SFD Report

Bhimeshwor Municipality
Nepal

Final Report

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SFD Report Bhimeshwor Municipality, Nepal, 2025

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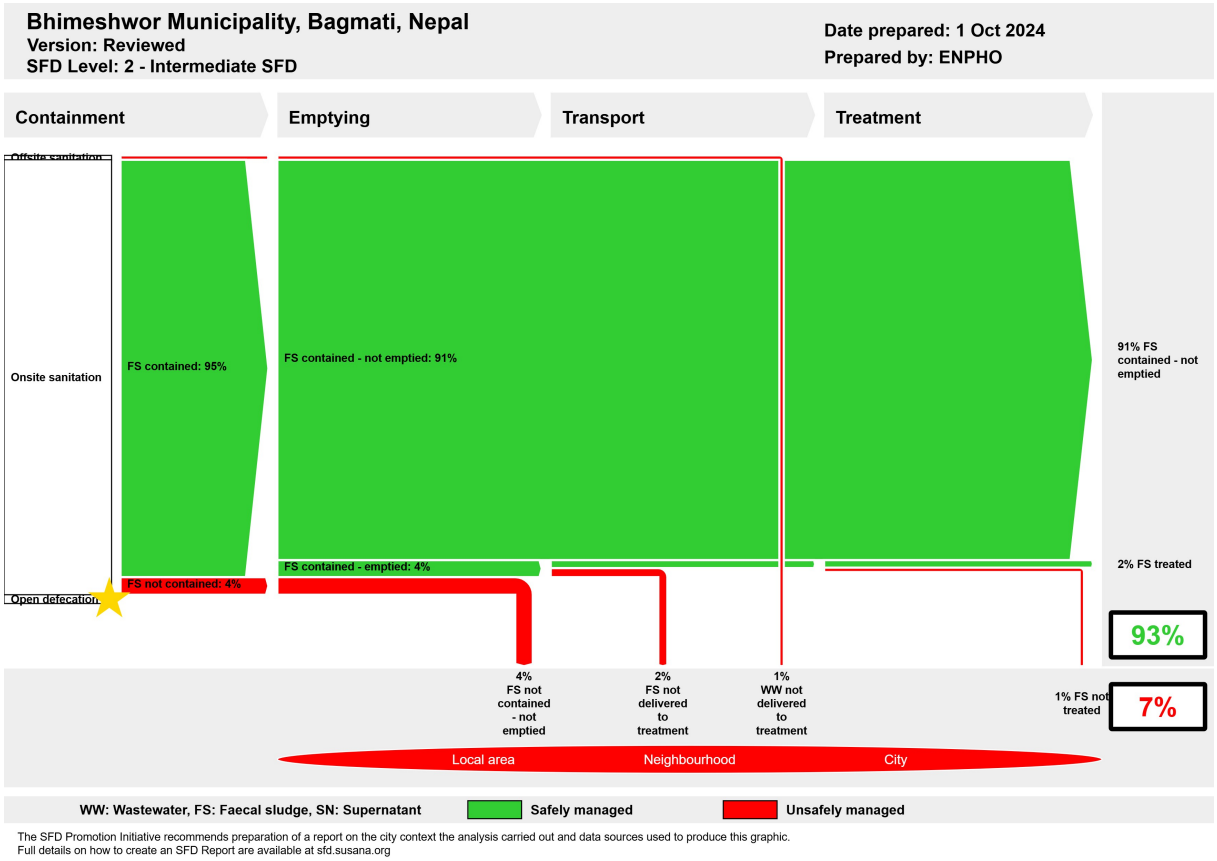
1. The SFD Graphic



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

2. Diagram information

SFD Level:

This SFD is level 2– Intermediate report.

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3. General city information

Bhimeshwor Municipality is situated in Dolakha District of Bagmati Province of Nepal. It is divided into 9 wards and covers an area of 133 sq. km.

It was established in 1996 and was reformed in 2017. It was reformed by merging 3 Village Development Committees (VDCs) namely Susmachhemawati, Boch abd Lakuridanda with previously formed Bhimeshwor Municipality. It ranges from 27°35'60" to 27°43'60" N latitude and 85°57'60" to 86°06'00" E longitude and at an altitude ranging from 840 metres above sea level (masl) to 3,549 masl (Bhimeshwor Municipality, 2024).

A population of 34,712 is residing on 10,164 households in the municipality (National Statistics Office, 2023). The annual population growth rate of the municipality is 0.68%. The municipality has a temperate climate (Cwb) with warm summers and dry winters. The annual average temperature of the municipality is 13.1°C and receives 3,174 mm rainfall per year (Climate-Data, 2021).

4. Service outcomes

The overview of different sanitation technologies across the sanitation value chain in the municipality is briefly explained in this section. All data in this section is from the household and institutional surveys conducted for this survey (ENPHO, 2024). Dolakha district was declared Open Defecation Free (ODF) on 29 August 2019. Thus, 100% of households have the coverage of improved sanitation facilities.

Containment:

Among households with improved sanitation facilities, about 1% of households rely on an offsite sanitation system and 99% rely on onsite sanitation systems. In the municipality, households that have their toilet outlet to water bodies are taken as offsite sanitation systems. Households with onsite sanitation systems have different sanitation technologies. About 6% of households have fully lined tanks, 27% have lined tanks with impermeable walls with open bottom and 66% have unlined pits.

Here, all the institutional buildings have toilets with 100% onsite sanitation system. Among which, 23% of institutional buildings fully lined tanks, 41% have lined tanks with impermeable walls and open bottom and 36% have unlined pits.

Bhimeshwor municipality has seven public toilets, among which two were non-functional. The toilets at *Haat Bazaar, Dolakha Temple,* and *Champuja Park* were constructed by the municipality while toilet at *Dolakha Bazaar* was jointly constructed by *Avayapur Youth Club, Avayapur Tole Development Committee and Pukhurcha Bhimeshwor Tole Development Committee* and toilet at Tamakoshi was jointly constructed by *Environment and Public Health Organization (ENPHO) and District Water Supply Office (DWSO).* Every day, almost 500 people use these toilets. The restrooms are mostly used by local bus staff, passengers, local shopkeepers, customers and city dwellers. In most toilets, the users are charged Rs. 5 (USD 0.04) for urination and Rs. 10 (USD 0.08) for defecation.

Emptying and Transport:

Among the buildings with onsite sanitation systems, only 4% of households while 90% of institutional buildings have emptied their containment. Both manual and mechanical emptying is practiced at households and institutional buildings while some households also practice open emptying in the municipality (KII-1, 2024) . Moreover, manual emptying is prevalent in the municipality.

The available municipal desludging vehicle is not functional at the time of study. However, a private desludging service provider from Kathmandu Valley serves as per demand for mechanical emptying in the municipality.

Treatment and Disposal/Reuse:

Here, mechanically emptied Faecal Sludge (FS) is disposed in a disposal site or applied to farmlands. While, manually emptied FS is dig and dumped, applied to farmlands, disposed to water bodies or composted. Therefore, all the emptied FS is disposed unsafely into an open environment or water bodies.

Approximately 53% of households have piped drinking water supply services in the municipality. Among other service providers, Charikot Water and Sanitation Users' Organization is one of the major drinking water services providers in Bhimeshwor Municipality. It serves in wards 2, 3, 4, 5, 6 and 7. It has distributed 5,050 taps to households. Among the remaining households without private drinking water supply service, 3% of households have access to drinking water from community taps and 44% of households rely on spring sources.

Spring sources are vulnerable to contamination. The vulnerability of sources depends on lateral spacing between sanitation systems and the sources. Despite the use of water treatment option, sample water from source, reservoir tank and final outlet of Charikot water supply scheme showed presence of *E. coli* contamination concluding, drinking water from private taps are at risk of contamination.

The SFD graphic shows that excreta generated from 93% of the population are safely managed while 7% of the population are unsafely managed. Only 2% of FS generated in the municipality was treated from biogas digester at household while safely managed FS generated from 91% of population is temporary as the FS has not been emptied. With the current practice of faecal sludge management (FSM), the proportion of safely managed FS will soon become unsafely managed once the containments start filling up.

5. Service delivery context

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

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

Ministry of Water Supply through its Department of Water Supply and Sewerage Management (DWSSM) articulated and endorsed Institutional and Regulatory Framework (IRF) for Faecal Sludge Management in Urban Areas of Nepal in 2017. The main objective of the IRF is to define the specific roles and responsibilities of key institutions for the effective management and regulation of Faecal Sludge Management (FSM).

6. Overview of stakeholders

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

Table 1: Overview of Stakeholders.

Key Stakeholders	Institutions / Organizations
Public Institutions at Federal Government	Ministry of Water Supply
Public Institutions at Provincial Government	Ministry of Water Supply, Energy and Irrigation
Public Institutions at Local Government	Bhimeshwor Municipality
Non-governmental Organizations	Environment and Public Health Organization (ENPHO)
Private Sector	Water Supply Users Committee
Development Partners, Donors	MuAN, BMGF, UCLG ASPAC

7. Process of SFD development

Data on sanitation situation were collected through household and institutional surveys (ENPHO, 2024) . Enumerators of the municipality were mobilized after orientating on sanitation technologies and proper use of mobile application (KOBOCOLLECT) to collect data for survey. The Key Informant Interviews (KIIs) were conducted with WASH focal person of the municipality, Water and Sanitation Users' Committee and caretakers of public toilets. Types of sanitation technologies used in various locations have been mapped using ARCGIS. For the Shit Flow Diagram (SFD) graphic production, initially, a relationship between sanitation technology used in questionnaire survey and Shit Flow Diagram Promotive Initiatives (SFD PI) methodology was made. Then, data were fed into SFD graphic generator to produce the SFD graphic.

8. Credibility of data

The major data were collected from random household sampling. Altogether, 370 households and 39 institutions were surveyed from 9 wards of Bhimeshwor Municipality. Primary data on emptying, transportation and current sanitation practices in the municipality were validated from KII with public toilet management, municipal representatives, and water service providers. The overall data and findings were shared with the stakeholders of the municipality and validated through a sharing program.

9. List of data sources

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

- Bhimeshwor Municipality, 2024. Bhimeshwor Municipality. [Online] Available at: https://www.bhimeshwormun.gov.np/ne/node/3 [Accessed 14 December 2024].
- Climate-Data, 2021. Climate-Data. [Online] Available at: https://en.climate-data.org/asia/nepal/central-development-region/charikot-1025397/ [Accessed 14 December 2024].
- ENPHO, 2024. *Sanitation Situation Assessment of Bhimeshwor Municipality. Unpublished*, s.l.: s.n.
- MoWS, 2020. *Open Defecation Free Nepal: Narration of the Journey*, Kathmandu: Secretariat of National Sanitation and Hygiene Coordination Committee, Nepal.
- National Statistics Office, 2023. *National Population and Housing Census 2021* National Report, Kathmandu: National Statistics Office.

