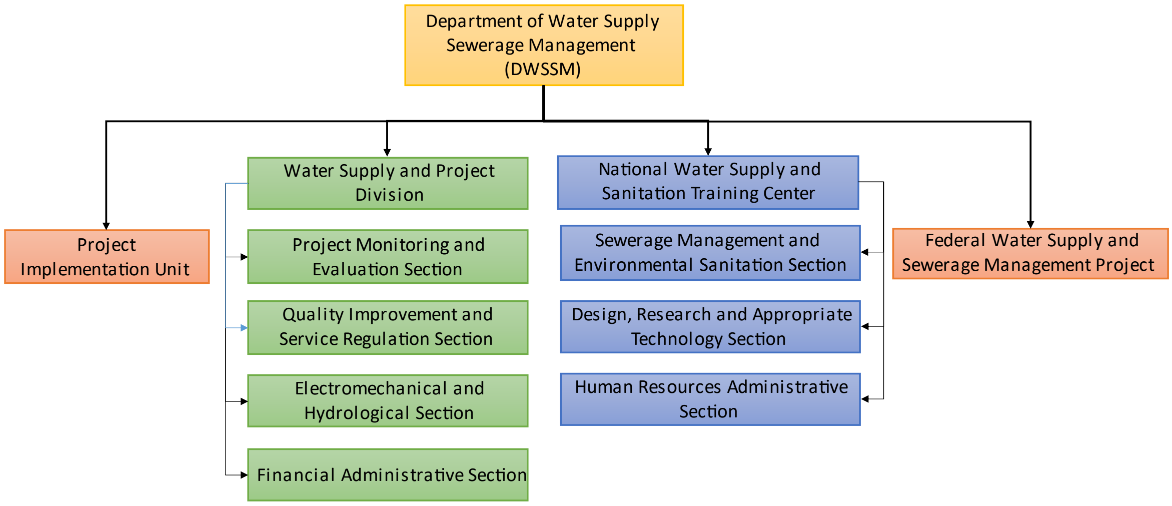


Figure 19: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).

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.

3.2.2 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 socioeconomic development. The policy has aimed to remedy challenges such as structuring of projects, land acquisition, coordination and approval, payments to private sectors and approval for environment impact (MoF, 2015).

3.2.3 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 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	✓	✓	✓

3.3 Planning

3.3.1 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. Interview was performed with Mr. Bharat Adhikari, Senior Officer of Urlabari Municipality for the planning and the activity that is going on sanitation sector and Mr. Chinta Mani Paudel, Manager of Urlabari Drinking Water Uses Committee. Table 10 shows the KII with the Municipal officers, Water Supply Management Board and Public Toilet Operator and Private Desludger (Figure 20).

Table 10: List of Key Informant Interviewed personnel.

S.N.	Name	Designation	Organization	Purpose of KII	Date
1.	Bharat Adhikari (KII-1)	Senior Officer	Urlabari Municipality	Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development	18th October, 2022
2.	Chinta Mani Paudel (KII-2)	Chairperson	Urlabari Water Users Committee	Supply and demand of water, water sources, groundwater contamination risk	18th October, 2022
3.	Som Prasad Gurgain, (KII-3)	Chairperson	Urlabari Septic Tanky	Emptying practices, finances, requirement, disposal and treatment	18th October, 2022

Figure 20: KII with member of Private Desludging Service Provider.

4.2 Household Survey

A 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 the household survey. The household survey was conducted using the mobile application "KOBOCOLLECT" after orientation. The SFD team members along with the municipal focal person went on field visits in households to encourage enumerators and observe the 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 390 households were sampled from 17,650 households distributed in 9 wards with proportionate stratification random sampling which is shown in Figure 21.

