# SFD Report

# Belbari 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 Belbari Municipality, Nepal, 2025

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## 1. The SFD Graphic

**Belbari Municipality, Koshi, Nepal**
**Version: Reviewed**
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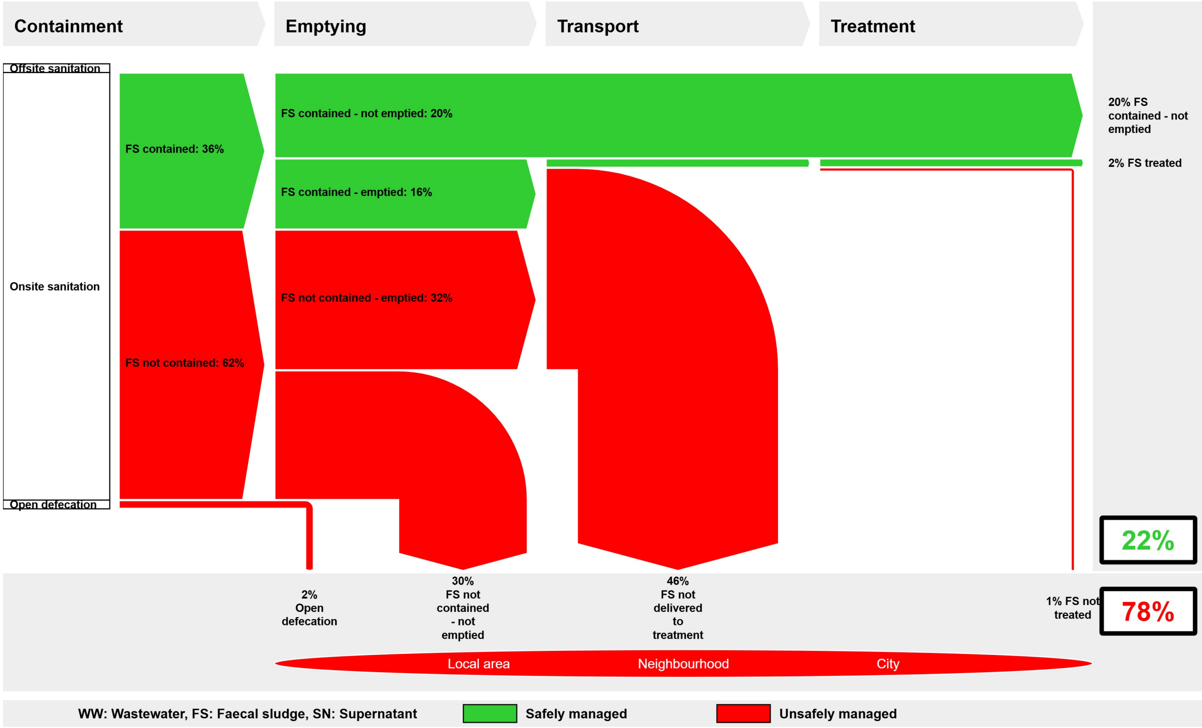


The SFD Promotion Initiative recommends preparation of a report on the city context the analysis carried out and data sources used to produce this graphic.
Full details on how to create an SFD Report are available at sfd.susana.org

## 2. Diagram information

**SFD Level:**

This SFD is a level 2 - Intermediate report.

**Produced by:**

Environment and Public Health Organization (ENPHO).

**Collaborating partners:**

Belbari Municipality

Municipal Association of Nepal (MuAN)

United Cities and Local Governments Asia-Pacific (UCLG ASPAC)

**Status:**

Final SFD Report.

**Date of Production:**

01/06/2024

## 3. General city information

Belbari is a municipality situated in Morang district, Koshi Province of Nepal. It was established on May 8, 2014 (Baisakh 25, 2071 BS) by merging Belbari and Kaseni VDC which was again restructured in December 20166 by merging Dangihat and Bahuni Village Development Committee (VDC). It comprises 11 political wards spread across 132.79 square kilometres of geographical area in the eastern terai region of Nepal.

The municipality's population stood at 81,771 individuals distributed across 20,459 households. The male and female populations were 38,297 (46.8%) and 43,474 (53.2%) respectively (NSO, 2021) . The municipality has experienced an annual growth rate of 2.1% per annum, and a population density of 615.8/km² (City Population, Belbari, 2021) .

The study area has a subtropical climate with three major seasons: summer, monsoon and winter season. The meteorological records were average annual rainfall of 1,312 mm, average annual minimum and maximum temperatures of 14.2°C and 30.6°C respectively (Adhikari and Thapa, 2017).

## 4. Service outcome

This section provides a quick summary of the various sanitation technologies used across the municipality's sanitation value chain. All data in this section are from the household and institutional surveys conducted for this study (ENPHO, 2023). Despite municipality being declared as Open Defecation Free (ODF), still 2% of the total population lacks access to basic sanitation facilities and defecate in open places, neighbor toilets, and public toilets.

*Containment:*

Of the total households of the municipality, 18% of households installed fully lined tanks with a single or double chamber, and 2% have built biogas. Additionally, 14% of households have constructed lined tanks with impermeable walls and an open bottom. Twin pits are installed by 21% of households, while single offset pits were adopted by 43% of households who use pre-cast concrete rings to assemble.

All 30 surveyed institutions in the municipality have access to a safely managed sanitation system: 53.3% institutional buildings had fully lined tanks, 33.3% had lined tanks with impermeable walls and open bottom, 10% had single pit, and 3.4% had built twin pits.

*Emptying and transportation:*

Notably, among the 98% of households with containment, 53.9% have emptied their containment due to faecal sludge overflow using mechanical desludging vehicles. About 22.2% of the population opts for mechanical emptying, while a significant 75.4% relies on manual methods, and 2.3% practiced open emptying of faecal sludge in drains.

The municipality has 2 private desludging service providers: Ramro septic tank cleaning service and Morang septic tank cleaning service with a vehicle of capacity 6,000-litre, offers on-demand emptying services and costs vary as per the containment shape.

*Treatment and Disposal:*

The municipality lacks a treatment plant. The mechanically emptied faecal sludge was either applied on farmland upon the request of the service taker or disposed of in an open environment like open ground or water bodies, whereas manually emptied sludge are applied on farmlands, used for composting, disposed of it in water bodies, and adopted the practice of dig and dump.

*Risk Assessment:*

The survey findings indicated 85.1% of households consumed groundwater as main source of drinking water, 14.2% had private tap in their home, and 0.5% relied on public taps. Likewise, 0.2% dependent on jar water for drinking purpose. Key Informant Interviews (KIIs) indicated that Belbari Small town WSUO has been covering 2,697 households in wards 1, 2, 3, and partial area of 4. Likewise, there are other different small WSUC serving to small number of households in their respective ward.

People who use open-bottom tanks and handpumps with a horizontal distance of less than 25 feet (7.6 m) from the source of pollutants and a depth of up to 100 feet (30.4 m) are thought to be at significant risk of groundwater pollution. While households who have installed lined pits with semi permeable walls and open bottom are at high risk of ground water contamination as they pumped through handpump for water consumption.

The SFD graphic shows that 22% of the excreta or faecal sludge generated are safely managed while 78% are unsafely managed. The safely managed Faecal Sludge (FS) generated by 20% of the population is temporary as this FS is only contained. So, once the containment gets filled and the FS from the containment is emptied, the percentage of unsafely managed FS would increase.

## 5. Service delivery context

Access to safe 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 endorsed the Water Supply and Sanitation Act 2022 which has 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, the National Sanitation and Hygiene Master Plan (NSHMP) 2011 has proved as an important strategic document for all stakeholders to develop uniform programs and implementation mechanism at all levels. It strengthens institutional set up with the formation of water and sanitation coordination committee at every tier of government to actively engage in sanitation campaigns.

There is not a specific policy for faecal sludge management. However, there are plans to allocate land for the construction of the Detailed Project Report (DPR) near the area designated for solid waste disposal management.

## 6. Overview of stakeholders

Based on the regulatory framework for Faecal Sludge Management (FSM), the major stakeholders for effective and sustaining service delivery as presented in Table 1.

**Table 1: Overview of Stakeholders.**

| Key Stakeholders | Institutions / Organizations |
|---|---|
| Public Institutions at Federal Government | Ministry of Water Supply |
| Public Institutions at Provincial Government | Ministry of Water Supply, Irrigation and Energy |
| Public Institutions at Local Government | Belbari Municipality, Belbari WSUC |
| Non-governmental Organizations | Environment and Public Health Organization (ENPHO) |
| Private Sector | Private desludging service providers, Public toilet operators. |
| Development Partners, Donors | MuAN, BMGF, UCLG ASPAC |

## 7. Credibility of data

The data were collected from proportionate stratification random sampling. Altogether, 584 households and 30 institutions were surveyed by 11 wards of the municipality. Primary data on emptying, transportation, and current sanitation practices in the municipality are validated from Key Informant Interviews (KIIs) with private desludgers, water service providers, public toilet caretaker and other different sanitation and environmental stakeholder. The overall data and findings were shared with the stakeholders of the municipality and validated through a sharing program on 22 April, 2024.

## 8. Process of SFD development

Data on sanitation situations is collected through household and institutional surveys (ENPHO, 2023). 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 engineer of municipality and private desludging service providers to understand the situation practices across the service chain. Types of sanitation technologies used in different locations were mapped using ARCGIS. To produce the SFD graphic, initially a relationship between sanitation technology used in questionnaire survey and SFD PI methodology was made. Then, data were fed into SFD graphic generator to produce the SFD graphics.

## 9. List of data sources

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


- Adhikari and Thapa. (2017). Vertebrate-faunal diversity profile of Sisauli Wetland, Belbari, Morang. Retrieved from Nepalese Journal of Biosciences.
- ENPHO. (2023). Sanitation Survey on Belbari Municipality. Belbari.
- ENPHO. (2023). Sanitation Survey on Belbari Municipality. Belbari.
- City Population, Belbari. (2021, May 23). City Population. Retrieved from nepal city population/morang/belbari: https://citypopulation.de/en/nepal/mun/admin/morang/0501__belbari/
- MICS. (2020). Multiple Indicator Cluster Survey, 2019. Kathmandu, Nepal: Central Bureau of Statistics.
- Belbari Municipality. (2019). Municipal Profile of belbari Municipality.
- NSO. (2021). National population and housing census 2021. Kathmandu: National Statisitics Office.