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Table of Contents

1 City context 1
1.1 Population 1
1.2 Topography and Geography 1
1.3 Climate 2
2 Service Outcomes 3
2.1 Overview 3
2.1.1 Sanitation System in Household Buildings 3
2.1.2 Sanitation Systems in Institutional Buildings 7
2.1.3 Public Toilets 8
2.1.4 Emptying and Transport 11
2.1.5 Treatment and Disposal/Reuse 12
2.1.6 Risk Assessment of Water Source Pollution 13
2.2 SFD Selection Grid 15
2.3 SFD Matrix 16
2.3.1 Proportion of Faecal Sludge from types of sanitation technologies 16
2.3.2 Proportion of Faecal Sludge Emptied (F3) 18
2.3.3 Proportion of FS emptied which is delivered to Treatment Plant and treated (F4 and F5) 19
2.4 SFD Graphic 19
3 Service delivery context 22
3.1 Policy, legislation, and regulation 22
3.2 Policies 23
3.3 Institutional roles 24
3.4 Service provision 26
3.5 Service standards 26
4 Stakeholder Engagement 27
4.1 Key Informant Interview 27
4.2 Household Survey 28
4.2.1 Determining Sample Size 29
4.3 Direct Observation 30
4.4 Sharing and Validation of Data 31
5 Acknowledgements 32

6 References 33

7 Appendix Annexes 35

7.1 Appendix 1: Roles and Responsibility of Various Tiers of Governments Delineated in Drafted SDP 2016 – 2030 35

7.2 Appendix 2: Total number of population and household in each ward and number of surveyed households 36

7.3 Appendix 3: List of Participants on SFD Survey Orientation 37

7.4 Appendix 4: List of Participants in Sharing and Validation Workshop 38

List of Tables

Table 1: Types of onsite sanitation technologies at households of Bhimeshwor Municipality . 5

Table 2: Types of sanitation technologies recategorized according to SFD PI. 6

Table 3: Type and number of surveyed institutions. 7

Table 4 : Explanation of terms used to indicate different frame selected in the SFD selection grid in Figure 14. 16

Table 5: Sanitation technologies and proportion of emptied faecal sludge (ENPHO[1], 2024). 19

Table 6: Sanitation Service Level and its Components. 26

Table 7: List of Key Informant Interviewed personnel. 27

List of figures

Figure 1: Ward boundary map of Bhimeshwor Municipality. 1
Figure 2: A graph showing the monthly average for precipitation and temperature of Bhimeshwor Municipality. 2
Figure 3: Sanitation technologies at households of Bhimeshwor Municipality. 3
Figure 4: Location map of households with status of access to improved sanitation. 4
Figure 5: Biogas digesters found at households in Bhimeshwor Municipality. 5
Figure 6: Unlined pit found at households in Bhimeshwor Municipality. 6
Figure 7: Location map of household with different types of containment. 7
Figure 8: Location map of institutional buildings with different types of containment in Bhimeshwor Municipality. 8
Figure 9: Public toilets and their status in Bhimeshwor Municipality. 11
Figure 10: Status of emptying of different types of containment. 11
Figure 11: The desludging vehicle of Bhimeshwor Municipality. 12
Figure 12: Picture showing spring source and private tap in Bhimeshwor Municipality. 13
Figure 13: Water quality test report of Charikot Water Supply Users Organization. 14
Figure 14: SFD selection grid for Bhimeshwor Municipality. 15
Figure 15: SFD Matrix of Bhimeshwor Municipality. 18
Figure 16 : SFD Graphic of Bhimeshwor Municipality. 20
Figure 17: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM). 25
Figure 18: KII with municipal representatives and caretaker of public toilet. 28
Figure 19: SFD orientation to local enumerators for data collection. 28
Figure 20: Location map of surveyed households. 30
Figure 21: Observation of a public toilet Bhimeshwor Municipality. 30
Figure 22: Sharing of findings during validation workshop. 31

Abbreviations

DWSO	District Water Supply Office
DWSSM	Department of Water Supply and Sewerage Management
DUDBC	Department of Urban Development and Building Construction
ENPHO	Environment and Public Health Organization
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSTP	Faecal Sludge Treatment Plant
GoN	Government of Nepal
HH	Household
IRF	Institutional and Regulatory Framework
KII	Key Informant Interview
KM	Kilometre
masl	metres above sea level
mm	Millimetre
MoWS	Ministry of Water Supply
MuAN	Municipal Association of Nepal
NPC	National Planning Commission
NSHMP	National Sanitation and Hygiene Master Plan
NWSSP	National Water Supply and Sanitation Policy
ODF	Open Defecation Free
PPP	Public Private Partnership
RWSSNP	Rural Water Supply and Sanitation National Policy
SDG	Sustainable Development Goal
SDP	Sector Development Plan
SFD	Shit Flow Diagram
SFD PI	Shit Flow Diagram Promotion Initiative
SN	Supernatant
SuSanA	Sustainable Sanitation Alliance
UCLG ASPAC	United Cities and Local Governments Asia-Pacific
VDC	Village Development Committees
WASH	Water, Sanitation and Hygiene
WSUC	Water and Sanitation Users Committee
WW	Wastewater
WWTP	Wastewater Treatment Plant

1 City context

Bhimeshwor Municipality is situated in Dolakha District in Bagmati Province of Nepal. It was established on 1996 and was restructured and reformed on 2017. It was reformed by merging 3 Village Development Committees (VDCs) namely, Susmachhemawati, Boch and Lakuridanda. It is divided into 9 wards. It shares its boundary with Baiteshwor Rural Municipality on the east, Sindhupalchok district on the west and north along with Kalinchok Rural Municipality on the north and Sailung Rural Municipality on the south (Bhimeshwor Municipality, 2024). Figure 1 shows the ward boundary map of Bhimeshwor Municipality.

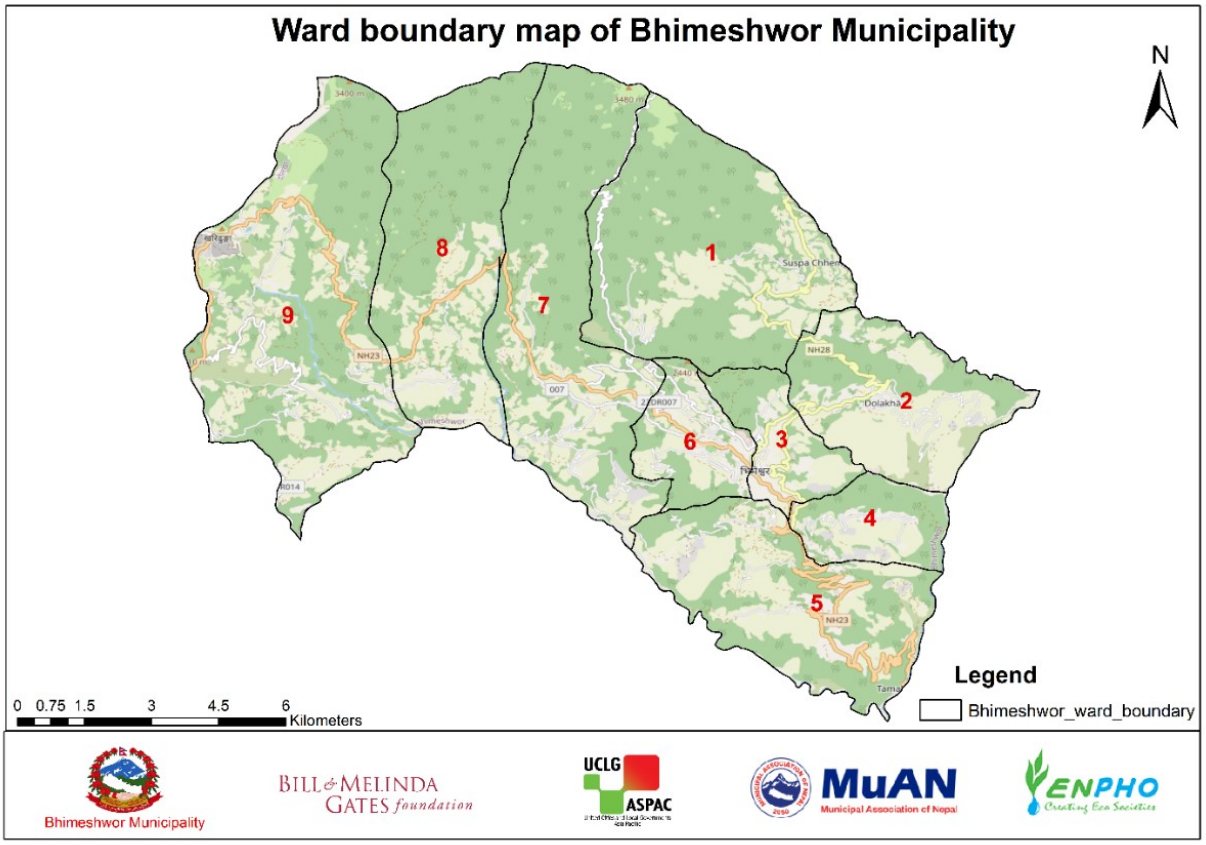


Figure 1: Ward boundary map of Bhimeshwor Municipality.

1.1 Population

As per the national population and housing census conducted in 2021, Bhimeshwor Municipality has a total population of 34,712 with 16,630 male and 18,082 female population. There are altogether 10,164 households. The average household size is 3.42 (National Statistics Office, 2023) and population density is 262 per km^2. The annual population growth rate of the municipality is 0.68%.

1.2 Topography and Geography

The elevation of Bhimeshwor Municipality ranges from 840 metres above sea level (masl) to 3,549 masl. The municipality ranges from 27°35'60" to 27°43'60" N latitude and 85°57'60" to 86°06'00" E longitude. It covers a total area of 133 km^2. on the western side of Dolakha district (Bhimeshwor Municipality, 2024). The municipality lies in the ranges of Midlands and

Mahabharat based on the physiographic division of Nepal. Thus, it has the topography based on the range. The region has a composition of sandstone, mudstone, conglomerate, Phyllites, Schist, gneiss, quartzite, granite and limestone as well as alluvial sediments i.e. sand, silt and clay along-with coarse gravels (Upreti, 1999).

1.3 Climate

Köppen–Geiger classification is one of the most used systems for climatic categorization. This classification is a widely used method for portraying climates worldwide, based on monthly air temperature and precipitation. The climatic condition of Bhimeshwor Municipality falls on temperate climate (Cwb) based on Köppen–Geiger classification. The climate here is warm and temperate. This climatic condition has warm summers and dry winters (Karki, et al., 2015) . Moreover, the climate in the lower belt of the municipality is comparatively warmer than in upper belt. The warmest month of the year is July with an average temperature of 17.4°C and coldest month is January with average temperature of 5.9°C. The annual average temperature of the municipality is 13.1°C. It receives 3,174 mm rainfall on average annually. The most rainfall occurs in July and the least in December (Climate-Data, 2021) . Figure 2 shows the graph of the monthly average for precipitation and temperature of Bhimeshwor Municipality.