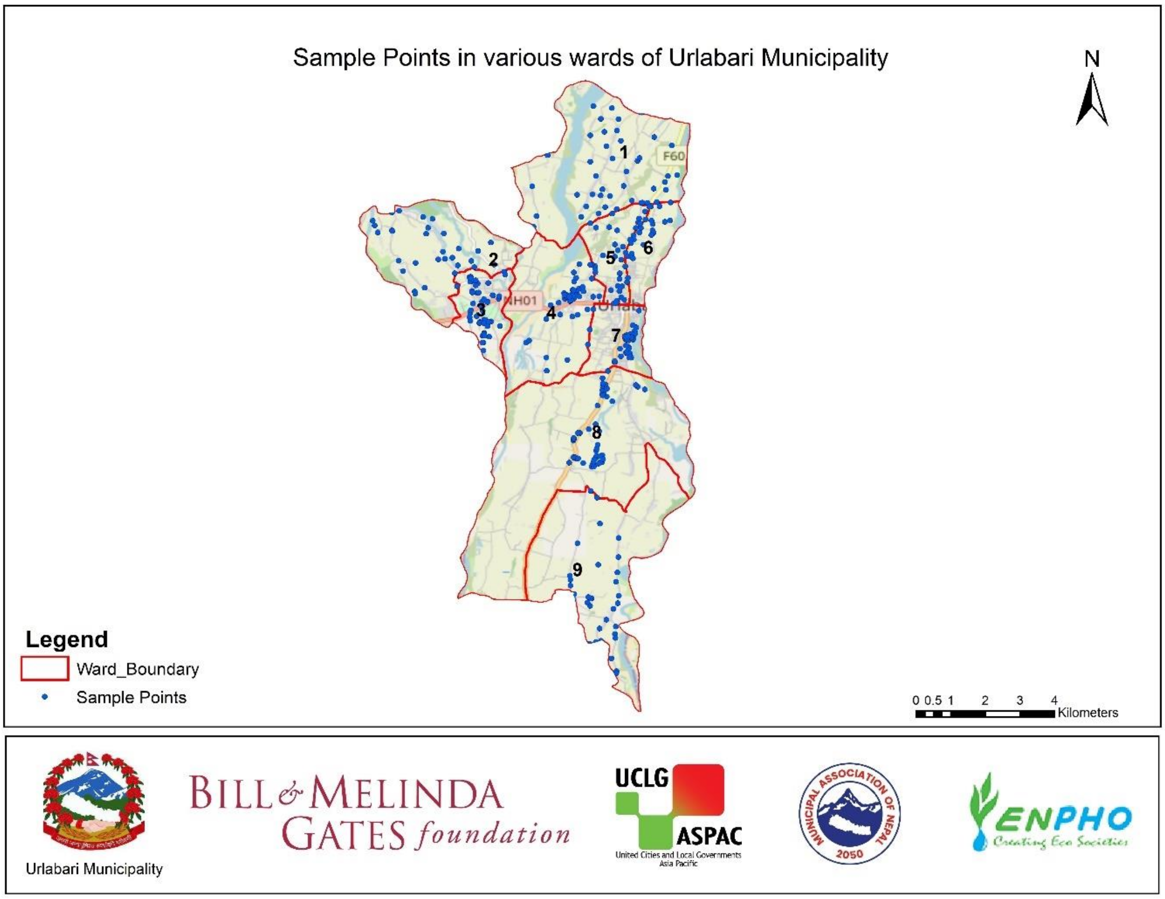


Figure 21: Distribution of sampling points in different wards of Urlabari Municipality.

4.2.2 Direct Observation

Various sanitation technologies in the households in all the wards were observed and visual references were kept in Figure 22. Also, observations of the toilet, water source, containments and transportation of faecal sludge were carried out.

Figure 22: 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, Chief Administrative Officer (CAO), 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 current sanitation status of the municipality (Figure 23).

Figure 23: Sharing and Validation at Urlabari 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 Ganga Prasad Kharel, Mayor, Mrs. Mina Kumari Khatiwada, Deputy Mayor, Mr. Agni Prasad Adhikari, Chief Administrative Officer of Urlabari Municipality. We would also like to thank Mr. Bharat Adhikari, Senior Officers and staff of Urlabari 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.

We are very grateful to Ms. Bhawana Sharma, Executive Director and Mr. Rajendra Shrestha, Program Director in Environment and Public Health Organization (ENPHO) for tremendous support and guidance during the whole process of the study. Together, we would like to thank all ENPHO colleagues for their support in the development of questionnaire for the survey and uploading data in KOBOCOLLECT tool.

We are grateful to the enumerators, Mrs. Anisha Dhimal, Mrs. Sabina Aryal, Mr. Manish Khatri, Mr. Bipin Bhattrai, Mrs. Rupa Ghimire, Mrs. Uma Gurung, Mrs. Kamala Phuyal, Mr. Pramod Babu Bhattrai and Saroj Dahal.