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# Abbreviations

| | |
|---|---|
| AEPC | Alternative Energy Promotion Centre |
| BMGF | Bill and Melinda Gates Foundation |
| DPR | Detailed Project Report (DPR) |
| DWSSM | Department of Water Supply and Sewerage Management |
| ENPHO | Environment and Public Health Organization |
| FS | Faecal Sludge |
| FSM | Faecal Sludge Management |
| GoN | Government of Nepal |
| HH | Household |
| IRF | Institutional and Regulatory Framework |
| KII | Key Informant Interview |
| KM | Kilometres |
| MDG | Millennium Development Goal |
| MICS | Multiple Indicator Cluster Survey |
| MuNASS-II | Municipalities Advocacy on Sanitation in South Asia – II |
| MuAN | Municipal Association of Nepal |
| MoH | Ministry of Health |
| MoHP | Ministry of Health and Population |
| MoWS | Ministry of Water Supply |
| MuAN | Municipal Association of Nepal |
| NGO | Non-Governmental Organization |
| NPC | National Planning Commission |
| NWSSP | National Water Supply and Sanitation Policy |
| ODF | Open Defecation Free |
| PPP | Public Private Partnership |
| RWSSNP | Rural Water Supply and Sanitation National Policy |
| SDP | Sector Development Plan |
| SFD | Shit Flow Diagram |
| 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 |
| WHO | World Health Organization |
| WSUO | Water Sanitation Users Organization |
| WW | Wastewater |

# 1 City context

Belbari is a municipality situated in Morang district, Koshi Province of Nepal. The name "Belbari" originated from the abundance of Bel trees that flourished in the jungle during ancient times. It signifies a place abundant with trees (Belbari Municipality, 2019) . It was established on May 8, 2014, A.D. (Baisakh 25, 2071 BS) by merging Belbari and Kaseni Village Development Committee (VDC) which was again restructured in December 2016 A.D (2073 BS) by merging Dangihat and Bahuni VDC (Figure 1). It comprises 11 political wards spread across 132.79 square kilometres of geographical area in the eastern terai region of Nepal (Belbari Municipality, 2019).

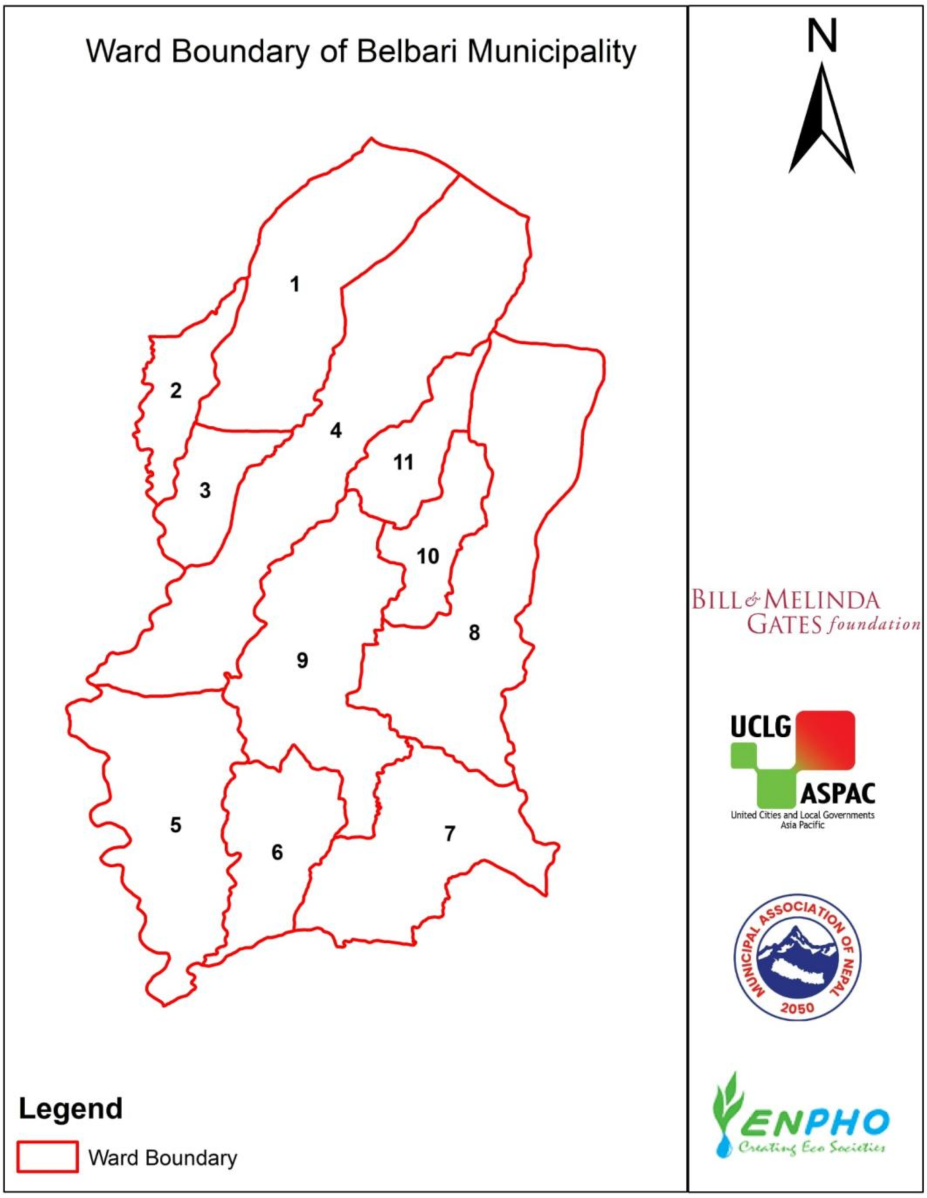


**Figure 1: Ward Map of Belbari Municipality.**

## 1.1 Population

The municipality's population, according to the 2021 National Population and Housing Census, is 81,771 individuals distributed across 20,459 households. The male and female populations are 38,297 (46.8%) and 43,474 (53.2%) respectively (NSO, 2021) . The municipality has experienced an annual growth rate of 2.1% per annum, resulting in a population density of 615.8/km² (City Population, Belbari, 2021) .

## 1.2 Climate

The study area has a subtropical climate with three major seasons: summer, monsoon and winter season. Summer is a hot and dry period of the year that lasts from February to mid-June. Monsoon season lasts from mid-June to late September characterized by torrential downpour with hot and humid climate. Winter is generally cold that lasts from late October to late February. The meteorological records are average annual rainfall of 1312 mm, average annual minimum, and maximum temperatures of 14.2°C and 30.6°C respectively (Adhikari and Thapa, 2017).

## 1.3 Topography

It is mainly characterized by strong terrain and fertile land, where the larger flatland is mainly used for farming system. It is situated at an altitude of 112 to 116 metres above sea level, has geographical coordinates ranging from 26°36’16’ North to 27°32’26’’ North latitude and 78°43’33’’ East to 78°28’42’’ East latitude. To the east lies Kanepokhari Rural Municipality and Letang Municipality, Sundarharaicha Municipality and Gramthan Rural Municipality are to the west, Letang Municipality and Kerabari rural municipality is to the north, and the southern border connects with Rangeli Municipality (Belbari Municipality, 2019).

# 2 Service Outcomes

## 2.1 Overview

The country has persistently worked towards achieving its current sanitation status for over three decades. On September 30, 2019, the Government of Nepal declared the nation free of open defecation, marking universal access to improved sanitation facilities nationwide (MoWS, 2017).

Despite the nationwide ODF declaration in 2019, the sanitation situation in many places remains unsatisfactory across the country. To assess the sanitation status across the entire sanitation value chain data on sanitation situation were collected through household and institutional surveys (ENPHO, 2023). A household survey was conducted in 583 sampled households using a proportionate sampling across the 11 wards of Belbari Municipality (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 reviews, Key Informant Interviews (KIIs) and a validation workshop are presented in this section.

### 2.1.1 Sanitation Systems in household buildings

The National Population and Housing Census, 2021 indicates that 2.7% of the households lacks access to basic sanitation facilities. Additionally, findings from this survey in 2023 revealed that 2% of the total households lacks access to improved sanitation facilities within municipality. An improved sanitation facility is defined as one that hygienically separates human excreta from human contact. Improved sanitation facilities include flush or pour flush to piped sewer systems, septic tanks, or pit latrines, ventilated improved pit latrines, pit latrines with slabs and composting toilets (MICS, 2019).

In the municipality, 98% of the households has access to improved sanitation facilities, all relying on onsite sanitation system. Any sanitation technology or system involving the collection and storage of excreta (referred to as faecal sludge) on the plot where it is generated is known as onsite sanitation (Susana, 2018) . In the municipality, 18% of households installed fully lined tanks with a single or double chamber, lacking provision for soak pits, and 2% have biogas built. Additionally, 14% of households have constructed lined tanks with impermeable walls and an open bottom. Twin pits are installed by 21% of households, while single offset pits are a popular choice, adopted by 43% of households who used pre-cast concrete rings to assemble the pits.

Table 1 illustrates the various types of onsite sanitation technologies used in the municipality and the corresponding proportion of households utilizing each.

**Table 1: Sanitation system showing open defecation and different onsite sanitation technologies installed at households in Belbari municipality (ENPHO, 2023).**

| Types of containment | Construction material used in the wall of the containment | Construction material used in the bottom of the containment | Number of Chambers | Number of containments | % | Recategorized as SFD | % |
|---|---|---|---|---|---|---|---|
| Biogas Digester | NA | NA | NA | NA | 2% | Fully lined tank | 21% |
| Fully Lined tank | Cemented brick/stone walls or concrete wall | PCC or plaster | One or two | NA | 19% | | |
| Lined tank with impermeable walls and open bottom | Cemented brick/stone walls or concrete wall | Soiling or nothing | One or two or more than two | NA | 14% | Lined tank with impermeable walls and open bottom | 14% |
| Single Pit | Concrete rings in piled up form | Soiling or nothing | NA | One | 43% | Lined pit with semipermeable walls and bottom | 63% |
| Twin Pits | Concrete rings in piled up form | Soiling or nothing | NA | Two | 20% | | |
| Open defecation | NA | NA | NA | NA | 2% | Open defecation | 2% |
| | | | | | | **Total** | **100%** |

**Biogas**: A biogas digester, an effective energy conversion technology, treats household-generated faecal sludge through anaerobic digestion. This process reduces sludge size, eliminates harmful pathogens, and yields biogas and nutrient-rich slurry, biologically stable to use as a soil conditioner (Linda Strande, 2014). The Alternative Energy Promotion Centre (AEPC) has promoted biogas technology in 77 districts of Nepal, contributing to improved health and sanitation (AEPC, 2018). In the municipality, 2% of households opted for biogas digesters. When creating a SFD graphic, biogas is reclassified as SFD containment, considering it as a fully lined tank.

**Fully Lined Tank**: A fully lined tank is a rectangular tank with impermeable walls and a base, engineered to prevent leakage or seepage of faecal sludge into the surrounding environment. This design ensures the safe storage of faecal sludge, protecting against groundwater contamination (Linda Strande, 2014). In the municipality, 18% of households have fully lined tanks.

**Twin Pits**: Ideally, twin pits consist of two properly constructed and well-maintained pits with semi-permeable, honeycombed lined walls and an open, permeable base designed for infiltration, ensuring structural integrity, and preventing contamination. These pits effectively treat faecal sludge when there is no exfiltration of water. (Saxena & Den, 2022) The two sets of pits are used alternately to store blackwater, with one pit in use while the other undergoes natural decomposition. These pits are either dug or made by assembling precast concrete rings at a minimum horizontal distance of 1.2m. Both pits are connected through a diversion box. About 21% of the households have twin pits installed in their house (Figure 2).

**Figure 2: Picture illustrating the design of twin pits installed at the household level.**

**Single Pit**: A properly constructed and well-maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base facilitating infiltration (Susana, 2018). Unlike fully lined tanks, single pits lack a specifically designed outlet for effluent, allowing percolation into the soil. In the municipality, 43% of households have single pits.