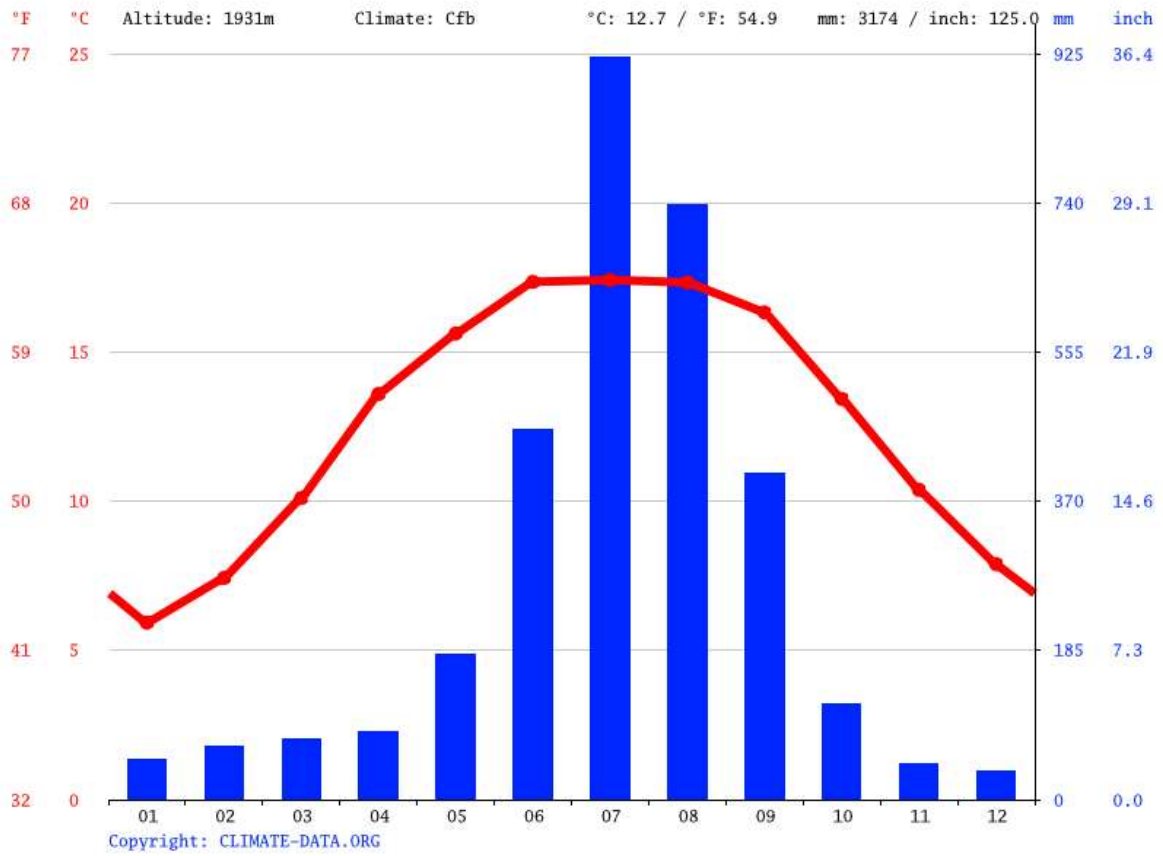


Figure 2: A graph showing the monthly average for precipitation and temperature of Bhimeshwor Municipality.

2 Service Outcomes

2.1 Overview

Data on sanitation situation were collected through household and institutional surveys (ENPHO, 2024). A total of 370 households were sampled from 10,164 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 secondary data, Key Informant Interviews (KIIs) and a validation workshop is presented in this section.

Sanitation is defined as infrastructures, facilities or services provided for safe management of human excreta emanating from toilet while handling, storage, and treatment onsite or offsite conveying it safely to the end use or disposal to protect human health and environment (Affam & Ezechi, 2021).

2.1.1 Sanitation System in Household Buildings

Bhimeshwor Municipality was declared Open Defecation Free (ODF) on 2015 (KII-1, 2024) and Dolakha district was declared ODF on 29 August 2019 (MoWS, 2020). The status of ODF indicates accessibility to basic sanitation on each household (HH). According to the survey report, Bhimeshwor Municipality do not have open defecation (ENPHO, 2024). Figure 3 shows sanitation technologies present at households in Bhimeshwor Municipality.



Figure 3: Sanitation technologies at households of Bhimeshwor Municipality.

All the households i.e. 100% of the households have improved sanitation facilities either with offsite or onsite sanitation systems. Offsite sanitation refers to a sanitation system in which excreta (referred to as wastewater) is collected and transported away from the plot where they are generated. An offsite sanitation system relies on sewer technology for transport. Onsite sanitation refers to a sanitation technology or sanitation system in which excreta (referred to as faecal sludge) is collected and stored and emptied from or treated on the plot where they are generated (SuSanA, 2018).

In the municipality, 1% of the households have offsite sanitation systems whereas 99% have onsite sanitation systems. Figure 4 presents the location map of households with status of access to improved sanitation.

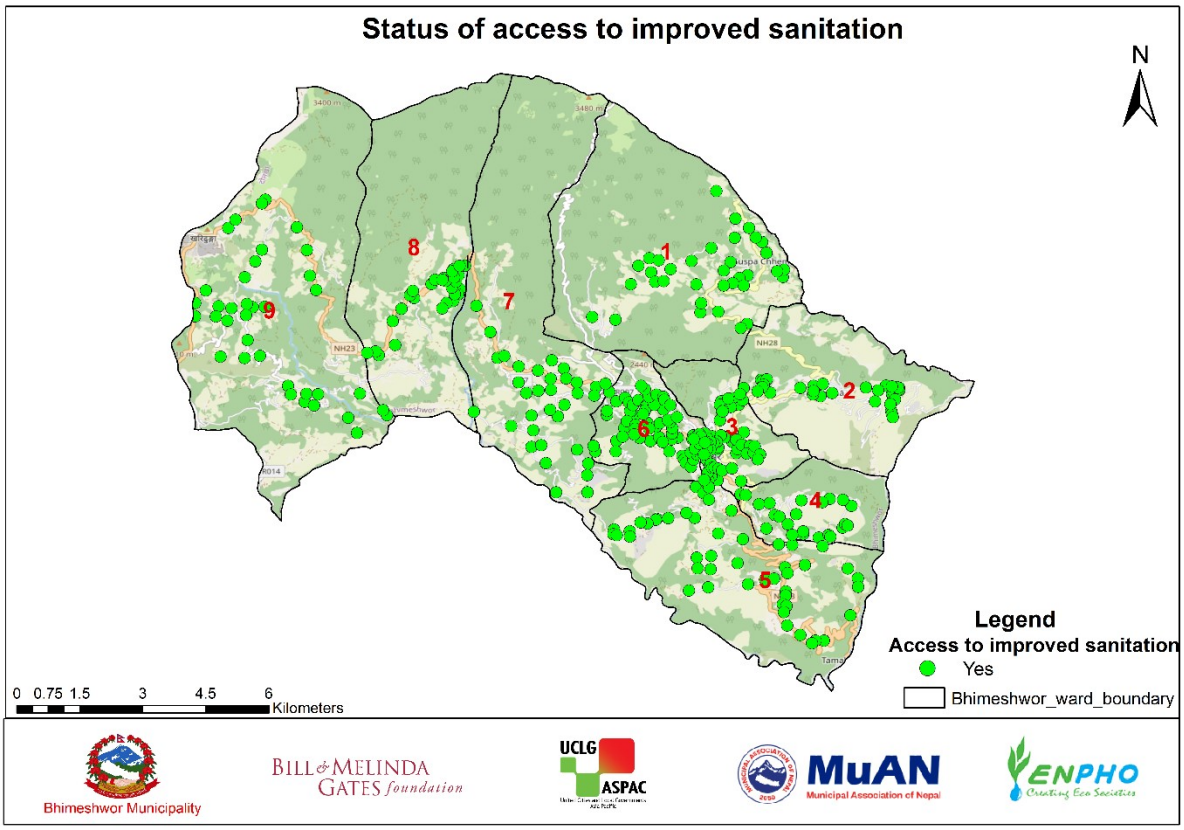


Figure 4: Location map of households with status of access to improved sanitation.

Types of Offsite Sanitation Systems

Bhimeshwor Municipality does not have sewerage network but 1% of households have offsite sanitation system. Here, households that have the outlet of toilet to water bodies are considered as offsite sanitation system. It is taken as toilet with no onsite container for the SFD graphic.

Types of Onsite Sanitation Systems

In the municipality, 99% of the households have onsite sanitation systems. Table 1 shows the types of onsite sanitation technologies and percentage of households using it at Bhimeshwor Municipality.

Table 1: Types of onsite sanitation technologies at households of Bhimeshwor Municipality

Containment	Wall construction materials	Bottom of containment	Chamber	Number	Connected to	%
Biogas digester	NA	NA	NA	NA	No outlet/ overflow	2%
Fully Lined Tank	Concrete walls OR Cemented brick/stone walls	PCC or plastered	One or Two	NA	Soak pit Sewer Open drain/open ground No outlet/ overflow	4%
Lined tank with impermeable walls and open bottom	Concrete walls OR Cemented brick/stone walls	Soiling or Nothing	one two More than two	NA	Soak pit Sewer Open drain/open ground No outlet/ overflow	27%
Unlined pit	Mud mortar brick wall/Mud mortar cement wall/No lining/Dry stone wall	Nothing	NA	NA	NA	66%

Biogas Digester is a waste to energy conversion technology designed to treat household organic waste and faecal sludge (FS) to generate biogas. 2% of households have built biogas digester in their houses. Alternative Energy Promotion Centre (AEPC) have promoted biogas technology at households in 77 districts of Nepal. The installation of biogas at households have supported in improving situation of health status and sanitation status in Nepal (AEPC, 2018). Figure 5 shows the types of biogas digester in Resunga Municipality.



Figure 5: Biogas digesters found at households in Bhimeshwor Municipality.

Fully lined tank is a rectangular tank with impermeable walls and base to safely store FS. It does not have outlet for the discharge of effluent (Strande, et al., 2014). 4% of households have fully lined tanks.

Lined tank with impermeable walls and open bottom is a rectangular onsite technology where the walls of the tank are lined and sealed, and a permeable base. The facility allows infiltration of effluents which could contaminate groundwater (Peal, et al., 2020). 27% of households have these types of containments in the municipality.

Unlined Pit is a dug pit in the ground. It has no lining in walls and a permeable base. It allows infiltration of effluents from walls and as well as bottom of the pit (SuSanA, 2018). 66% of households have unlined pits. Figure 6 shows unlined pits found in Bhimeshwor Municipality.



Figure 6: Unlined pit found at households in Bhimeshwor Municipality.

Table 2 shows the types of sanitation technologies recategorized according to the Shit Flow Diagram Promotion initiative (SFD PI).

Table 2: Types of sanitation technologies recategorized according to SFD PI.

Sanitation System	Percentage
No onsite container (T1A1C7)	1%
Onsite Sanitation System	
Fully lined tank (T1A3C10)	6%
Lined tank with impermeable walls and open bottom (T1A4C8 and T1A4C10)	27%
Unlined pit (T1A6C10 and T2A6C10)	66%
Grand Total	**100%**

According to the SFD PI, biogas digester and fully lined tanks are recategorized as fully lined tanks. Thus, 6% of households have fully lined tanks.

Figure 7 shows location map of households with different types of containment at Bhimeshwor Municipality.