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7 Appendix

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

UCLG ASPAC

Municipalities Network Advocacy on Sanitation in South Asia

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

Attendance Sheet

Program: SFD orientation
Date: 2079/07/01 - 2079/07/02
Venue: Urlabari Municipality.

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Ethnicity
1	‹ l						
2	Sa						
3							
4.							
5.	Anisha Dhimal	Urlabari - 8		9816318905	[illegible]	[illegible]	
6.	Sabina Aryal	Urlabari - 3		9817356923	[illegible]	[illegible]	
7.	Manish Khatri	Urlabari - 1		9824004663	[illegible]	[illegible]	
8.	Bipin Bhattarai	Urlabari - 4		9824395623	[illegible]	[illegible]	
9.	Rupa Ghimire	Urlabari - 9		9829316418	Rupa	[illegible]	
10.	Uma Gurung	Urlabari - 5		9827377501	[illegible]	[illegible]	
11	[illegible]	Urlabari - 6		981430844[illegible]	[illegible]	[illegible]	
12	मनोज बाबु भट्टराई	Urlabari - 7		9810524939	मनोज	मनोज	
13.	[illegible]	Urlabari - 2		9817327935	[illegible]	[illegible]	
14	Janga Bahadur Rimal	Urlabari.	helper.		JBR	JBR	
15.	Anshu Shrestha	Urlabari		9820336273	[illegible]	[illegible]	
16	[illegible] Bahadur Tamang	"		9843869144	[illegible]	[illegible]	
17	Jagam Shrestha	ENPHO		9841671138	[illegible]	[illegible]	
18	Rupak Shrestha.	ENPHO		9849463840	[illegible]	[illegible]	

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

आज मिति २०८० जेष्ठ २४ गते उर्लाबारी नगरपालिकामा नेपाल नगरपालिका संघको आयोजनामा वातावरण र जनस्वास्थ्य संस्था (इन्फो) को प्राविधिक सहयोग, The United Cities and Local Government Asia Pacific (UCLG-ASPAC) को सहकार्य तथा Bill and Melinda Gates Foundation (BMGF) को आर्थिक सहयोगमा मानव मल मुत्र प्रवाह रेखाचित्र (Shit Flow Diagram - SFD) प्रमाणीकरण सम्बन्धि अभिमुखीकरण कार्यक्रममा निम्न अनुसार सरोकारवालाहरूको उपस्थिति रहेको छ ।

उपस्थिति :-

क्र.सं.	नाम	पद	कार्यालय	फोन नं.	हस्ताक्षर
१.	गंगा प्रसाद खरेल	प्रमुख	उर्लाबारी न.पा	९८४१०५२३२८	[illegible]
२.	मिना कुमारी खतिवडा	उप. प्र.		९८४२२[illegible]५०६	[illegible]
३.	अर्जुन प्रसाद अधिकारी	प्र. प्र. अ.			[illegible]
४.	तिलक कु पाँडे	वडाध्यक्ष १			[illegible]
५.	राजकुमार कर्णेल	″ -२			
६.	भीमराज दुङ्गाना	″ -३			
७.	कल्याणकुमार राई	″ -४			[illegible]
८.	राकेश लामा तामाङ	″ -५			[illegible]
९.	चिन्तामणी पोखरेल	″ -६			
१०	श्रीमती उर्मिला थापा	″ -७			[illegible]
११.	फुल बहादुर कार्की	″ -८			
१२.	नरबहादुर तामाङ	″ -९			
१३.	हरि खतिवडा	स्वास्थ्य	न.प्र. स्वास्थ्य	९८[illegible]	[illegible]
१४	तारा प्र. गुरागाँई	शि. सं	उर्ला. न.पा.	9851085417	[illegible]
१५	अशोक घिमिरे	अधिकृत	उ.न.पा.	9841907134	[illegible]
१६.	हिमाल देव	इन्जिनियर	उर्लाबारी न.पा	9852044708	[illegible]
१७.	पोखराज साह	इन्जिनियर	उर्लाबारी न.पा.	9861596508	[illegible]
१८	श्याम बहादुर कार्की	[illegible]	″	९८४२०६९४५	[illegible]
१९	कुबेर ढकाल	कर्मचारी	उ.न.पा.	९८४२०६६४४१	[illegible]