While reclassifying according to SFD graphic, twin pit and single pit are considered as lined pit with semipermeable walls and open bottom, which is installed by more than half (63%) of the sampled households.

**Lined Tank with Impermeable Walls and Open Bottom:** This rectangular onsite technology involves constructing tanks with impermeable walls and a permeable base, allowing the infiltration of effluents that could potentially contaminate groundwater (Peal, et al., 2020) . In the municipality, 14% of households have installed this type of containment. Due to the permeable base with risk of groundwater contamination, containments such as single offset pit and lined tank are considered unsafe which are built in overall every ward of the municipality.

Overall location of the people practicing open defecation and different sanitation technologies built across the different wards of municipaity are shown in GIS map of Buddhabhumi Municipality (Figure 3).

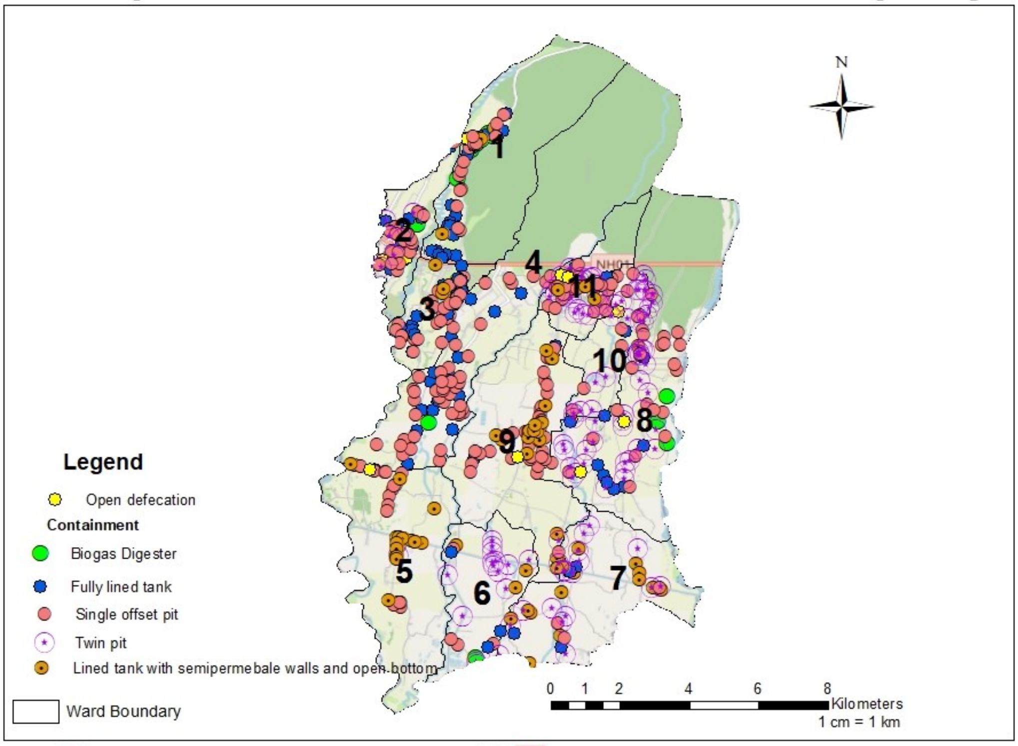


**Figure 3: Map locating different types of containment in Belbari Municipality.**

### 2.1.2 Sanitation System in Institutional Buildings

All the 30 surveyed institutions had access to a safely managed sanitation system in the municipality. Different educational institutes, government and non-government offices, health care centres and hotels with lodging facilities were surveyed.

The findings showed that 53.3% of institutional buildings had made fully lined tanks, 33.3% had lined tanks with impermeable walls and open bottom, 13.4% had lined pits with semi-permeable walls and open bottom (10% single offset pit, 3.4% twin pit). Only 2.8% of the sampled institutions are emptied till date. The proportion of different types of sanitation technologies are shown in sampled institutions as shown in Figure 4.

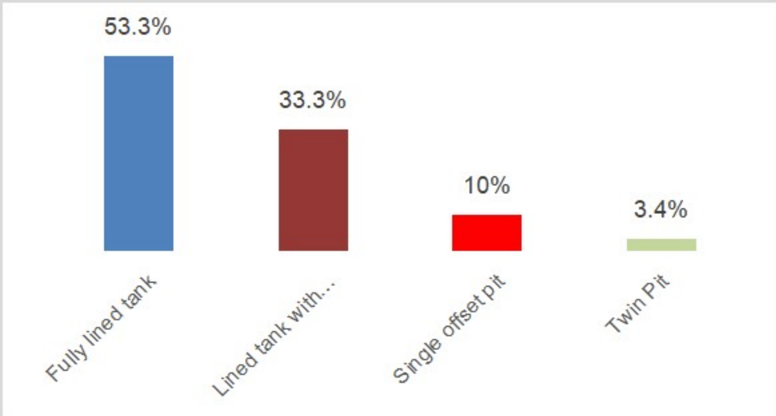


**Figure 4: Containments used in institutional buildings.**

### 2.1.3 Public Toilets

As per findings of KII (KII-3, 2023), there are approximately 4-5 public toilets situated in various areas of the municipality. During the survey, information about 2-3 of these public toilets was taken.

One of these toilets is located near the newly constructed Nondra bridge. It was constructed by Belbari Municipality and feature separate sections for male and female users. The excreta from the toilet are connected into rectangular holding tanks, as illustrated in the accompanying Figure 5.

**Figure 5: Public toilet constructed near Nondra Bridge.**

There is another public toilet located in Dangighat, ward 10, which was built around 10 years ago by the Bhaunne Kirtiman Road Construction Users Committee. Just like the municipal toilets, this one has separate sections for men and women. Water for this toilet is sourced from a nearby tube well. An elderly woman takes care of the maintenance and cleanliness of the toilet and collects fees from users. The sanitary condition of the toilet is satisfactory, and the excreta from toilet is connected to a rectangular holding tank, shown in Figure 6.

**Figure 6: Public toilet constructed in Dangihat, ward 10.**

### 2.1.4 Emptying and Transportation Services of Containment

**Emptying of containment**

Emptying is one of the major components of the sanitation service chain. Regular emptying of the containment prevents sludge overflow and blockages (Strande, 2014). It ensures the proper functioning of containment basically for the septic tank which functioned well until the volume of sludge is one-third of the total volume of the tank. Interestingly, of the total 98% of households with containment, 53.9% have emptied their containment due to faecal sludge overflow. Single offset pits and twin pits are emptied more frequently compared to rectangular tanks (KII-2, 2023). Figure 7 shows the municipal map with status of containment emptying, green indicating the emptied containments and red indicating containment that have not been emptied.

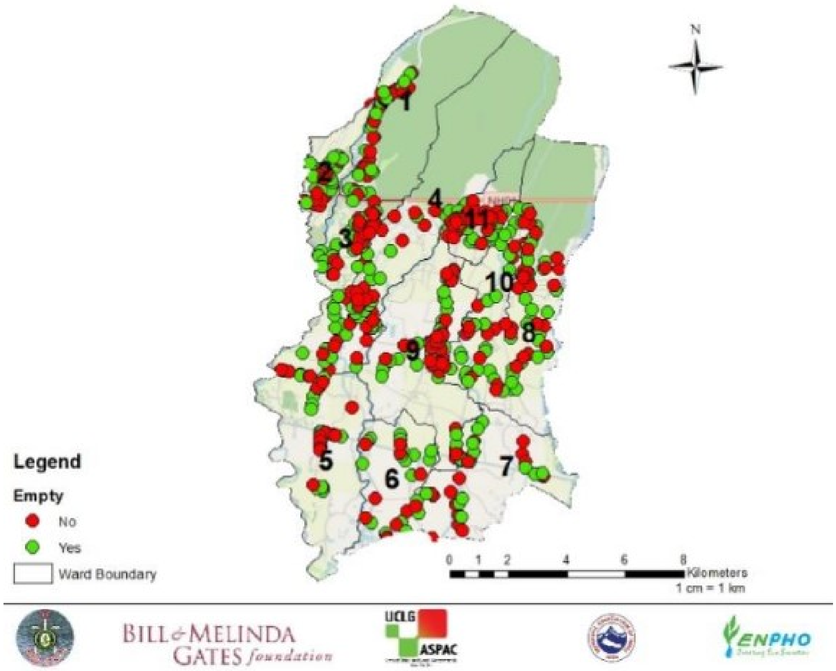


**Figure 7: Map showing containment emptied status in wards.**

The findings indicate that 22.3% of the population opts for mechanical emptying, while a significant 75.4% still relies on manual methods, and 2.3% practiced open emptying frequently observed in rainy season. Despite having mechanical desludging service available, the majority opt for manual desludging. Upon the further analysis it was found that the reason for people practicing manual emptying varies, 68.4% finds the service charge for mechanical desludging expensive, 14.9% had no idea about contact medium to mechanical desludger, and access to traditional sanitation worker for manual emptying was easy option to them, for 7.1% their containments was not easily accessible for mechanical desludging, and 9.6% prefer applying faecal sludge to farm after manually emptying (Figure 8).

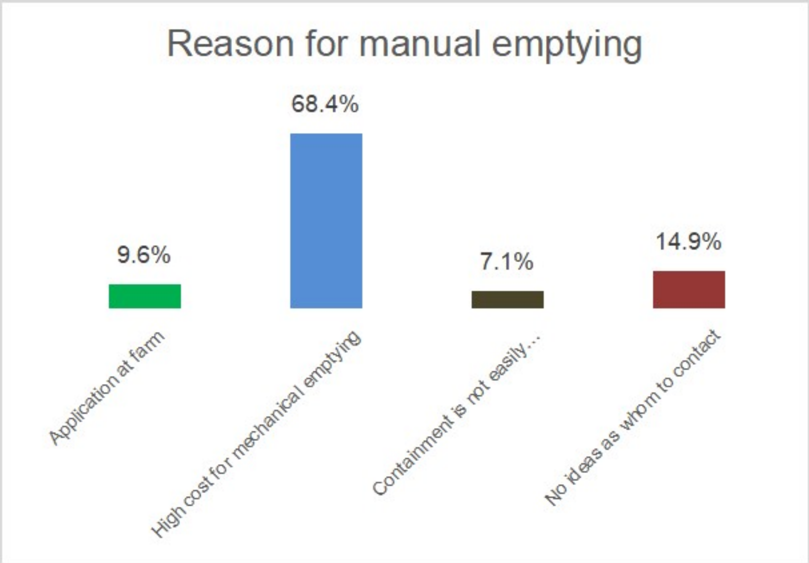


**Figure 8: Reason for manual emptying.**

Private desludging services are offered in the municipality by two providers: Ramro septic tank cleaning service and Morang septic tank cleaning service. The interview was taken with the desludgers and the detail description obtained from the interview is incorporated in following Table 2 (KII-2, 2023). The Figure 9 are the pictures of desludging vehicle that provide services in the municipality.