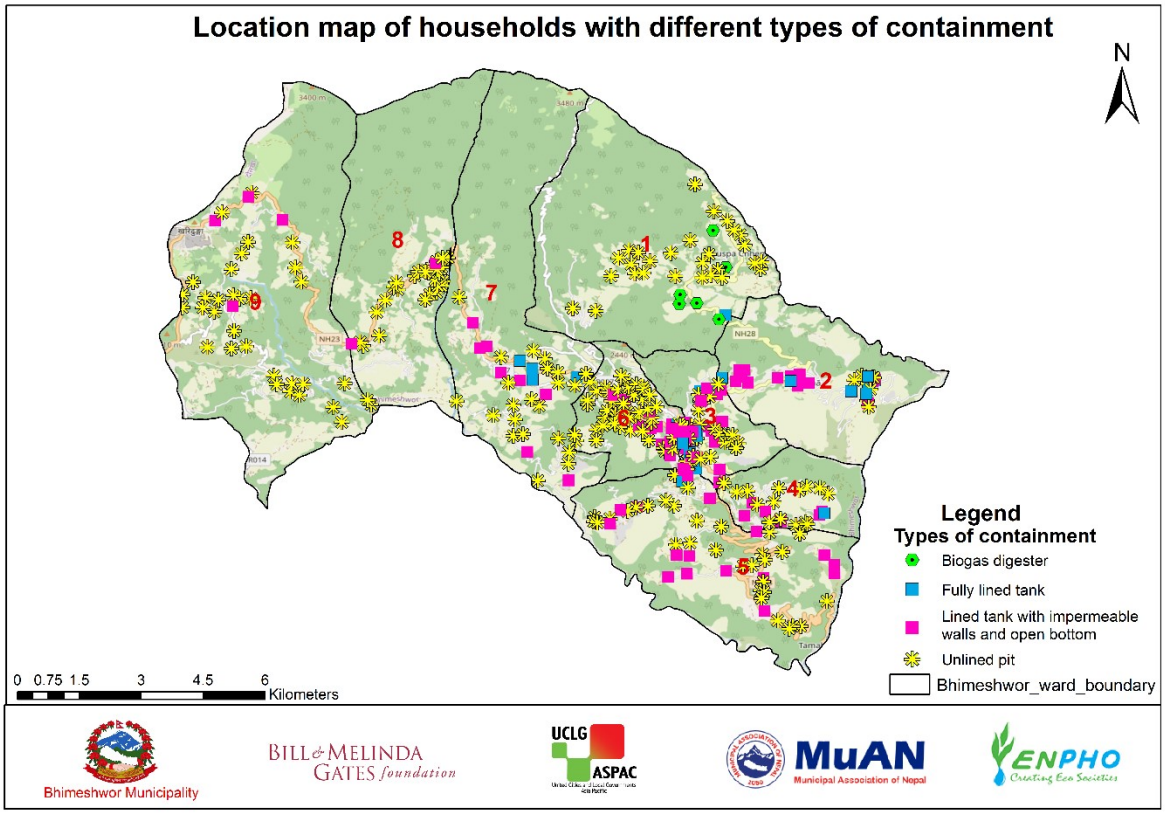


Figure 7: Location map of household with different types of containment.

2.1.2 Sanitation Systems in Institutional Buildings

Altogether 39 institutional buildings were surveyed. The sanitation data of institutional buildings were obtained from different types of institutions. Table 3 shows the types and number of surveyed institutions.

Table 3: Type and number of surveyed institutions.

Type of Institution	Number of Surveyed Institutions
Educational Institution	9
Government /Non-government Office	16
Health Care Centre	9
Hotel/Home Stay	5
Grand Total	**39**

All the institutional buildings in the municipality have toilets with 100% of institutional buildings with onsite sanitation systems. Various containment types are found in the institutional buildings. About 23% of the buildings have fully lined tanks, 41% have lined tanks with impermeable walls and open bottom and 36% have unlined pits. The data shows that almost 77% of the institutional buildings have improperly built containment that possesses risk to groundwater contamination. Figure 8 shows the location map of institutional buildings with different types of containments in Bhimeshwor Municipality.

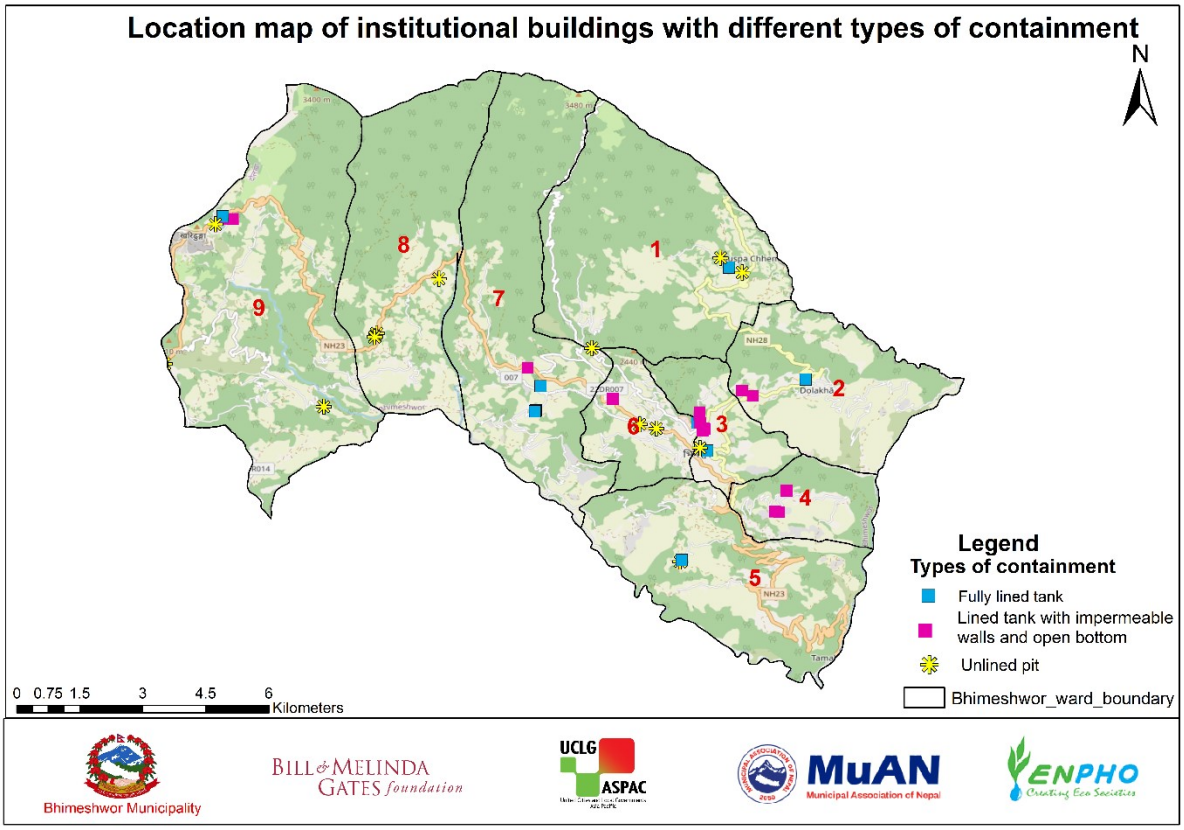


Figure 8: Location map of institutional buildings with different types of containment in Bhimeshwor Municipality.

2.1.3 Public Toilets

There are seven public toilets in Bhimeshwor Municipality (KII-1, 2024) (KII-4, 2024) among which two of them were non-functional. The information about public toilets obtained during KII and observation are fed in this report. Charges for toilet use are NRP 10 (USD 0.08) for urination and NRP 15 (USD 0.11) for defecation.

Public toilet at *Haat Bazaar*

The toilet located at *Haat Bazaar* was constructed by the Bhimeshwor Municipality on 2022 and came in operation since 2024. It has a separate male and female compartments. It serves 9 users at a time with 2 pans and 4 urinals in male compartment and 3 pans in female compartment. The public vehicle passengers and local shopkeepers are the major service recipients of this toilet. About 200-250 users uses the toilet per day. The users are charged NPR 5 (USD 0.04) for urination and NPR 10 (USD 0.08) for defecation.

The outlet of the toilet is connected to a containment but has a leakage in pipe connecting toilet and containment. The containment has not been emptied. The toilet is cleaned regularly. Water required for the toilet is supplied from a tank on the taps of each compartment provided by a water service provider. The toilet compartments have a ventilation. Handwashing basins are placed inside both compartments (KII-4, 2024) . A caretaker is responsible for overall management of the toilet.

Public toilet at *Dolakha Bazaar*

The toilet located at *Dolakha Bazaar* was constructed jointly by Avayapur Youth Club, Avayapur Tole Development Committee and Pukhurcha Bhimeshwor Tole Development Committee. It has a separate male and female compartments. It serves 9 users at a time with 1 pan and 3 urinals in male compartment and 2 pans and 3 urinals in female compartment. The public vehicle passengers, local shopkeepers and temple visitors are the major service recipients of this toilet. About 100-150 users uses the toilet per day. The users are responsible to pay NPR 5 (USD 0.04) for urination and NPR 10 (USD 0.08) for defecation.

The outlet of the toilet is connected to a containment but has not been emptied. The toilet is not in good sanitary condition. Water required for the toilet is supplied from a 500 litres overhead tank on the taps of each compartment. The toilet compartments have a ventilation. Handwashing basins are placed inside each compartment. The Pakhlati Bazaar Management Committee is responsible for overall operation and management of the toilet (KII-4, 2024).

Public toilet at *Dolakha Temple*

The toilet located at *Dolakha Temple* was constructed by the Bhimeshwor Municipality and reconstructed by Dolakha Bhimsen Management Committee on 2006 A.D. It has a separate male and female compartments. It serves 12 users at a time with 2 pans and 5 urinals in male compartment and 5 pans in female compartment. The temple visitors are the major service recipients of this toilet. About 100-150 users uses the toilet per day. The users are responsible to donate the service of urination and defecation.

The outlet of the toilet is connected to a 9,000 litres containment but has not been emptied yet. The toilet is cleaned regularly. Water required for the toilet is supplied from a 3,000 litres reserve tank on the taps of each compartment. The toilet compartments have a ventilation. Handwashing basins are placed inside each compartment. The Dolakha Bhimsen Management Committee is responsible for overall operation and management of the toilet (KII-4, 2024).

Public toilet at *Tamakoshi*

The toilet located at *Tamakoshi* was constructed jointly by Environment and Public Health Organization (ENPHO) and District Water Supply Office (DWSO), Dolakha on 2016. It has a separate male and female compartments. It serves 11 users at a time with 3 pan and 5 urinals in male compartment and 3 pans in female compartment. The public vehicle passengers and local shopkeepers are the major service recipients of this toilet. About 50-100 users uses the toilet per day. The users are charged NPR 5 (USD 0.04) for urination and NPR 10 (USD 0.08) for defecation.

The outlet of the toilet is connected to a containment but has not been emptied. The toilet is cleaned regularly. Water required for the toilet is supplied from a 500 litres overhead tank on the taps of each compartment. The toilet compartments have a ventilation. Handwashing basins are placed outside the compartments (KII-4, 2024) . A caretaker is responsible for overall management of the toilet.

Public toilet at *Champuja Park*

The toilet located at *Champuja Park* was constructed by the Bhimeshwor Municipality. It has a separate male and female compartments. It serves 4 users at a time with 2 pans in male compartment and 2 pans in female compartment. Water required for the toilet is supplied from a 500 litres overhead tank on the taps of each compartment. The toilet compartments have a ventilation. Handwashing basins is placed out the toilet compartment.

Figure 9 shows the public toilets located in different places of Bhimeshwor Municipality and their status.















Figure 9: Public toilets and their status in Bhimeshwor Municipality.

2.1.4 Emptying and Transport

Emptying is one of the key elements of sanitation service chain. It basically assures the proper operation of containment. Regular emptying of the containment prevents sludge overflow and blockages (Strande, et al., 2014) . Moreover, emptying of containment is determined by the number of users, duration of years and types and size of containment.