क्र.सं.	नाम	पद	कार्यालय	फोन नं.	हस्ताक्षर
१८	कविता ढुंगाना	पाचौं	उ० न० पा०	9842014189	
१९	चन्द्रकला खुलाल	अधिकृत	,,	9842099874	
२०	गोविन्द कार्की	ना.सु.	,,		
२१	रोशन उराव	इन्जिनियर	,,	9824228759	
२२	निमिते लिवाङ	कं.अ.	,,	9819060447	
२३	विकाश [illegible]	अधिकृत	,,	9851065760	
२४	रोशन थापा	स्व.प्र.अ.	,,	9829314949	
२५	सीता बुढाथोकी	का.प.स.	उर्लाबारी–९	9842201645	
२६	[illegible]	[illegible]	,, [illegible]	[illegible]	
२७	अम्बिका प्र. [illegible]	अधिकृत	,, ,,	[illegible]	
२८	कृष्ण माया कडरिया	का.स.	,,	98420282?9	
२९	कृष्ण [illegible]	का.पा.स.	,, 6	[illegible]	
३०	मान ब. [illegible]	व.कृ.नि.	उर्लाबारी ६	[illegible]	
३१	[illegible]	पत्रकार	,, – 6	[illegible]	
३२	जगलाल मण्डल	पत्रकार	उर्लाबारी ८	[illegible]	
३३	सबिता [illegible]	कं.अ.	उर्लाबारी-४	9815377203	
३४	दिलीप पोखरेल	पत्रकार	उर्लाबारी-३	[illegible]	
३५	सञ्जय प्रधान	नगरप्रहरी	उर्लाबारी-४	[illegible]	
३६	बद्रि भट्टराई	अ.हे.व.	,,	[illegible]	
३७	मदन बाबु [illegible]	पत्रकार	उर्लाबारी दैनिक	[illegible]	
३८	सिर्जना गौतम	प्रा.स.	उ.न.पा.	[illegible]	
३९	मन माया तामाङ	[illegible]	वडनं 6	[illegible]	
४०	सन्त कुमारी वि.क	का.पा.सद.	वडनं १	[illegible]	
४१	भरत अधिकारी	अधिकृत	उ.न.पा.	[illegible]	
४२	सुमन घिमिरे	पत्रकार	[illegible] दैनिक	[illegible]	
४३	बसन्त पौडेल	[illegible]	उर्लाबारी न.पा.	[illegible]	
४४	लक्ष्मी [illegible] पौडेल	[illegible]	उर्लाबारी ५	[illegible]	
४५	गीता [illegible]	सरसफाइ	,,		गीता
४६	हेम कुमारी नेपाली	कर्मचारी प्रतिनिधि	उर्लाबारी २	[illegible]	हेम
४७	[illegible] लिम्बु	सरसफाइ कर्मचारी	उ.न.पा	[illegible]	
४८	गजेन्द्र अधिकारी		,,	[illegible]	
४९	राज कु. ढुंगाना		,,	[illegible]	

क्र.स	नाम	पद	कार्यालय	फोन नं	हस्ताक्षर
	नरेन्द्र तिमल्सिना		उ.न.पा.	९८४२०२३९१३	
	मुरारी प्रसाद घिमिरे	प्रशासकीय अ	उर्लाबारी		
	तेज कुमार थापा	[illegible]	उर्लाबारी		
	शोभा लामिछाने	[illegible]	"		
	कुमारी देवी ओमा	[illegible]	"		
	दीपक श्रेष्ठ	इन्जिनियर	एन्फो	९८४१४५६६४०	

7.3 Appendix 3: Lab report of Urlabari Drinking Water Users Committee and Sanitation Organization

SUSTAINABLE DEVELOPMENT ENVIRONMENT QUALITY ANALYSIS QUALITY CONTROL — NEPAL BATAWARANIYA SEWA KENDRA

NEPAL BATAWARANIYA SEWA KENDRA

Morang Merchants' Association Complex

TESTING LABORATORY, UNDER NEPLAS SCHEME ISO/IEC: 17025:2017

Pdt Meghraj Marga (Goshwara Road), Biratnagar-7 Nepal Tel +977-21-570887

Date: 23rd August 2022

Test Report

Name of the Client	*Urlabari Khanepani Upavokta Tatha Sarsafai Sanstha*	*Location*	*Urlabari, Morang*
Sampled by	*NBSK*	*Date of Collection*	*20-08-2022*
Type of Sample	*Drinking Water*	*Date of Analysis*	*21-08-2022*
Sample code No	*SN- 236 (W),2022*	*Date of Completion*	*23-08-2022*