**Table 2: Details on private desludging service providers.**

| Service Providers | Ramro Septic tank Sanitation service | Morang Septic tank and Sanitation Service |
|---|---|---|
| Service started on | 2020 | 2021 |
| Capacity of vehicles | 6,000 litres | 6,500 litres |
| Cost per trip | For containments: Rs. 2,500 (USD 18)<br>For ring tank: Rs. 500 per ring (USD 4) | |
| Average number of trips per month | 30-40 | 20-30 |
| Disposal Practice | Farmland (on-demand), or land on lease for disposing faecal sludge | |

**Figure 9: Private desludging vehicle for containment emptying in Belbari Municipality.**

### 2.1.5 Treatment and Disposal/Reuse of Faecal Sludge

The municipality lacks a treatment plant. The mechanically emptied faecal sludge is either applied on farmland at the request of the service taker (Figure 10) or disposed of in an open environment like open ground or water bodies. The desludging vehicle was observed disposing of the sludge onto farmland on request of landowner, where it is used as fertilizer. Figure 10 illustrates the desludging vehicle in the act of disposing sludge on farmland.

**Figure 10: Desluding vehicle disposing the sludge to farmland.**

Of those who manually emptied faecal sludge, about 69.7% adopt the practice of digging new pits and dumping the old filled ones. Around 23.7% directly use the sludge on farmlands. A small minority, about 4.4%, use it for composting, but this method is considered unsafe, and 2.1% dispose of it in water bodies (Figure 11). However, the direct application to farm, and disposal in water bodies cannot be considered safe as it possess direct risk to environment and public health.

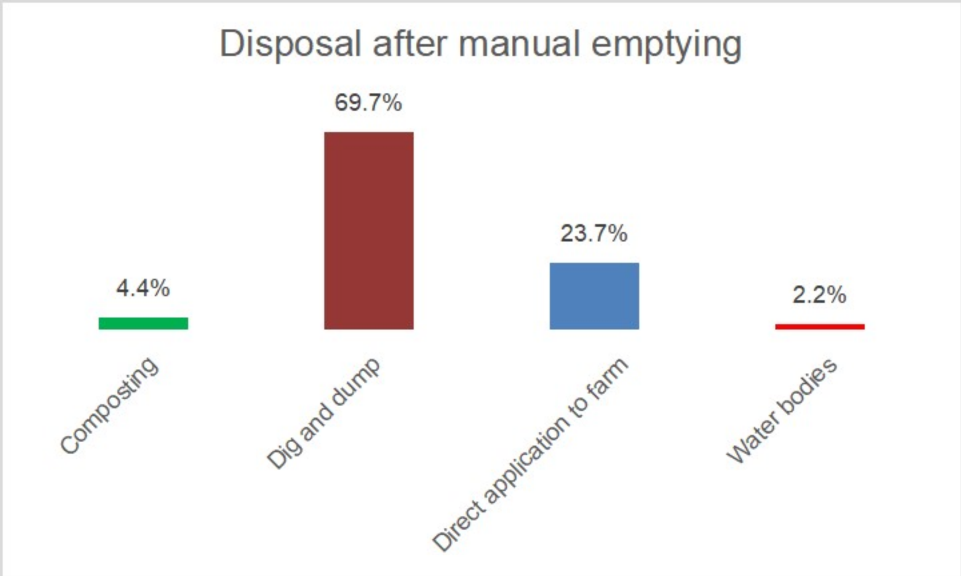


**Figure 11: Disposal practices after manual emptying.**

### 2.1.6 Risk assessment of groundwater pollution from open bottom containment

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

**a. Sources of Drinking Water**

According to the survey, 85.1% of households use groundwater as their main drinking water source, while 14.2% have private taps at home. A small percentage, 0.5%, rely on public taps, and 0.2% use jar water. Key informant interview (KII-3, KII-4 2023) revealed that the Belbari Small Town Water and Sanitation Users Organization serves 2,697 households in wards 1, 2, 3, and partial area of 4. They operate an overhead tank with a capacity of 450 cubic metre and a water treatment system. The source of water is two large boreholes dug 120 metres deep, using a groundwater pumping system where water from depths of 115-117 metres is treated in a plant equipped with pressure filters and a chlorination unit (KII-4, 2023).

During a site visit to the WSUO, photographs of the overhead tank, boring system, and water treatment facilities were taken and are included in Figure 12.

**Figure 12: Belbari small town WSUO site visit pictures.**

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

The term aquifer pollution vulnerability is intended to represent the varying level of natural protection afforded by the contaminant attenuation capacity of the unsaturated zone or semi-confining beds above an aquifer, because of physicochemical processes (filtration, biodegradation, hydrolysis, adsorption, neutralization, volatilization, and dispersion)—all of which vary with their texture, structure, clay content, organic matter, pH, redox and carbonate equilibria. Groundwater vulnerability is specific to containment type and pollution scenarios (Andreo, 2013). Here, 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 World Health Organization (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.

People using open bottom tanks and consuming water from the handpumps with the depth up to 100 feet (30.4 m) and horizontal distance of the pump within 25 feet (7.6 m) from the source of pollutants are assumed at significant risk to groundwater pollution.

Figure 13 illustrates the depth of hand pumps and their horizontal distance from lined pits with semi-permeable walls and an open bottom (twin pits and single offset pits). In total, 64% of households have installed lined pits with semi-permeable walls and an open bottom. Among these, 92% of households use groundwater as a source of drinking water, and it was found that 86% of these households are at high risk of groundwater contamination due to the water being pumped through hand pumps. Thus, the population with lined pits having semi-permeable walls and an open bottom, without outlet or overflow, and presenting a significant risk of groundwater pollution (T2A5C10) is 51% (calculated as 64% x 92% x 86% = 51%).

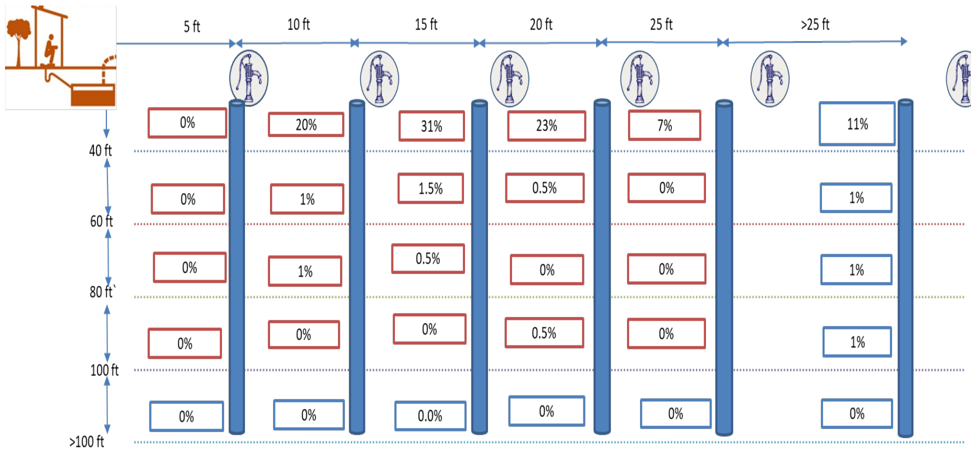


**Figure 13: Depth of hand pumps and lateral spacing of it with containment types: lined pit with semi-permeable walls and open bottom.**

Figure 14 illustrates the depth of hand pumps and their horizontal distance from lined tanks with impermeable walls and an open bottom. Specifically, 14% of households have installed lined tanks with impermeable walls and an open bottom, of which 86% rely on groundwater for drinking. Among these households, it was revealed that 83% are at a high risk of groundwater contamination due to the water pumped through hand pumps. Consequently, the population with lined tanks having impermeable walls and an open bottom without outlet or overflow and presenting a significant risk to groundwater pollution (T2A4C10) is 9% (calculated as 14% x 86% x 83% = 9%).

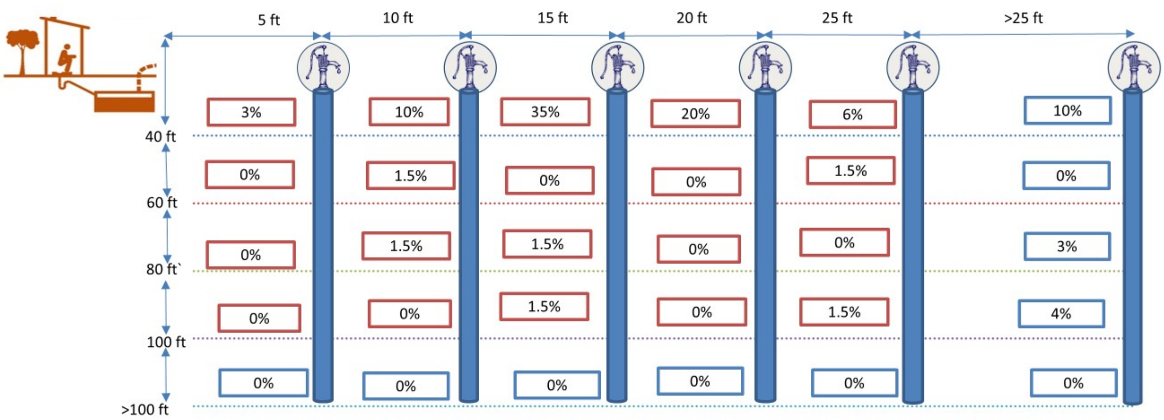


**Figure 14: Depth of hand pumps and lateral spacing of it with containment types lined tank with impermeable walls and open bottom.**

## 2.2 SFD Selection Grid

The SFD grid consists of different containment technology used in list A and its connection in list B. Sanitation technologies selected in the SFD grid in Belbari 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 households without toilet resorting to open defecation. Similarly, horizontal row at the top of the selection grid shows options for connection made for the outlet or overflow of discharge from the toilet.

As per the containment definition by Shit Flow Diagram Promotive Initiative (SFD PI), various containments are categorized into different SFD categories. For example, biogas is reclassified as a fully lined tank, given that the walls and bottom of the biogas structure are water-sealed and share similar features with a fully lined tank. Similarly, single pits and twin pits, constructed by assembling pre-cast concrete rings on top of each other, are collectively referred to as lined pits with semi-permeable walls and an open bottom. However, fully lined tanks and lined tanks with impermeable walls and open bottom do not require reclassification and remain unchanged. After the reclassification of these containments, the types of sanitation technologies and their connections are chosen in the SFD selection grid, as illustrated in Figure 15.

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

**Figure 15: SFD selection grid for Belbari Municipality.**

A brief explanation of terms used to indicate different frames selected in the SFD selection grid is explained in Table 3.

**Table 3: Explanation of terms used to indicate frame selected in the SFD selection grid.**

| | |
|---|---|
| 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. |
| T1A3C8 | A correctly designed, properly constructed, and well maintained fully lined tank with impermeable walls and base, tank connected to open ground and this system is considered not contained. |
| T1A4C10 | A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. However, since the tank is not fitted with a supernatant/effluent overflow this system is considered contained. |
| T1A4C8 | A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. Since the tank is fitted with a supernatant/effluent overflow connected to open ground, the excreta in this system is considered not contained. |
| T1A5C10 | A correctly designed, properly constructed and well-maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is not fitted with a supernatant/effluent overflow, so this system is considered contained. |
| T2A4C10 | A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. 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 | 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. |
| T1B11C7 to C9 | With no toilet, users defecate in water bodies, on open ground and to don't know where; consequently, the excreta is not contained. |

## 2.3 SFD matrix

### 2.3.1 Proportion of Faecal Sludge from types of sanitation technologies

In the second step of developing an SFD graphic, the proportion of Faecal Sludge (FS) in each type of sanitation technology is calculated. Following detailed instructions in SFD PI, a default "100%" value is applied when onsite containers are connected to soak pits, water bodies, or open ground, representing the entire contents as faecal sludge, with a portion being periodically emptied.