Among the households with onsite sanitation systems, only 4% of the households have emptied their containment whereas 96% have not emptied yet. But unlike the emptying practice at households, majority institutional buildings i.e. 90% have emptied their containments while only 10% have not emptied (ENPHO, 2024). Here, the emptying ratio of containment types of fully lined tanks are more than other containment types regardless of its time of construction. This is because of regular emptying of biogas digesters. While the containment types lined tank with impermeable walls and open bottom and unlined pits allows effluents to infiltrate (Peal, et al., 2020), preventing them from filling up quickly. Figure 10 shows emptying status of different types of containment at households.

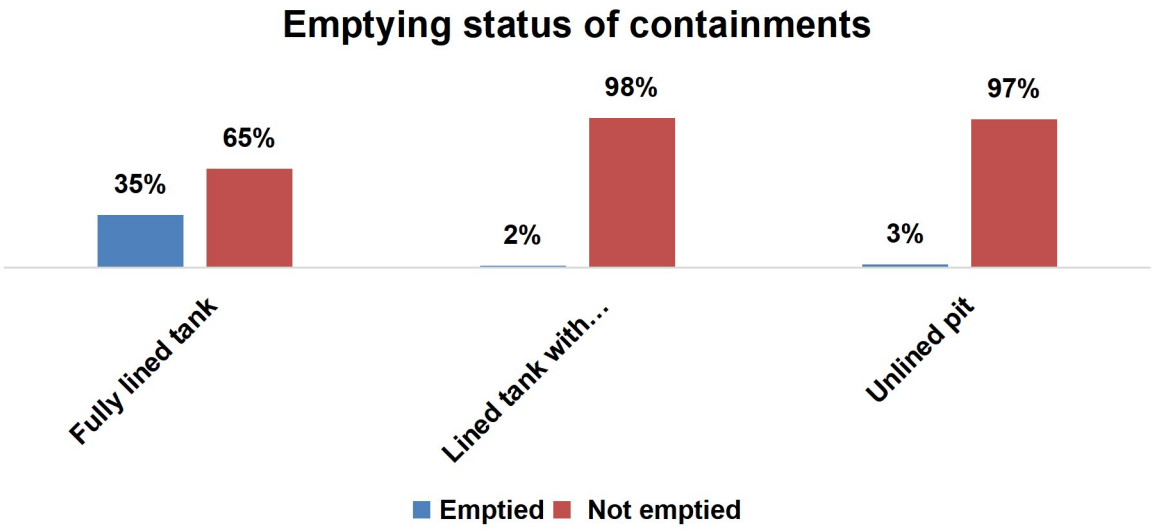


Figure 10: Status of emptying of different types of containment.

The municipality does not have regular containment emptying practice as maximum containments are with open bottom and does not get filled in standard time as per the containment size. Thus, on-demand emptying practice is found in the municipality (KII-1, 2024). Here, both manual and mechanical emptying is practiced while manual emptying is prevalent (ENPHO, 2024). Though open emptying data was not obtained from the household survey, the municipality has open emptying practice especially in the urban areas (KII-1, 2024). Open emptying method is the practice of discharging effluent into an open/stormwater drain during rainy season. Among the households that have emptied their containments, 60% of households emptied manually and 40% emptied mechanically. Moreover, 50% of institutional buildings practiced manual emptying and 50% practiced mechanical emptying (ENPHO, 2024). The unavailability of desludging service is the reason for prevalent manual emptying in the municipality.

The municipality has a desludging vehicle however it is not functional (Figure 11). In addition, there is no private desludging service providers. Therefore, the municipality does not have any desludging services. For mechanical emptying, private desludging service from Kathmandu valley provides the service (KII-1, 2024).



Figure 11: The desludging vehicle of Bhimeshwor Municipality.

2.1.5 Treatment and Disposal/Reuse

Bhimeshwor Municipality does not have a Faecal Sludge Treatment Plant (FSTP) but has a designated disposal site located at ward 5. In addition, the municipality is also planning for the construction of Wastewater Treatment Plant (WWTP) as a part of sewerage system. The sewerage system is designed for conveyance of sewage and stormwater to treatment plants. The sewerage system is being planned for wards 3, 4 and 6. Moreover, remaining wards will have onsite sanitation system until further planning (KII-1, 2024).

Currently, mechanically emptied FS is being disposed in a disposal site or applied to farmlands (KII-1, 2024) . While, manually emptied FS is dig and dumped, applied into farmlands, composted or released into water bodies (ENPHO, 2024). Moreover, about 2% of FS generated in the municipality is treated by biogas digester installed at households but major portion of FS generated and collected are not treated or disposed safely.

2.1.6 Risk Assessment of Water Source Pollution

The risk of water source pollution was assessed based on source of drinking water, secondary data on water quality and the vulnerability of water source in regard to lateral spacing between sanitation system and the sources.

a. Sources of drinking water and water production

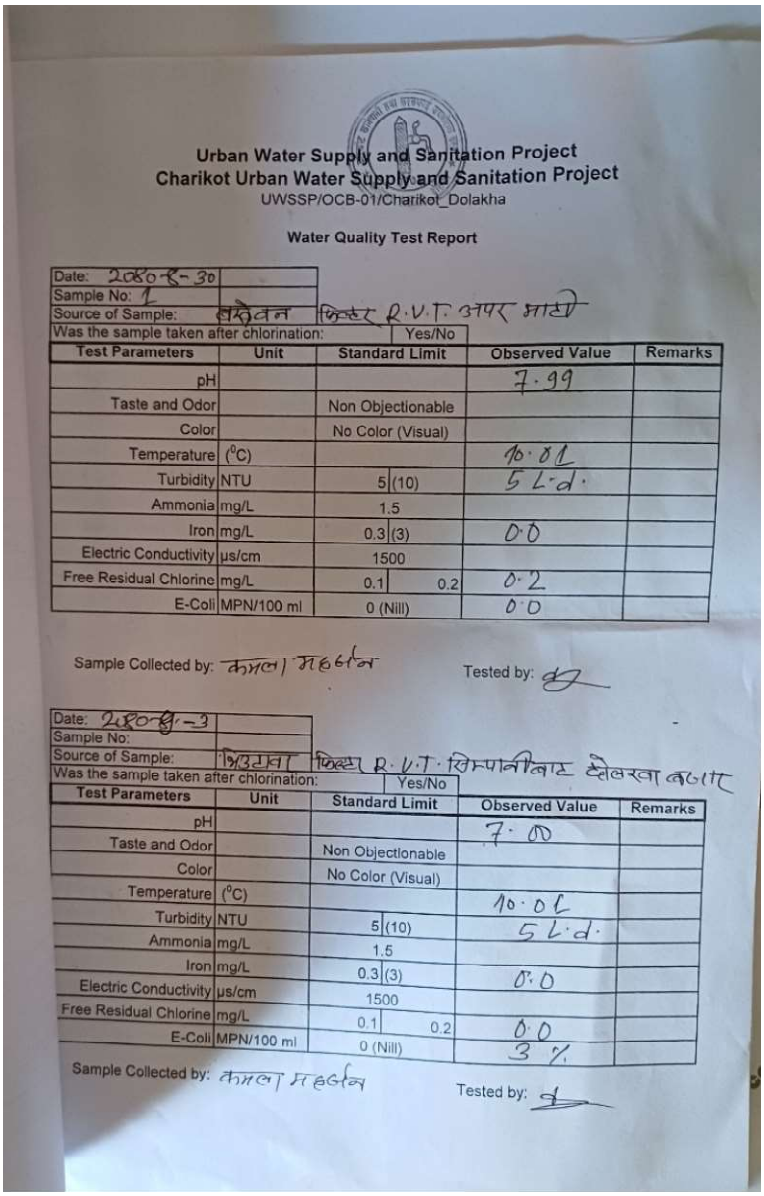
Approximately 53% of households in the Bhimeshwor Municipality have piped drinking water supply services, 3% of households get drinking water from community taps and 44% of households rely on spring sources for drinking water. About 37 Water and Sanitation Users' Committee (WSUCs) are providing drinking water supply service at households and institutions in the municipality (ENPHO, 2024) . Figure 12 shows spring source and private tap in the municipality.





Figure 12: Picture showing spring source and private tap in Bhimeshwor Municipality.

Charikot Water Supply Users Organization is one of the major water service providers in the municipality. It was established on 23 February 2007. It has been providing water supply services in ward 2, 3, 4, 5, 6 and 7. It serves drinking water services to 5,050 households. The organization is supplying water from 8 different spring sources including Khahare khola, jharpekhola, haati chahara, dut khola, jhule and nigale. The water from sources is collected on 14 reservoir tanks and distributed through pipeline at private taps in households. The water supply scheme has water treatment system which includes sedimentation tank, filtration and chlorination. The organization tests water quality of the scheme in the interval of 1 week, 15 days or 1 month. The sample water from source, reservoir tank and final outlet is taken for the testing. Despite of water treatment option, the presence of *E. coli* is found in drinking water during rainy season (KII-3, 2024).



Urban Water Supply and Sanitation Project
Charikot Urban Water Supply and Sanitation Project
UWSSP/OCB-01/Charikot_Dolakha

Water Quality Test Report

Date: 2080-8-30				
Sample No: 1				
Source of Sample: बसेवन फिल्टर R.V.T. अपर माटी				
Was the sample taken after chlorination:		Yes/No		
Test Parameters	**Unit**	**Standard Limit**	**Observed Value**	**Remarks**
pH			7.99	
Taste and Odor		Non Objectionable		
Color		No Color (Visual)		
Temperature	(°C)		10.01	
Turbidity	NTU	5 (10)	5 L.d.	
Ammonia	mg/L	1.5		
Iron	mg/L	0.3 (3)	0.0	
Electric Conductivity	µs/cm	1500		
Free Residual Chlorine	mg/L	0.1 0.2	0.2	
E-Coli	MPN/100 ml	0 (Nill)	0.0	

Sample Collected by: कमला महर्जन Tested by:

Date: 2080-8-3				
Sample No:				
Source of Sample: भिउटावा फिल्टर R.V.T. सिम्पानीबाट दोलखा बजार				
Was the sample taken after chlorination:		Yes/No		
Test Parameters	**Unit**	**Standard Limit**	**Observed Value**	**Remarks**
pH			7.00	
Taste and Odor		Non Objectionable		
Color		No Color (Visual)		
Temperature	(°C)		10.0 L	
Turbidity	NTU	5 (10)	5 L.d.	
Ammonia	mg/L	1.5		
Iron	mg/L	0.3 (3)	0.0	
Electric Conductivity	µs/cm	1500		
Free Residual Chlorine	mg/L	0.1 0.2	0.0	
E-Coli	MPN/100 ml	0 (Nill)	3 %	

Sample Collected by: कमला महर्जन Tested by:

Figure 13: Water quality test report of Charikot Water Supply Users Organization.

Similarly, Dolakha Bazaar Water and Sanitation Users' Committee (WSUC) is another water service provider in the municipality. It was established in 1960, later the water supply system was upgraded. It supplies drinking water to 245 households in ward 2. The scheme collects water from spring sources and is stored in 3 reservoir tanks of capacities 150 m^3, 50 m^3, and 40 m^3. The stored water is then distributed on taps at households. The scheme does not have water treatment system however chlorine dosing is used during rainy season. Furthermore, no water quality test is performed (KII-3, 2024).