SN	Parameters	Units	NDWQS (MCL)	Results					
				1st Ayogena	2nd Ayogena	T4757	T4807	T2595	T4471
1	pH	-	6.5 - 8.5	6.74	7.18	7.11	6.93	7.13	6.86
2	Turbidity	NTU	5(10)	0	0	0	0	0	0
3	Total dissolved solids	mg/L	1000	127.7	108.55	110.85	111.2	109.05	108.85
4	Iron (Fe)	mg/L	0.3(3)	0.09	0.12	0.13	0.12	0.08	0.09
5	Residual Chlorine	mg/L	0.1-0.2	1	1	0	0	0	0
6	Total Coliform	CFU/100	Nil	Nil	Nil	Nil	Nil	Nil	Nil
7	Fecal Coliform	CFU/100	Nil	Nil	Nil	Nil	Nil	Nil	Nil
8	Conductivity	µS/cm	1500	255.4	217.1				
9	Colour	Hazen	5(15)	0	0				
10	Taste & Odour	-	-	Odourless	Odourless				
11	Fluoride as (F)	mg/L	0.5-1.5	1.20	0.95				
12	Ammonia as (NH_4-N)	mg/L	1.5	<0.05	<0.05				
13	Nitrate as (NO_3-N)	mg/L	50	0.47	0.34				
14	Nitrite Nitrogen	mg/l	3	<0.05	<0.05				
15	Chloride as (Cl)	mg/L	250	6	7				
16	Total Hardness	mg/L	500	99	78				
17	Calcium	mg/L	200	30.46	25.65				
18	Sulphate	mg/L	250	20	22				
19	Manganese (Mn)	mg/L	0.2	<0.05	<0.05				
20	Arsenic (As)	mg/L	0.05	<0.005	<0.005				
21	Zinc as (Zn)	mg/L	3	<0.05	<0.05				
22	Lead as (Pb)	mg/L	0.01	<0.01	<0.01				
23	Cadmium as (Cd)	mg/L	0.003	<0.003	<0.003				
24	T- Chromium as (T-Cr)	mg/L	0.05	<0.05	<0.05				
25	Cyanide	mg/L	0.07	<0.01	<0.01				

SN	Name	Tap nos.	Address
1.	Tek Bahadur Limbu	4757	Khopldada, Urlabari-09
2.	Fulmaya Moktan	4807	Assamo Tole, Urlabari-09
3.	Sharmila Karki	2595	Abiral Chowk Urlabari-01
4.	Thamesh Gurung	4471	Jhure Urlabari-05

Prepared by   *Analyst*   *Authorized signature* *Lab In-charge*

P.O. Box 104, Email: nenscbrt@gmail.com/seamnmmaesc@gmail.com

7.4 Appendix 4: Published report on Faecal Sludge Management Act, 2079

उर्लाबारी नगरपालिका

स्थानीय राजपत्र

खण्ड : ५ सङ्ख्या : ८ मिति : माघ २६, २०७९

भाग - १

उर्लाबारी नगरपालिका, मोरङ

स्थानीय सरकार सञ्चालन ऐन, २०७४ को दफा १०२ ले दिएको अधिकार प्रयोग गरी उर्लाबारी नगरपालिकाबाट सर्वसाधारणको जानकारीका लागि यो राजपत्र प्रकाशन गरीएको छ ।

दिसाजन्य लेदो व्यवस्थापन ऐन, २०७९

SFD Promotion Initiative

SFD Urlabari Municipality, Nepal, 2023

Produced by:

Rupak Shrestha, ENPHO
Jagam Shrestha, ENPHO
Buddha Bajracharya, ENPHO
Sabuna Gamal, ENPHO
Anita Bhuju, ENPHO
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This Executive Summary and the SFD Report are available from:

www.sfd.susana.org