For onsite containers connected to a sewer network or open drains, a "50%" value is used, indicating that half the contents are modelled as faecal sludge, with periodic emptying. The remaining fraction contains faecal sludge in the container and infiltrate (for open-bottomed tanks), while the other half is modelled as supernatant discharging into the sewer network or open drains. The formula for calculating FS proportions is provided below:

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

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

i. The proportion of FS in septic tanks is 0% as there is no septic tank available.

ii. The proportion of FS in fully lined tanks is calculated as 100% as there are no connections made to an open drain; the tank maintains a 100% FS proportion.

iii. The FS proportion from lined tanks with open bottoms and all types of pits is 100%, as there are no connections of lined tanks with impermeable walls and open bottoms to open drains.

After determining the proportion of FS in each type of sanitation technology, the corresponding population proportions from the selected technologies in the SFD selection grid are set. Figure 16 illustrates the SFD matrix of the municipality.

**Belbari Municipality, Koshi, Nepal, 23 Mar 2024. SFD Level: 2 - Intermediate SFD**
**Population: 81771**
**Proportion of tanks: septic tanks: 0%, fully lined tanks: 100%, lined, open bottom tanks: 10(**

| Containment | | | | |
|---|---|---|---|---|
| **System type** | Population | FS emptying | FS transport | FS treatment |
| | **Pop** | **F3** | **F4** | **F5** |
| **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 |
| **T1A3C10**<br>Fully lined tank (sealed), no outlet or overflow | 20.0 | 40.0 | 27.0 | 95.0 |
| **T1A3C8**<br>Fully lined tank (sealed) connected to open ground | 1.0 | 18.0 | 0.0 | 0.0 |
| **T1A4C10**<br>Lined tank with impermeable walls and open bottom, no outlet or overflow | 4.0 | 34.0 | 0.0 | 0.0 |
| **T1A4C8**<br>Lined tank with impermeable walls and open bottom, connected to open ground | 1.0 | 23.0 | 0.0 | 0.0 |
| **T1A5C10**<br>Lined pit with semi-permeable walls and open bottom, no outlet or overflow | 12.0 | 58.0 | 0.0 | 0.0 |
| **T1B11 C7 TO C9**<br>Open defecation | 2.0 | | | |
| **T2A4C10**<br>Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution | 9.0 | 25.0 | 0.0 | 0.0 |
| **T2A5C10**<br>Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution | 51.0 | 58.0 | 0.0 | 0.0 |

**Figure 16: SFD Matrix of Belbari Municipality.**

### 2.3.2 Proportion of Faecal Sludge Emptied (F3)

The column labelled "Population (Pop)" in Figure 16 displays the proportion of contents for each type of onsite container (fully lined tanks (sealed), lined tanks with impermeable walls and open bottom, and lined pits with impermeable walls and open bottom). The variable F3 represents the proportion of contents in each type of onsite container that undergoes at least one emptying after construction. The calculation of the proportion of faecal sludge emptied (F3) is based on the percentage of containment emptied (ENPHO, 2023) and the amount of faecal sludge (FS) emptied during the process (KII-2, 2023).

According to findings from household surveys and Key Informant Interviews (KII-2, 2023), approximately 90% of the FS in the containment is emptied. This is attributed to most containments getting filled due to groundwater intrusion, resulting in a high liquid content that can be easily pumped out by desludging vehicles. However, an average of 10% of the FS in the containment, characterized by high thickness and poor water solubility, remains un-removed during emptying, as reported from KII-2 with desludger information. The calculation of the emptied proportion of FS is adjusted accordingly as follows (Table 4).

$$\begin{aligned} Actual\ Proportion\ of\ FS\ emptied\ (F3) \\ = percentage\ of\ containment\ emptied \\ \times proportion\ of\ FS\ removed\ during\ emptying \end{aligned}$$

**Table 4: Sanitation technologies and proportion of emptied faecal sludge (ENPHO, 2023[1]; KII_2, 2023[2]).**

| SN | Sanitation Technologies | SFD Reference Variable | Percentage of Emptied Containment (1) | Emptied Proportion of FS during emptying (2) | Actual Proportion of Emptied FS (F3) |
|---|---|---|---|---|---|
| 1 | Fully lined tank (sealed), no outlet or overflow | T1A3C10 | 45% | 90% | 40% |
| 2 | Fully lined tank (sealed), connected to an open ground | T1A3C8 | 20% | 90% | 18% |
| 3 | Lined tank with impermeable walls and open bottom, no outlet or overflow (High Risk) | T2A4C10 | 27% | 90% | 25% |
| 4 | Lined tank with impermeable walls and open bottom, no outlet or overflow | T1A4C10 | 38% | 90% | 34% |
| 5 | Lined tank with impermeable walls and open bottom, connected to an open ground | T1A4C8 | 25% | 90% | 23% |
| 6 | Lined pit with semi-permeable walls and open bottom, no outlet or overflow | T1A5C10 | 64% | 90% | 58% |
| 7 | Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution (High Risk) | T2A5C10 | 64% | 90% | 58% |

### 2.3.3 Proportion of FS emptied which is delivered to Treatment Plant and treated (F4 and F5)

The faecal sludge treatment plant is not available in the municipality, thus values of F4 and F5 are 0. However, fully lined tank, no outlet or overflow(T1A3C10) that consists of biogas digester are considered treated (F5). In the provided SFD matrix, 20% of fully lined tanks, including 2% with functioning household biogas digesters, are considered treated (F4=27%) with 95% efficiency (F5=95%).

## 2.4 Summary of Assumptions

**Onsite Sanitation Systems:**

- ✓ The proportion of FS in septic tanks was set to 0%, 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 were set to 100% according to the relative proportions of the systems, as per the guidance provided by SuSanA.
- ✓ Variables F3, F4 and F5 for all onsite sanitation systems were derived from the household survey and cross-checked with KIIs conducted.
- ✓ 40% of the emptied FS from fully lined tanks no outlet or overflow (system T1A3C10) is delivered to treatment and treated in the FSTP (F4 = 27% and F5 = 95%).

## 2.5 SFD Graphic

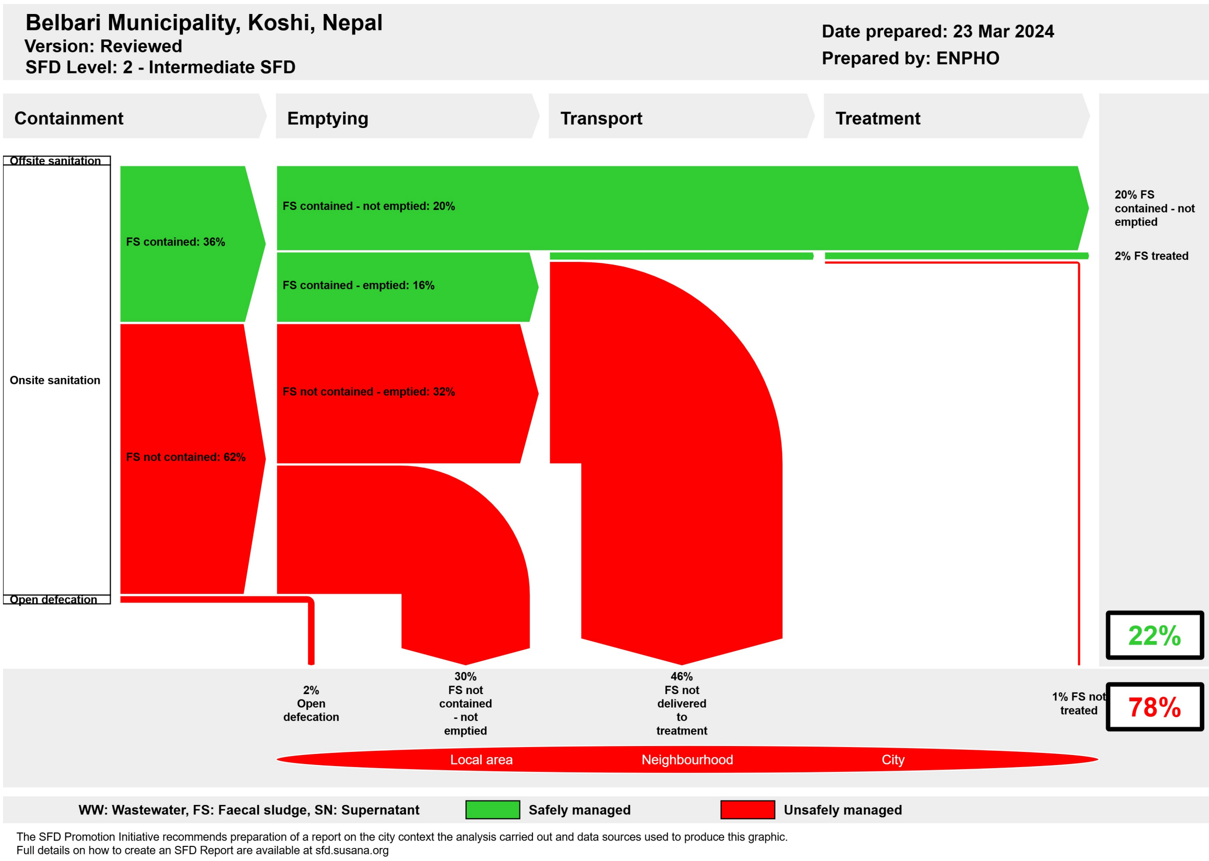


**Figure 17: SFD Graphic of Belbari Municipality.**

Figure 17 presents SFD of Belbari Municipality visually represents the status of sanitation practices of the municipality across the entire sanitation value chain. It shows that FS generated by 22% of the population is safely managed (Green). Initially, FS generated by 36% of the population is safely contained. However, this proportion drops to 20% which can be considered safe until emptied. The emptied FS remains safe depending upon the nature of the emptying mechanism and available treatment facilities. Out of the 16% of safely contained FS which has been emptied, only 2% is considered treated, primarily coming from biogas digesters.

Overall, FS generated by 78% of the population is unsafely managed (Red). It includes 1% of FS not treated, and 30% FS which is neither contained nor emptied. Additionally, 46% of emptied FS (14%-FS contained, 32% FS not contained) is not delivered to treatment plant, and 2% openly defecates. This highlights the significant gaps that must be addressed to mitigate environmental and public health risks associated with inadequate FS management practices.

### 2.5.1 Onsite Sanitation

98% of the population in Belbari Municipality utilizes onsite sanitation technologies. Among them, FS from 36% of the population is appropriately stored in technically effective containment, as depicted by "FS contained" in the SFD graphic. FS from the remaining 62% of the population is stored in unsafe containment, represented as "FS not contained."