Apart from this water service provider, Asahari, Simpani, Ramkot and Suile are some WSUC among others in the municipality (ENPHO, 2024) (KII-1, 2024). The WSUC collects water from spring sources located above and more than 500 metres away from the community (KII-3, 2024). The water supply service is not uniformly distributed in the municipality thus, locals are obliged to rely on spring sources located nearby the community (within the range of 25 metres for drinking water supply.

b. The vulnerability of spring source and water pollution

The households using drinking water directly from spring source have their source located in less than 5 metres to more than 25 metres horizontally from their containment. A study suggests that *E. coli* can travel to hundreds of metres horizontally in fractured rocks and gravels (Krishnan, 2011) . As the geology of Bhimeshwor Municipality consists of rocky landscape, such as quartzite, granite and limestone as well as alluvial sediments i.e. sand, silt and clay along-with coarse gravels (Upreti, 1999) , *E. coli* contamination is possible in groundwater and spring sources. Many study also suggests that humic matter such as microorganisms in water can be removed naturally, in a period of time and in continuous flow of water (Balke & Zhu, 2008) (Odling, et al., 2020) . Thus, it can be said that population consuming water from private taps are at insignificant risk of *E. coli* consumption while population accessing water directly from spring sources are at possible risk of it.

Based on the risk assessment, 26% of the population depends on lined tanks with impermeable walls and an open bottom, with no outlet or overflow (T1A4C10, low risk) and 66% relies on unlined pits (63%, T1A6C10, low risk and 3%,T2A6C10, high risk).

2.2 SFD Selection Grid

Figure 14 shows the types of sanitation technologies present in the Bhimeshwor Municipality selected in the Shit Flow Diagram (SFD) selection grid. The vertical column on the left side of grid represents sanitation technologies to which toilet is connected to, and horizontal row at top is connection of the technologies.

<table>
<tr><th>List A: Where does the toilet discharge to? (i.e. what type of containment technology, if any?)</th><th colspan="9">List B: What is the containment technology connected to? (i.e. where does the outlet or overflow discharge to, if anything?)</th></tr>
<tr><th></th><th>to centralised combined sewer</th><th>to centralised foul/separate sewer</th><th>to decentralised combined sewer</th><th>to decentralised foul/separate sewer</th><th>to soakpit</th><th>to open drain or storm sewer</th><th>to water body</th><th>to open ground</th><th>to 'don't know where'</th><th>no outlet or overflow</th></tr>
<tr><td>No onsite container. Toilet discharges directly to destination given in List B</td><td></td><td></td><td></td><td></td><td>Significant risk of GW pollution
Low risk of GW pollution</td><td></td><td>T1A1C7</td><td></td><td></td><td rowspan="2">Not Applicable</td></tr>
<tr><td>Septic tank</td><td></td><td></td><td></td><td></td><td>Significant risk of GW pollution
Low risk of GW pollution</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Fully lined tank (sealed)</td><td></td><td></td><td></td><td></td><td>Significant risk of GW pollution
Low risk of GW pollution</td><td></td><td></td><td></td><td></td><td>T1A3C10</td></tr>
<tr><td>Lined tank with impermeable walls and open bottom</td><td>Significant risk of GW pollution
Low risk of GW pollution</td><td>Significant risk of GW pollution
Low risk of GW pollution</td><td>Significant risk of GW pollution
Low risk of GW pollution</td><td>Significant risk of GW pollution
Low risk of GW pollution</td><td>Significant risk of GW pollution
Low risk of GW pollution</td><td></td><td></td><td>T1A4C8</td><td></td><td>Significant risk of GW pollution
T1A4C10</td></tr>
<tr><td>Lined pit with semi-permeable walls and open bottom</td><td colspan="9" rowspan="5">Not Applicable</td><td>Significant risk of GW pollution
Low risk of GW pollution</td></tr>
<tr><td>Unlined pit</td><td>T2A6C10
T1A6C10</td></tr>
<tr><td>Pit (all types), never emptied but abandoned when full and covered with soil</td><td>Significant risk of GW pollution
Low risk of GW pollution</td></tr>
<tr><td>Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil</td><td></td></tr>
<tr><td>Toilet failed, damaged, collapsed or flooded</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>No toilet. Open defecation</td><td colspan="6">Not Applicable</td><td></td><td></td><td></td><td>Not Applicable</td></tr>
</table>

Figure 14: SFD selection grid for Bhimeshwor Municipality.

The detail description of selected terms in the selection grid is provided in Table 4:

Table 4: Explanation of terms used to indicate different frame selected in the SFD selection grid in Figure 14.

T1A1C7	A fully functioning toilet discharging directly to a correctly designed, properly constructed, fully functioning centralised combined sewer. The excreta is raw, untreated and hazardous.
T1A3C10	A correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. It includes poorly designed and/or constructed and/or maintained septic tanks that, because of these faults or deficiencies, are NOT performing as septic tanks, instead they are acting as sealed vaults. However, since the tank is NOT fitted with a supernatant/effluent overflow this system is considered contained.
T1A4C8	A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. It includes wall-lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks. Since the tank is fitted with a supernatant/effluent overflow connected to open ground, the excreta in this system is considered NOT contained.
T1A4C10	A correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. It includes all lined but open bottomed tanks and containers which are sometimes mistakenly referred to as septic tanks (e.g. cubluks in Indonesia). However, since the tank is NOT fitted with a supernatant/effluent overflow this system is considered contained.
T1A6C10	A correctly designed, properly constructed and well maintained unlined pit with permeable walls and base, through which infiltration can occur. The tank is NOT fitted with a supernatant/effluent overflow 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.

2.3 SFD Matrix

2.3.1 Proportion of Faecal Sludge from types of sanitation technologies

The second step in the process of developing the SFD graphic is the calculation of the proportion of contents of each type of onsite container which is faecal sludge. SFD matrix calculates the proportion of people using each type of system and the proportion of each system, from which FS and supernatant is emptied, transported and treated. A detailed instruction on how to calculate SFD proportion in SFD PI was used as guide to calculate SFD proportion. As stated on SFD PI, the default "100%" value is used for onsite containers which are connected to soak pits, water bodies or to open ground. This will model the contents as 100% faecal sludge and a proportion of this may be emptied periodically. The remaining not emptied fraction is made up of one or more of the following: faecal sludge which remains in the container, supernatant (when discharging to water bodies or to open ground), and infiltrate. The value for onsite containers that are connected to a sewer network or to open drains is used as "50%" which means half of the contents are modelled FS and a proportion of this may be emptied periodically. The remaining not emptied fraction will comprise faecal sludge which remains in the container and, in the case of open-bottomed tanks, infiltrate. The

other half of the contents is modelled as supernatant discharging into the sewer network or to open drains. The formula obtained from SFD PI used for FS proportion calculation is shown below:

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

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

i. The proportion of FS in septic tank is 0%, since there are no septic tanks in the municipality.

ii. The proportion of FS in fully lined tank is 100%, as the fully lined tanks are not connected to an open/stormwater drain or sewer.

iii. The proportion of FS from lined tanks with open bottom and all types of pit is 100%, as the lined tanks with impermeable walls and open bottom and any pits are not connected to an open/stormwater drain or sewer network.

Upon calculation of proportion of FS in each type of sanitation technologies, the population using the system selected in the SFD selection grid are fed in. The column Population (Pop) gives the proportion of population using type of sanitation system.

Figure 15 shows the SFD matrix of Bhimeshwor Municipality.

Bhimeshwor Municipality, Bagmati, Nepal, 1 Oct 2024. SFD Level: 2 - Intermediate SFD
Population: 34712
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
T1A1C7 Toilet discharges directly to water body	1.0			
T1A3C10 Fully lined tank (sealed), no outlet or overflow	6.0	35.0	86.0	95.0
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	26.0	2.0	0.0	0.0
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	1.0	0.0	0.0	0.0
T1A6C10 Unlined pit, no outlet or overflow	63.0	2.0	0.0	0.0
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	3.0	0.0	0.0	0.0

Figure 15: SFD Matrix of Bhimeshwor Municipality.

2.3.2 Proportion of Faecal Sludge Emptied (F3)

The proportion of faecal sludge emptied (F3) is calculated based on percentage of containment emptied and amount of FS emptied during the process (ENPHO, 2024). The information on FS emptied from containment is obtained from the survey. In an average 20% of the FS in the containment which is very thick and does not dissolve in water, is not removed during emptying. Hence, actual proportion of FS emptied from each containment is calculated as:

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

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

Table 5: Sanitation technologies and proportion of emptied faecal sludge (ENPHO[1], 2024).

Sanitation Technologies	SFD Reference Variable	Percentage of Population using	Empited Proportion of FS (1)	FS Empited from Containment (1)	Actual Proportion of Empited FS (F3)
Toilet discharges directly to water body	T1A1C7	1%	0%	0%	0%
Fully lined tank (sealed), no outlet or overflow	T1A3C10	6%	35%	80%	28%
Lined tank with impermeable walls and open bottom, connected to open ground	T1A4C8	1%	0%	0%	0%
Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	26%	2%	80%	2%
Unlined pit, no outlet or overflow	T1A6C10	63%	2%	80%	2%
Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	T2A6C10	3%	0%	80%	0%

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

The variable F4 is the proportion of FS that is delivered to treatment plant and F5 is the proportion of FS that is treated. Here, 86% of FS from the biogas digester which is reclassified as fully lined tanks with no outlet or overflow (T1A3C10) is delivered to treatment plant and treated. Thus, the emptying proportion of FS for the system is 86% (F4 = 86%) and the capacity of fully functioning biogas digester is taken to 95% (F5 = 95%). Apart from biogas digester, FS emptied from other sanitation technologies are applied in farmlands without treatment, disposed in an open environment, or in water bodies. Hence, the portion of FS delivered to treatment plant for the remaining technologies (F4) and treated (F5) is 0%.

2.4 SFD Graphic

Figure 16 shows the SFD graphic of Bhimeshwor Municipality. The graphic shows that excreta generated from the proportion of the population that are safely managed is shown in green coloured arrowhead whereas unsafely managed excreta are shown in red coloured arrowhead. It shows that excreta from 93% of the population are safely managed and excreta from 7% of the population are unsafely managed. It also represents the sanitation value chain going from left to right.

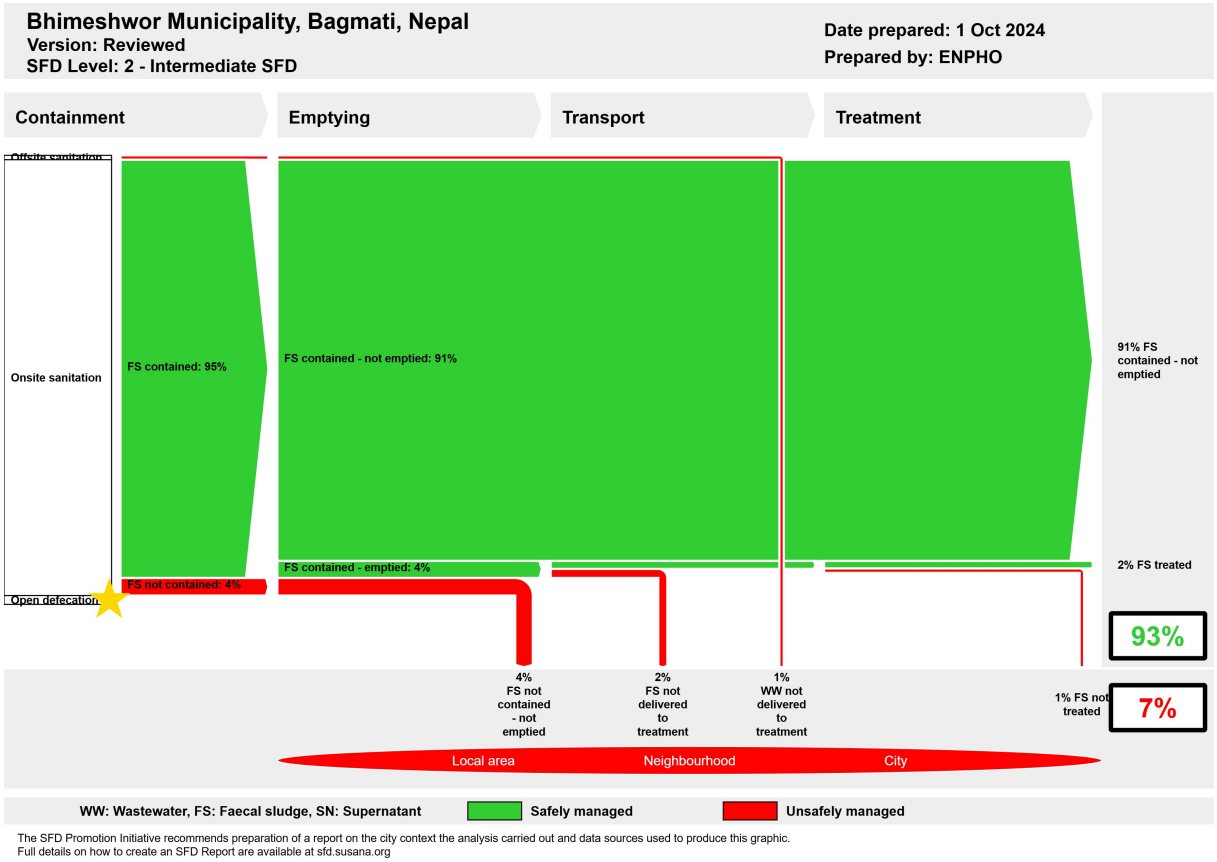


Figure 16: SFD Graphic of Bhimeshwor Municipality.

Offsite Sanitation

Bhimeshwor Municipality does not have a sewer network, however, 1% of households have offsite sanitation systems. The wastewater generated from these households is disposed of untreated to water bodies. Therefore, wastewater from 1% of the population is not treated and is unsafely managed.

Onsite Sanitation

In the municipality, 99% of households rely on onsite sanitation systems. Of the total households having an onsite sanitation system, FS from 95% of the population is contained, while FS from 4% of population is not contained.

FS contained

The definition of 'FS contained' is faecal sludge contained within an onsite sanitation technology which ensures safe level of protection from excreta i.e. pathogen transmission to the user or general public is limited. These are tanks or pits that are correctly designed, properly constructed, fully functioning, and/or are causing no risk- or only a 'low' risk- of polluting groundwater used for drinking (SuSanA, 2018).

The value of FS contained i.e. 95% is obtained from the summation of population using fully lined tanks without outlet or overflow (T1A3C10), lined tanks with impermeable walls and open bottom without outlet or overflow (T1A4C10) and unlined pits without outlet or overflow (T1A6C10) without posing a significant risk to groundwater.

FS not Contained

The definition of 'FS not contained' is faecal sludge contained within an onsite sanitation technology which does not ensure safe level of protection from excreta i.e. pathogen transmission to the user or general public is likely. These are tanks or pits that are incorrectly designed, or poorly constructed, or poorly functioning, and/or are causing a 'significant' risk of polluting groundwater used for drinking (SuSanA, 2018).

The value of FS not contained i.e. 4% is obtained from the population using lined tanks with impermeable walls and open bottom connected to an open ground (T1A4C8) and unlined pits without outlet or outflow with significant risk to groundwater (T2A6C10).

FS contained - not Emptied

The value of 91% is obtained from the proportion of the population using sanitation systems where the FS is contained and have not emptied their containment. However, this 91% of safely managed FS should be considered as only temporary, as most of the pits and tanks have not yet filled up and the FS generated remains 'not emptied'. Therefore, these systems will require emptying services in the short and medium term as they fill up.

FS contained Emptied

The value of 4% is obtained from the proportion of population using sanitation systems where the FS is contained and have emptied their containment.

FS not contained - not Emptied

The value of 4% is obtained from the proportion of the population using sanitation systems where the FS is not contained and have not emptied their containment.

FS not delivered to treatment

The proportion of FS not delivered to treatment, i.e. 2%, is obtained from the FS contained emptied which have not been delivered to biogas digester and FSTP.

FS treated and FS not treated

About 2% of households in the municipality have biogas digester and some amount of FS delivered biogas digesters at households is treated. Thus, the proportion of FS treated i.e. 2% is obtained from the containment type fully lined tank with no outlet or overflow (T1A3C10). While FS delivered to treatment plant is not treated 100% because of the efficiency of the system. Thus, 1% FS not treated is obtained from it.

3 Service delivery context

3.1 Policy, legislation, and regulation

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

Local Government Operation Act, 2017

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

Environment Protection Act, 2019

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

Water Supply and Sanitation Act, 2022

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

Environment Friendly Local Governance Framework 2013

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

discharged only after being processed through biological or engineering technique. While it has failed to identify the necessity of faecal sludge treatment plants as it has assumed safety tank in the households is sufficient for treating faecal sludge.

Institutional and Regulatory Framework for Faecal Sludge Management, 2017

Ministry of Water Supply through its Department of Water Supply and Sewerage Management (DWSSM) articulated and endorsed Institutional and Regulatory Framework (IRF) for Faecal Sludge Management in Urban Areas of Nepal in 2017. The main objective of the IRF is to define the specific roles and responsibilities of key institutions for the effective management and regulation of 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 National Sanitation and Hygiene master Plan (NSHMP) 2011. It provides guidelines for sustaining ODF outcomes and initiating post-ODF activities through an integrated water, sanitation and hygiene plan at municipalities and districts. The guideline redefined sanitation as management of services and facilities to safely dispose of/reuse faecal sludge, collection and treatment of solid waste and wastewater to establish a hygienic environment and promote public health. Indicators are set to guide total sanitation movement with an arrangement for resource management, monitoring and evaluation, capacity building.

3.2 Policies

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

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

Nepal is a signatory of the historical resolution of 2010 United Nations General Assembly on the Human Right to Water and Sanitation. Nepal committed to Millennium Development Goals (MDGs) for 2000- 2015. The goal was accomplished through declaration of the country as free from open defecation on 30th September 2019. After the MDGs, United Nations General Assembly set 17 global goals as Sustainable Development Goals (SDGs). Sanitation is prioritized on SDG 6. The target 6.2 of SDG 6 majorly focuses on sanitation. It mentioned to achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations by 2030. In line with SDG 6.2, Nepal has targeted to provide improved sanitation to 95% households that are not shared and urban households with toilets connected to sewer system or proper FSM to 90% by 2030 (NPC, 2017). National Sanitation and Hygiene Master Plan, 2011 was developed for coordinated planning and implementation of National Sanitation Campaign. The campaign strengthened institutional setup tier of government in a participatory approach. In an alignment total sanitation campaign was initiated formally to sustain ODF. The guideline set various indicators to assess the sustainability of sanitation services. Remarkably, it extended sanitation definition as management of services and facilities to safely dispose of/reuse faecal sludge, collection and treatment of solid waste and wastewater to establish the hygienic environment and promote public health (NPC, 2017).

Similarly, Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (SDP 2016-2030) was formulated in 2016 for sector convergence, institutional and legal reforms, capacity development and establishing coordination and harmonization in the sector. The SDP classified service system and delineated roles and responsibilities for effective and sustainable service delivery. The SDP highlighted that majority of households rely on onsite sanitation system (70%) that requires effective treatment of faecal sludge. However, there is lack of concrete policies, guidelines, and indicators on Faecal Sludge Management in the sector for effective planning, implementation, and service delivery. Nepal was declared ODF nation on September 23, 2019 (MoWS, 2020) however, the target of 90% households with toilets connected to sewer system or proper FSM is yet to be achieved.

3.3 Institutional roles

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

At Federal Government

National Planning Commission: At the federal government, the National Planning Commission is the specialized and apex advisory body for formulating a national vision, developing policy, periodic plans, and sectoral policies. The NPC assesses resource needs,

identifies sources of funding, and allocates budget. It serves as a central agency for monitoring and evaluating development policy, plans and programs. It supports, facilitates, and coordinates with federal, provincial, and local government for developing policy plans and implementation.

Ministry of Water Supply: Ministry of Water Supply is the lead ministry responsible for planning, implementation, regulation, and monitoring and evaluation of sanitation programs in the country (GoN, 2015). Under the MoWS, Department of Water Supply and Sewerage Management (DWSSM) plan and implement water and sanitation projects funded by foreign donors or inter provincial projects or serves at least 15,000, 5,000 and 1,000 people in terai, hilly and mountain region respectively (GoN, 2015). The organizational structure of DWSSM is shown in Figure 17.

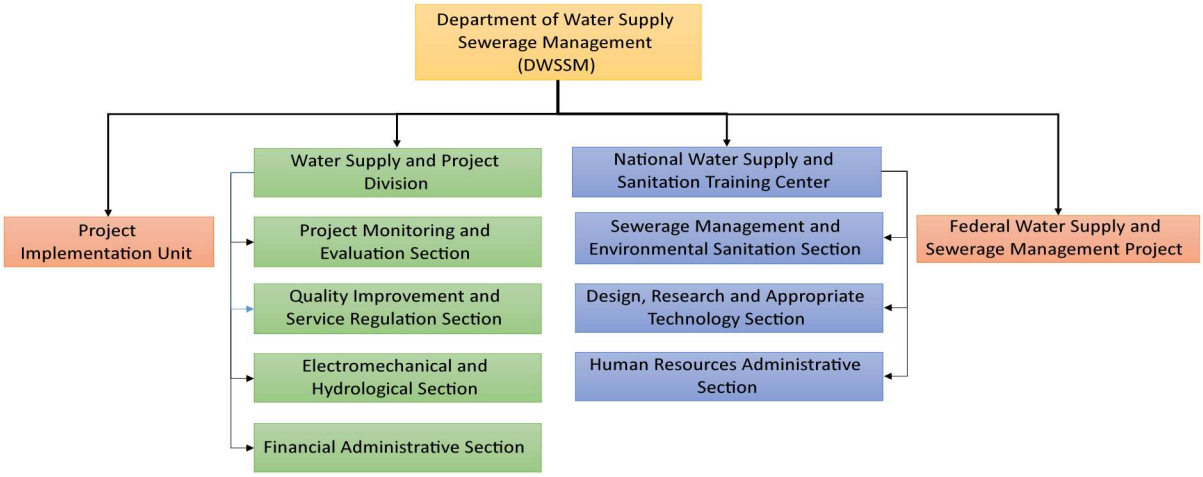


Figure 17: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).

Ministry of Urban Development: The Ministry of Urban Development (MoUD) works on integrated urban planning and development in municipalities, including faecal sludge management. Department of Urban Development and Building Construction (DUDBC) under MoUD is implementing body and sets the standards for safe, affordable building construction and implementation for managed residential environment.