**FS contained**

The term 'FS contained' refers to faecal sludge within an onsite sanitation technology that ensures a safe level of protection from excreta, limiting pathogen transmission to the user or the general public. These containment systems, such as tanks or pits, are correctly designed, properly constructed, fully functioning, and pose little to no risk of polluting groundwater used for drinking (Susana, 2018). FS generated by 36% of the population is contained.

The value of FS contained (36%) is derived from the summation of the percentage of the population using the following containment systems: fully lined tank without outlet or overflow (T1A3C10), lined tank with impermeable walls and open bottom without outlet or overflow (T1A4C10), and lined pit with semi-permeable walls and open bottom without outlet or overflow (T1A5C10).

**FS not Contained**

The term 'FS not contained' refers to faecal sludges within an onsite sanitation technology that does not ensure a safe level of protection from excreta, with a likely risk of pathogen transmission. These containment systems, such as tanks or pits, are incorrectly designed, poorly constructed, poorly functioning, and/or pose a 'significant' risk of polluting groundwater used for drinking (Susana, 2018). FS generated by 62% of the population is not contained.

The value of FS not contained (62%) is obtained from the summation of the percentage of the population using the following containment systems: fully lined tank, connected to an open ground (T1A3C8), lined tank with impermeable walls and open bottom without outlet (T2A4C10) and open ground (T1A4C8). Additionally, the FS collected in lined pits with semi-permeable walls and open bottoms, without outlet or overflow, poses a 'significant risk' to groundwater pollution (T2A5C10).

**FS contained - not Emptied**

It is faecal sludge that is contained within an onsite sanitation technology but not removed may persist within the container or infiltrate into the ground, depending on the type of sanitation technology in use (Susana, 2018). The value of 20% is obtained from the proportion of the population using sanitation systems where the FS is contained and have not emptied their containment. However, this 20% of safely managed FS should be considered as only temporary, as most of the pits and tanks have not yet filled up and the FS generated remains 'not emptied'. Therefore, these systems will require emptying services in the short and medium term as they fill up.

**FS contained - Emptied**

It is faecal sludge which is removed from an onsite sanitation technology where it is contained and can be emptied, utilizing either mechanical or manual emptying equipment. 16% is obtained from the proportion of population using sanitation systems where the FS is contained and have emptied their containment.

**FS not contained - Emptied**

In this faecal sludge is removed from an onsite sanitation technology where it is not contained and can be emptied, utilizing either mechanical or manual emptying equipment. The value of 32% is obtained from the proportion of the population using sanitation systems where the FS is not contained and have emptied their containment.

**FS not contained - not Emptied**

It is faecal sludge that is not contained within onsite sanitation technology and not removed. It may persist within the container or infiltrate into the ground, depending on the type of sanitation technology in use. The value of 30% is obtained from the proportion of the population using sanitation systems where the FS is not contained and not emptied.

**FS not delivered to treatment**

The proportion of FS not delivered to treatment, i.e. 46%, is the summation of FS contained - emptied and FS not contained - emptied. Since there is no FSTP, mechanically emptied sludge and manually emptied FS are not delivered to treatment plant. The emptied FS is disposed of untreated to farmlands or in open environment. Therefore, this proportion of disposed FS possesses risk to local area and neighbourhood.

**FS delivered to treatment**

The proportion of FS delivered to treatment is 2% which comes from the FS contained - emptied. The FS which is generated from biogas system are considered as treated.

### 2.5.2 Open Defecation

It is a situation where no toilet is in use, and people resort to open defecation in fields, forests, bushes, bodies of water, or other open spaces. Despite municipality having ODF status, 2% of the population still defecate openly or use neighbors toilet or public toilet.

# 3 Service delivery context description

## 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 the 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 on clean and quality drinking water, sanitation services and management of sewerage and wastewater. It defines sewerage and wastewater management as construction of sewer networks and treatment plants to preserve sources of water. It is entitled federal, provincial, and local level for the operation and management of water and sanitation services. The act also explicitly defines the responsibility of every citizen to preserve, conserve and maintain the sources of water and use responsibly.

**Environment Friendly Local Governance Framework 2013**

The environment-friendly local governance framework 2013 has been issued to add value to environment-friendly local development concept encouraging environmental protection through local bodies. The framework has set basic and advanced indicators for households, settlement, ward, village, municipality, and district levels for declaration of environment friendly. The use of water sealed toilets in households as basic indicators for sanitation and health. Provision of toilet with safety tank and use as advanced indicators for sanitation. Provision of gender, children and disabled friendly public toilets in parks, petrol pumps and main market as basic indicator for municipal level. Advance indicators such as drainage discharged only after being processed through biological or engineering technique. While it has failed to identify the necessity of faecal sludge treatment plants as it has assumed safety tank in the households is sufficient for treating faecal sludge.

**Institutional and Regulatory Framework for Faecal Sludge Management, 2017**

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

**Total Sanitation Guideline, 2017**

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

### 3.1.1. Policy

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

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

Nepal is a signatory of the historical resolution of 2010 United Nations General Assembly on the Human Right to Water and Sanitation. Nepal committed to Millennium Development Goals (MDGs) for 2000- 2015 The goal was accomplished through declaration of the country as free from open defecation on 30th September 2019. National Sanitation and Hygiene Master Plan, 2011 was developed for coordinated planning and implementation of National Sanitation Campaign. The campaign strengthened the 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 a lack of concrete policies, guidelines, and indicators on faecal sludge management in the sector for effective planning, implementation, and service delivery. Nepal was declared ODF nation on September 23, 2019, (MoWS, 2017) however, the target of 90% households with toilets connected to sewer system or proper FSM is yet to be achieved.

Currently, there is not a specific policy in place for faecal sludge management in the municipality. However, solid waste management is a priority, and the municipality has allocated land for waste disposal purposes. In recent developments, the municipality is planning to create a Detailed Project Report (DPR) for the construction of a Faecal Sludge Treatment Plant (FSTP). This initiative is being undertaken with technical support from ENPHO and coordination with MuAN. Furthermore, there are plans to allocate land for the construction of the DPR near the area designated for solid waste disposal management.

### 3.1.2. Institutional roles

Federal, provincial, and local government are entitled for implementation of water and sanitation programs to ensure the rights on access to safe water and sanitation.

**At Federal Government**

**National Planning Commission**: At the federal government, the National Planning Commission is the specialized and apex advisory body for formulating a national vision, developing policy, periodic plans, and sectoral policies. The NPC assesses resource needs, identifies sources of funding, and allocates budget. It serves as a central agency for monitoring and evaluating development policy, plans and programs. It supports, facilitates, and coordinates with federal, provincial, and local government for developing policy plans and implementation.

**Ministry of Water Supply**: Ministry of Water Supply is the lead ministry responsible for planning, implementation, regulation, and monitoring and evaluation of sanitation programs in the country (GoN, 2015). Under the MoWS, Department of Water Supply and Sewerage Management (DWSSM) plan and implement water and sanitation projects funded by foreign donors or inter provincial projects or serves at least 15,000, 5,000 and 1,000 people in terai, hilly and mountain region respectively (GoN, 2015). The organizational structure of DWSSM is shown in Figure 18.

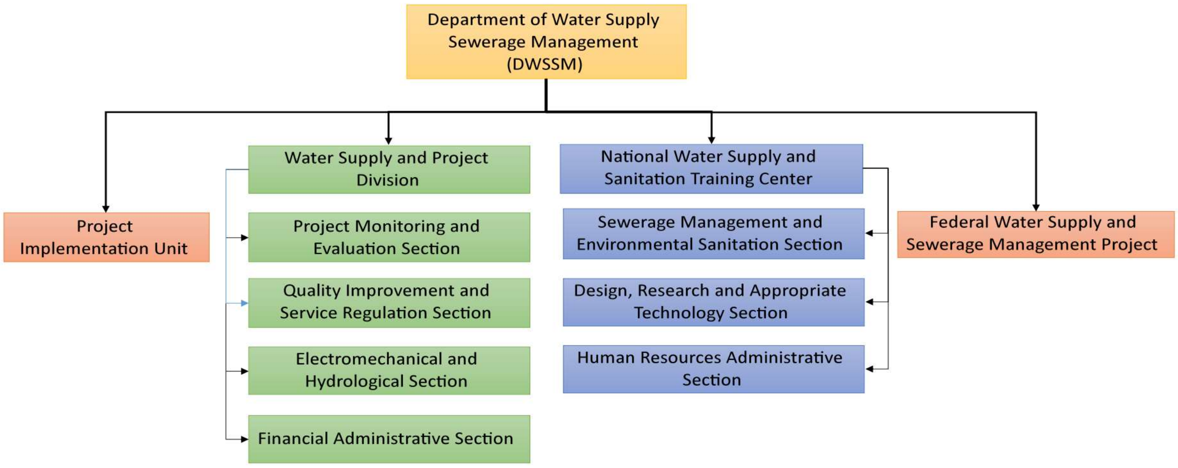


**Figure 18: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).**

## At Provincial Government

**Ministry of Water Supply, Irrigation and Energy:** Ministry of water supply, Irrigation and Energy in Koshi province is major executing body for planning, developing, and implementing water supply and sanitation programs. Planning and implementation of water supply and sanitation infrastructure in the province is executed through Water supply and Sanitation Divisional Office (WSSDO). WSSDO implements the water and sanitation programs meeting the following criteria:

i. Inter local government projects.

ii. Beneficiaries between 5,000 to 15,000 in terai region, 3,000 to 5,000 in hilly region and 500 to 1,000 in Himalayan region.

## At Local Government

**Municipal council:** Figure 19 shows the organography of the municipality. There is no specific sanitation section. However, the sanitation related works comes under the environment and emergency management subsection under infrastructure development section.

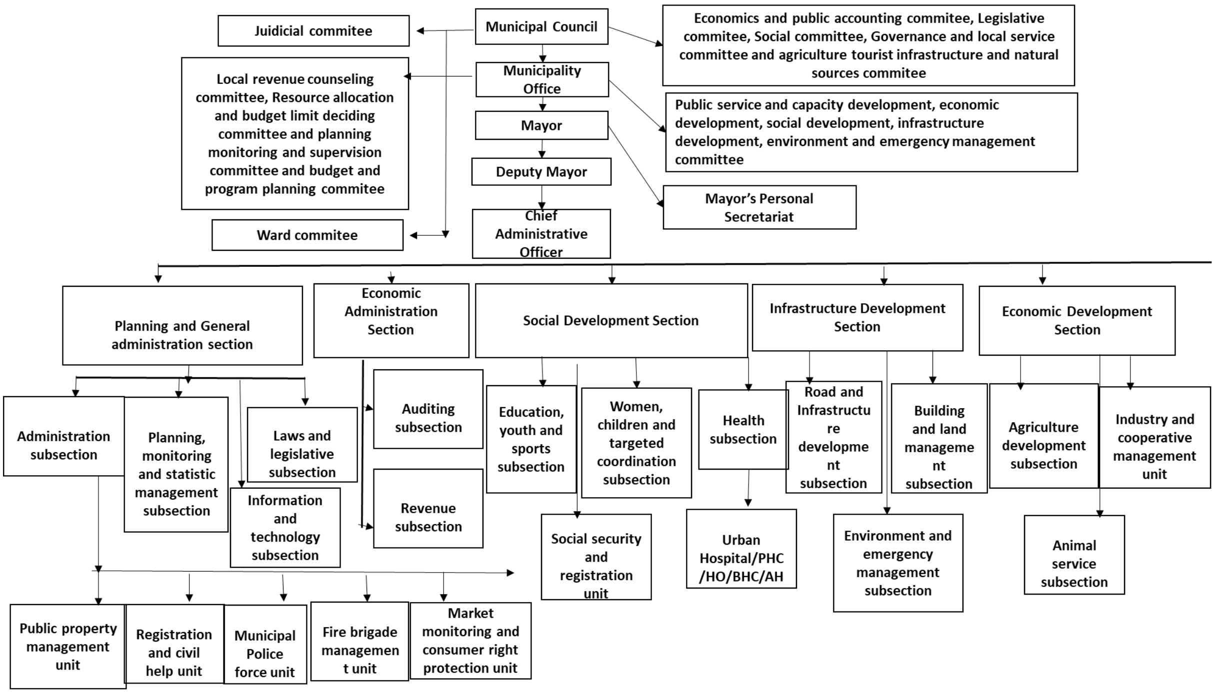


**Figure 19: Organogram of Belbari Municipality.**

## 3.1.3. Service provision

Urban Water Supply and Sanitation Policy 2009 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) . There hasn't been the development of any specific policy regarding faecal sludge management yet.

## 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 5. However, FSM specific standards have yet to be developed and implemented.

**Table 5: 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 grey water | ✓ | ✓ | ✓ |
| **6** | Small-bore sewer collection for toilet and septic tank effluent, low-cost treatment, and disposal | | ✓ | |
| **7** | Sanitary sewers for wastewater collection, transmission, non-conventional treatment, and disposal | ✓ | | |
| **8** | Sanitary sewers for wastewater collection, the transmission of conventional treatment and disposal | ✓ | | |
| **9** | Limited solid waste collection and safe disposal | ✓ | ✓ | ✓ |

# 4 Stakeholder Engagement

## 4.1 Key Informant Interviews (KIIs)

During the study, Key Informant Interviews (KIIs) were conducted to gather insights from key stakeholders working in the sanitation sector of Belbari Municipality. The objective was to obtain a comprehensive understanding of current sanitation service practices. Municipal staff, different private desludgers, concerned people in Water sanitation Users Committee, and caretaker of public toilet were interviewed. Figure 20 provides glimpses of Key Informant Interviews (KIIs) conducted with different stakeholders, such as engineers from Belbari Municipality, pump operators from Belbari WSUO, and two additional images featuring private desludgers. Further details are present in Table 6.

**Table 6: List of Key Informant Interviewed personnel.**

| S.N. | Name | Designation | Organization/ Company | Purpose of KII | Date |
|---|---|---|---|---|---|
| 1. | Birendra Giri (KII-1) | Engineer | Belbari Municipality | Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development | 28th January, 2024 |
| 2. | Man Bahadur Gurung,Rajkumar Magar (KII-2) | Private desludger (Ramro Septic tank sewa, Morang septuc tank tatha sarsafai sewa) | Belbari Municipality | Emptying practices, finances, requirement, disposal and treatment | 28th January, 2024 |
| 3. | Anish Subedi (KII-3) | Manager | Belbari Urban WSUO | Water supply services | 28th January, 2024 |
| 4. | Bhimlal Ghimire (KII-4) | Pump operator | Belbari Urban WSUO | Water supply services | 28th January, 2024 |
| 5. | Urmila Malik, (KII-5) | Caretaker | Public toilet, Belbari Municipality | Sanitation status of toilet | 28th January, 2024 |

**Figure 20: Glimpses of Key Informant Interview with different stakeholders of the municipality.**

## 4.2 Household Survey

Household survey was conducted in all wards of the municipality through mobilization of local enumerators selected by the municipality. The enumerators were given two days orientation about sanitation technologies and methods for conducting the household survey. The household survey was conducted using the mobile application “KOBOCOLLECT” after orientation. SFD team member went on field visits in households to encourage enumerators and observe household sanitation status. Mr. Dil Prasad Rai, the mayor of the municipality, provided encouragement and motivation to the enumerators before the survey. The images below show the enumerators practicing Kobotoolbox for data collection, with the mayor encouraging them before heading out into the field (Figure 21).

**Figure 21: Glimpses of SFD orientation to enumerators in municipal hall.**

### 4.2.1 Determining Sample Size

The number of households to be sampled in the municipality was determined by using Cochran (1963:75) sample size formula $no = \frac{z2pq}{e2}$ and its finite population correction for the proportion n= $n_o/(1+ (n_o-1)/N)$.

Where,

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

This is followed by proportionate stratification random sampling such that each ward in the municipality is considered as one stratum. The sample sized required in each ward is calculated as $n_h= (N_h/N)*n$, where $N_h$ is a total population in each stratum. Thus, a total of 584 households were sampled from 20,459 households distributed in 11 wards with proportionate stratification random sampling. The household samples surveyed in the municipality is shown in Figure 22.

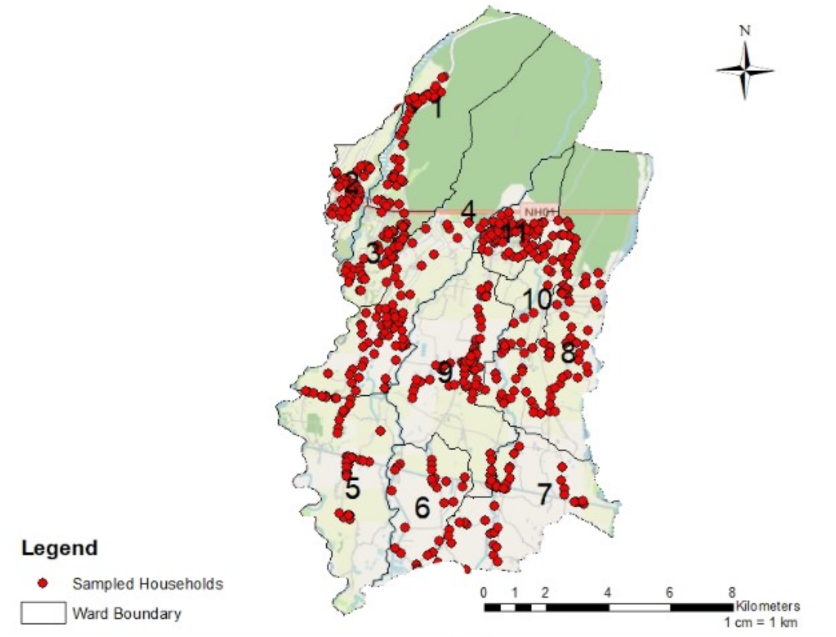


**Figure 22: Distribution of sampling points in different wards of Belbari Municipality.**

## 4.3 Direct Observation

Various sanitation technologies in the households of all the wards were observed and visual references were kept. Also, observation of the emptying of containments and transportation of faecal sludge by private desludging vehicles were carried out. The enumerators practicing on field (left side), and the disposal site of desludging vehicle (middle picture) was observed. The municipality has allocated land for solid waste disposal and management site (right picture), planning is being made to allocate land for building FSTP nearby to the place. The observation of the place was also done (Figure 23).

**Figure 23: Field practice for data collection (left), Faecal sludge disposal site visit (middle), solid waste dumping place (right).**

## 4.4 Sharing and Validation of Data

The Shit Flow Diagram Sharing and Validation workshop was conducted in the municipality to share the findings of the sanitation situation survey and receive the suggestion from municipal stakeholders. Altogether, 34 participants including the Chief Administrative Officer (CAO), ward chairpersons and other members from municipal executive council, sectoral staff, and municipal staff actively participated on the workshop and provided the valuable suggestions (Figure 24). Mr. Kiran Prasad Dhakal, CAO of the municipality, even provided his commitment to build DPR of FSTP in technical support of ENPHO and coordination with MuAN. The list of participants with their designation is attached to Appendix 3.

**Figure 24: Discussion on SFD by stakeholder of the municipality in validation sharing program.**

# 5 Acknowledgements

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

We extend our sincere appreciation to the individuals who provided invaluable support and guidance during the study: Mr. Dil Prasad Rai, Mayor, Ms. Nitu Thapa Koir, Deputy Mayor of Belbari Municipality, for continuous support in the study. We would also like to thank Mr. Kiran Prasad Dhakal, Chief Administrative Officer of the municipality and Mr. Birendra Giri, engineer of Belbari Municipality for facilitating the enumerators and continuous support throughout the study.

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

Our heartfelt appreciation also goes to Ms. Bhawana Sharma, Executive Director, and Mr. Rajendra Shrestha, Program Director of Environment and Public Health Organization (ENPHO) for their tremendous support and guidance throughout the study. We are grateful to the entire ENPHO team for their gracious support, as well as the MuNASS-II team, without whom this study would not have been possible.

Finally, we extend our thanks to the enumerators: Ms. Usha Shrestha, Angel Dewan, Tanka Bahadur Thapa, Binju Chaudhary, Sunindra Bahadur Limbu, Gaurab Rokaha, Sabin Rokaha, and Laxmita Adhikari for their support during the survey.

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# 7 Appendix

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

| System Classification | | Minimum Key HR Required | Regulation & Surveillance | Financing & Construction | Ownership of System | Service Delivery | |
|---|---|---|---|---|---|---|---|
| **Size** | Sanitation | | | | | Provision | Production |
| **Small** | Onsite sanitation | Water Supply and Sanitation Technician (WSST) | Federal and or Provincial Government | User+/ community+/ other | | | |
| **Medium** | Septage Management | Sub-engineer | Federal and or Provincial Government | Provincial+/ Local Govt+/ Community+/ Private Sector | | Local Govt | Users committee/ Utility manager |
| **Large** | Septage or FSM Management | WASH Engineer + finance & admin staff | Federal and or Provincial Government | Provincial+/ Local Govt+/ Community+/ Private Sector | | Local Govt | Utility Manager |
| **Mega** | Septage/ FSM Management | WASH Engineer + finance & admin staff | Federal and or Provincial Government | Provincial+/ Local Govt+/ Community+/ Private Sector | | Local Govt | Utility Manager |

Appendix 2: List of enumerators in SFD orientation

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

1- Dalit
2- Brahmin/Chettri/Thakuri
3- Janajati
4- Muslim

Attendance Sheet

Program: SFD orientation on Belbari Municipality
Date: 2080/10/15 to 2080/10/16.
Venue: Belbari Municipality Hall

| S.N | Name | Organization | Designation | Phone no | Signature Day 1 | Signature Day 2 | Age | Gender | Ethnicity |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Usha Shrestha | Belbari-6 | | 9824372071 | Usha | Usha | 20 | F | 3 |
| 2 | Angel Dewan | Belbari-9 | | 9827300878 | [illegible] | [illegible] | 24 | F | 3 |
| 3. | Tanka Bdr. Thapa | Belbari-1 | | 9814351920 | Thapa | Thapa | 21 | M | 2 |
| 4 | Binju Chaudhary | Belbari-3 | | 9862159190 | [illegible] | [illegible] | 32 | F | 3 |
| 5 | Surendra Bdr. Gurung | Belbari-4 | | 9826374146 | [illegible] | [illegible] | 25 | M | 3 |
| 6 | Gaurab Rokaha | Belbari-11 | | 9811399903 | [illegible] | [illegible] | 18 | M | 3 |
| 7 | Sabin Rokaha | Belbari-5 | | 9812369123 | [illegible] | [illegible] | 20 | M | 3 |
| 8. | Swastik Niroula | Belbari-2 | | 986370947 8 | [illegible] | [illegible] | 24 | M | 3 |
| 9. | Laxmita Adhikari Giri | Belbari-10 | | 9815003098 | [illegible] | [illegible] | 28 | M | 2 |

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

1- Dalit
2- Brahmin/Chettri/Thakuri
3- Janajati
4- Muslim

Attendance Sheet

Program: SFD orientation
Date: 2080/10/15 to 2080/10/16
Venue: Belbari Municipality Hall.

| S.N | Name | Organization | Designation | Phone no | Signature Day 1 | Signature Day 2 | Age | Gender | Ethnicity |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Dil Prasad Rai | Belbari Municipality | Mayor | | | [illegible] | | | |
| 2. | Birendra Giri | " | Engineer | 9849599521 | | [illegible] | | | |
| 3. | [illegible] Bhrami | .. | [illegible] | [illegible] | | [illegible] | | | |
| 4 | Mohan Basnet | —11— | ASI | 9842125375 | | [illegible] | | | |
| 5. | Asmita Shrestha | ENPHO | Asst. Project Officer | 986196057 | [illegible] | [illegible] | | | |
| 6. | Anita Bhuju | ENPHO | A.P.O. | 9849358197 | Bhuju | Bhuju | | | |
| | | | | | | | | | |

Appendix 3: List of Participants present in Sharing and Validation meeting of SFD

आज मिति २०८१ साल वैशाख १० गतेका दिन बेलबारी नगरपालिकामा नेपाल नगरपालिका संघको आयोजनामा वातावरण र जनस्वास्थ्य संस्था (एन्फो) को प्राविधिक सहयोग, The United Cities and Local Government Asia Pacific (UCLG ASPAC) को कार्यान्वयन र Bill and Melinda Gates Foundation (BMGF) को आर्थिक सहयोगमा Municipalities Network Advocacy on Sanitation in South Asia (MuNASS II) कार्यक्रम अन्तर्गत संचालन गरिएको Shit Flow Diagram (SFD) सम्बन्धी छलफल र प्रमाणीकरण कार्यशाला कार्यक्रममा निम्न अनुसार मुख्य सरोकारवालाहरूको सहभागिता रहयो ।

उपस्थिति :

| क्र.सं. | नाम | कार्यालय | पद | फोन नं. | हस्ताक्षर |
|---|---|---|---|---|---|
| १. | टिल प्रसाद राई | बेलबारी नगरपालिका | नगर प्रमुख | ९८५२०४६५०८ | |
| २. | नितु थापा कोइराला | बेलबारी नगरपालिका | नगर उप-प्रमुख | ९८५२०३४१३५ | |
| ३. | किरण प्रसाद टकाल | बेलबारी नगरपालिका | प्र. प्र. अ | ९८५२०६४१११ | [illegible] |
| ४. | निलम कु० राई | " ६ | कार्यपालिका सदस्य | 9824345615 | [illegible] |
| ५. | रिता राजवंशी | " ८ | " " | 9816355192 | रिता |
| ६. | सुनिता चौधरी | " 6 | वडा अध्यक्ष | 9863751559 | [illegible] |
| ७. | जाच मान माखा | " १० | कार्यपालिका स. | ९८४२०५५९५५ | [illegible] |
| ८. | टेक बहादुर राई | " ६ | वडा अध्यक्ष | ९८५२०९३०९९ | [illegible] |
| ९. | ओमेन्द्र प्रसाद सुवेदी | बे.न.पा.३ नं वडा | वडाध्यक्ष | ९८५२०५६९२६ | [illegible] |
| 10 | चन्द्र प्रकाश पहलैत | " " १ नं वडा | वडा सदस्य | 9852045477 | [illegible] |
| ११. | महेन्द्र खड्का | बेनपा | अधिकृतस्तर छैठौं | 9852045204 | [illegible] |
| १२ | सुमान घिमिरे | बेलबारी न.पा | सहायक चौथो | 9842587053 | [illegible] |
| १३. | तारा मगराई | " | अधिकृतस्तर छैठौं | 9842530337 | [illegible] |
| १४ | चतुर्भुज मांझी | " | सहायकस्तर (पाँचौ) | 9842034255 | [illegible] |
| १५ | सन्तोष त्रिपाठी | " | जं.स्वा.नि. | 9852041656 | [illegible] |
| १६ | धनमाया राई | " | ने.स.क | — | [illegible] |
| १७ | रोशन दाहाल | " | अ.सं.पाँचौ | 9845608613 | [illegible] |

| नाम | कार्यालय | पद | फोन नं. | हस्ताक्षर |
|---|---|---|---|---|
| मुक्तिनाथ गौतम | बेलबारी न.पा. | स्रोत व्यक्ति | ९८४२३८९६६४ | [illegible] |
| दिनेश निरौला | बेलबारी न.पा. | प्र. प्रमुख | ९८६२१९८९२७ | [illegible] |
| मनोज भट्टराई | बे.न.पा. | योजना शाखा | ९८४२०८६११६ | [illegible] |
| पार्वती गौतम | ,, ११ | कार्यपालिका सदस्य | 9812380... | [illegible] |
| सन्तोष खड्का | बेलबारी ०७ | प्रमुख प्रशासकीय | ९८६६५०७१५५ | [illegible] |
| कृष्ण न्यौपाने | बेलबारी नपा | सूचना प्रविधि अधिकृत | ९८४२८०२४६ | [illegible] |
| शालिग्राम कोइराला | बेलबारी ९ | वडा अध्यक्ष | ९८४२२४३६४४५ | [illegible] |
| केशव प्र. आचार्य | बेलबारी न.पा. | सोसिएल सचिव (न.प्र.) | ९८४२०५६६५ | [illegible] |
| मदन राजभण्डारी | बेलबारी न.पा. | MIS operator | 9842195227 | [illegible] |
| कृष्ण न्यौपाने | सूचना प्रविधि अधिकृत | बे.न.पा. | ९८४०४०४५७१ | [illegible] |
| सीता गुरागाई | बेलबारी न.पा | उ.वि.अ. | ९८४२२१४६९४ | [illegible] |
| गंगा गौतम | बेलबारी न.पा. | ना.प्र. | ९८४२२०६९८० | [illegible] |
| करुणा चौहान | बेलबारी न.पा | " | 9808784784 | Kamana |
| विरेन्द्र गिरी | बेलबारी न.पा. | इन्जिनियर | ९८४५२९९४२१ | [illegible] |
| घनश्याम भण्डारी | बेलबारी न.पा. | का.स. |  | [illegible] |
| संजिव खड्का | ,, ,, | नगर प्रहरी | ९८०६५२२३५० | [illegible] |
| विना मल्लीक | ,, ,, | का.ले. |  | विना |
| रोशन भाउजी | ,, | क.ले. |  | [illegible] |
| राम भट्टराई | ,, | ड्राइभर |  | [illegible] |
| जीवन राई | ,, | नगर प्रहरी |  | [illegible] |
| राजेन्द्र श्रेष्ठ | ENPHO | P.D. | ९८४१०८२९४८ | [illegible] |
| बुद्ध वज्राचार्य | ENPHO | P.C. | ९८४१९३२०२० | [illegible] |
| अनिता भुजेल | ENPHO | A.P.O. | ९८४५३४८९५७ | [illegible] |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

## Appendix 4: Water Quality Test Report

Government of Nepal
Ministry of Water Supply
Department of Water Supply and Sewerage Management
Federal Water Supply & Sewerage Management Project
Biratnagar
Water Quality Testing Laboratory
Itahari, Sunsari

**WATER QUALITY TEST REPORT**

Name of Client:- Belbari WUSC
Sampled By:- :- Belwari WUSC
Source of Sample:- Boring
Sampling Point:- Tap-1 (Tanki)
Location:- Belwari-3, Morang
GPS:-

Sample Code:- P-448
Date of Collection:- 2080/09/24
Date of Analysis:- 2080/09/24
Date of Completion:- 2080/09/26

| S.No. | Category | Parameters | Observed Values | NDWQS, 2079 BS | Methods Used |
|---|---|---|---|---|---|
| 1 | Physical | Turbidity (NTU) | 0.0 | 5 | 2130 B, APHA, 21st EDITION |
| 2 | | Temp. °c | 25 | - | 2550 B, APHA, 21st EDITION |
| 3 | | pH | 7.0 | 6.5 - 8.5 * | 4500-H+ B, APHA, 21st EDITION |
| 4 | | Electrical Conductivity (µs/cm) | 318 | 1500 | 2510 B, APHA, 21st EDITION |
| 5 | Chemical | Residual Chlorine (FRC) (mg/L) | 0 | 0.1-0.5 | COLORIMETRY |
| 6 | Microbiological | Faecal coliform *E.coli*(CFU/100 ml) | 0 | 0 | 9222 D., APHA,21st EDITION |

APHA: *American Public Health Association, Standard Methods for Examination of Water & Waste Water*
* *These values show lower and upper limits.*
*() Values in parentheses refer the acceptable values only when alternative is not available.*
The entire test was conducted as per the National Drinking Water Quality Standard Guide Line, 2062BS
Note: 1. The above results refer only to the submitted sample and test performed.
2. This report cannot be used for any publicity or advertisement without the written consent of this lab.
3. Test report shall not be reproduced in full, without written approval of the laboratory.

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Government of Nepal
Ministry of Water Supply
Department of Water Supply and Sewerage Management
Federal Water Supply & Sewerage Management Project
Biratnagar
Water Quality Testing Laboratory
Itahari, Sunsari

## WATER QUALITY TEST REPORT

Name of Client:- Belbari WUSC
Sampled By:- :- Belwari WUSC
Source of Sample:- Boring
Sampling Point:- Tap-2 (Khem Gautam)
Location:- Belwari-3, Morang
GPS:-

Sample Code:- P-449
Date of Collection:- 2080/09/24
Date of Analysis:- 2080/09/24
Date of Completion:- 2080/09/26

| S.No. | Category | Parameters | Observed Values | NDWQS, 2079 BS | Methods Used |
|---|---|---|---|---|---|
| 1 | Physical | Turbidity (NTU) | 1.2 | 5 | 2130 B, APHA, 21st EDITION |
| 2 | | Temp. °c | 25 | - | 2550 B, APHA, 21st EDITION |
| 3 | | pH | 7.0 | 6.5 - 8.5 * | 4500-H+ B, APHA, 21st EDITION |
| 4 | | Electrical Conductivity (µs/cm) | 317 | 1500 | 2510 B, APHA, 21st EDITION |
| 5 | Chemical(FRC) | Residual Chlorine (mg/L) | 0 | 0.1-0.5 | COLORIMETRY |
| 6 | Microbiological | Faecal coliform *E.coli*(CFU/100 ml) | 0 | 0 | 9222 D., APHA,21st EDITION |

APHA: *American Public Health Association, Standard Methods for Examination of Water & Waste Water*
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SFD Promotion Initiative

SFD Belbari Municipality, Nepal, 2025

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