At Provincial Level

Ministry of Water Supply, Energy and Irrigation: Ministry of Water Supply, Energy and Irrigation of provincial government in Bagmati Province is major executing body in the province for planning, developing, and implementing water supply and sanitation programs. Planning and implementation of water supply and sanitation infrastructure in Bhimeshwor is executed through Federal Water Supply and Sewerage Management Project (FWSSMP), Ramechhap. FWSSMP implements the water and sanitation programs meeting the following criteria:

i. Inter local government projects.

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

At Local Level

The Planning Section in the Bhimeshwor Municipality is responsible for overall management of water supply and sanitation. This section oversees all the planning and operation related to environment, water supply and sanitation.

3.4 Service provision

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

The municipality does not have a sewer network. The toilet system is directly connected to open drain, water bodies or open ground. The toilets that are connected to containments are emptied mechanically by desludging suction truck from municipality or private service providers whereas manually emptied by traditional desludgers.

3.5 Service standards

The sanitation service standards have been set by Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (2016-2030). It classifies sanitation services as high, medium, and basic based on sanitation facilities in place. The sanitation service levels with indicators are shown in Table 6. However, FSM specific standards have yet to be developed and implemented.

Table 6: Sanitation Service Level and its Components.

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

4 Stakeholder Engagement

4.1 Key Informant Interview

The Key Informant Interviews (KIIs) and objective sharing of the study were conducted with major stakeholders of the sanitation sector in the municipality. The focal person at the municipality was interviewed on current sanitation services with respect to technical, institutional, and financial aspects. Also, the KII was performed with Water Supply Users' Committees to obtain the information related to drinking water supply. Also, an interview was performed with caretaker of public toilet along with observation to find sanitation status and management practice of public toilet (Table 7 and Figure 18).

Table 7: List of Key Informant Interviewed personnel.

S.N.	Name	Designation	Organization/Company	Purpose of KII	Date
1.	Ramji Thapa (KII-1)	Engineer	Bhimeshwor Municipality	Sanitation status, ongoing projects on sanitation, policies and plan for sanitation development	4 March, 2024
2.	Kamala Maharjan (KII-3)	Board member	Charikot Water Supply and Sanitation Organization	Water supply services and water quality in Bhimeshwor Municipality	4 March, 2024
3.	Sita K.C. (KII-3)	Manager	Charikot Water Supply and Sanitation Organization	Water supply services and water quality in Bhimeshwor Municipality	4 March, 2024
4.	Indralal Shrestha (KII-3)	Manager	Dolakha Bazaar Water and Sanitation Users' Committee	Water supply services and water quality in Bhimeshwor Municipality	7 March, 2024
5.	Mohan Bahadur Karki (KII-4)	Caretaker	Public toilet-Haatbazaar	Quantitative and qualitative management on public toilet and public toilet operation	6 March, 2024
6.	(KII-4)	User	Public toilet-Dolakha bazaar	Quantitative and qualitative management on public toilet and public toilet operation	6 March, 2024
7.	Anup Thami (KII-4)	Management Committee Member	Public toilet-Dolakha Temple	Quantitative and qualitative management on public toilet and public toilet operation	6 March, 2024
8.	Tara (KII-4)	Caretaker	Public toilet-Tamakoshi	Quantitative and qualitative management on public toilet and public toilet operation	11 September, 2024



Figure 18: KII with municipal representatives and caretaker of public toilet.

4.2 Household Survey

A random household survey was conducted in all wards of the municipality. The local enumerators selected from the municipality were oriented prior to the survey and were mobilized for data collection. A mobile application "KOBOCOLLECT" was used for data collection from the households. In the orientation, enumerators were clarified on survey objectives, technical terms concerning sanitation, use of the mobile application and procedure of random sampling survey based on the provided map (Figure 19).



Figure 19: SFD orientation to local enumerators for data collection.

4.2.1 Determining Sample Size

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

Where,

Z^2	1.96	At the confidence level of 95%
p	0.5	Assuming that about 50% of the population should have some sanitation characteristics that need to be studied (this was set at 50% since this percentage would yield the maximum sample size as the percentage of the population practising some form of sanitation is not known at the intervention sites).
q	1-p	
e	+/-3%	Level of precision or sampling error.
N		A total number of population (households in the municipality).

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

n_h= (N_h/N)*n, where N_h is a total population in each stratum.

A total of 370 households were sampled from 10,164 households distributed in 9 wards with proportionate stratification random sampling. The household samples surveyed in the municipality is shown in Figure 20.

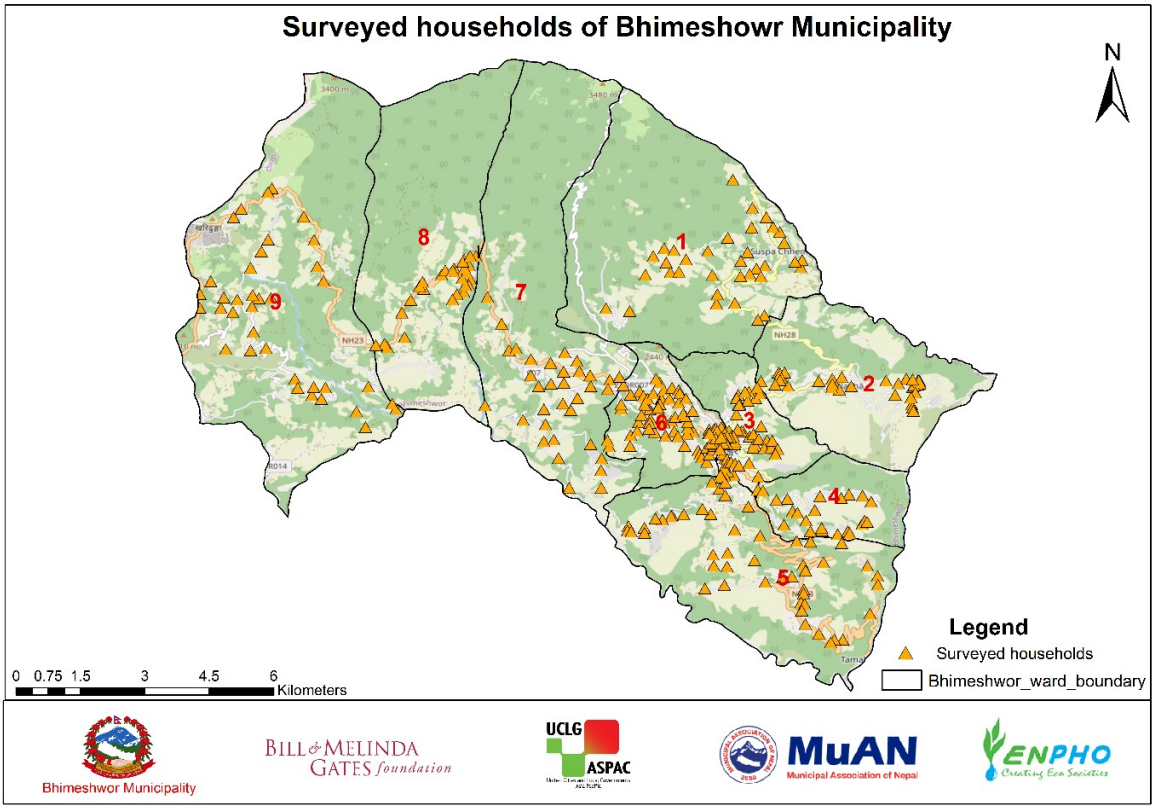


Figure 20: Location map of surveyed households.

4.3 Direct Observation

Various sanitation technologies in the households were observed and visual references were kept. Also, observation of the public toilets was carried out. Figure 21 shows observation of a public toilet in Bhimeshwor Municipality.



Figure 21: Observation of a public toilet Bhimeshwor Municipality.

4.4 Sharing and Validation of Data

The Shit Flow Diagram Sharing and Validation Workshop was conducted at Bhimeshwor Municipality to share the findings on sanitation situation survey and receive the suggestions from the municipal stakeholders. Altogether, 49 participants including Mayor, Deputy Mayor, CAO, ward chairpersons, municipal council members, sectoral staffs and other relevant stakeholders actively participated on the workshop and provided valuable suggestions. Participants recognized the pressing need on FSM in the municipality and agreed to keep it as an agenda for municipal planning meeting. Figure 22 shows the picture of SFD findings sharing to the participants. The list of participants with their designation is attached in Appendix 4.



Figure 22: Sharing of findings during validation workshop.

5 Acknowledgements

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

We offer sincere acknowledgement to Mr. Ishwor Narayan Manandhar, Mayor, Ms. Kamala Basnet, Deputy Mayor, Mr. Bishaksen Dhakal, CAO and Mr. Ramji Thapa, Engineer of the Bhimeshwor Municipality for providing valuable time and information during study. Similarly, we would like to thank all the respective staffs of the municipality and key stakeholders involved during the study, without whose help this study would not have been completed.

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7 Appendix Annexes

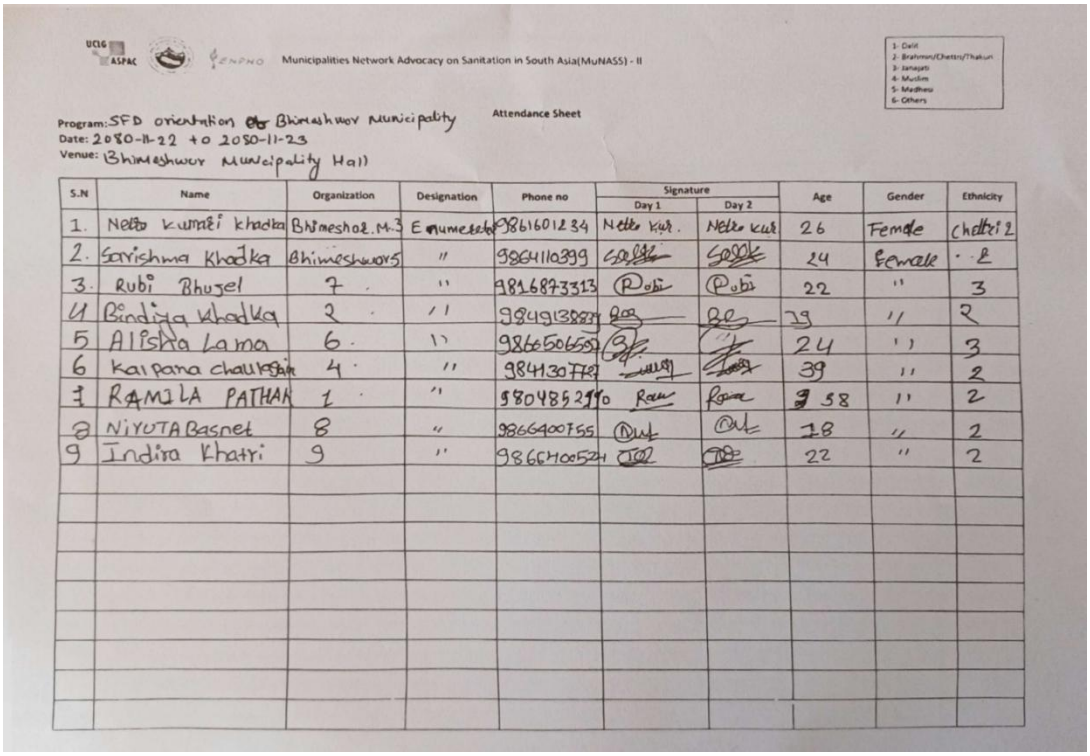
7.1 Appendix 1: Roles and Responsibility of Various Tiers of Governments Delineated in Drafted SDP 2016 – 2030

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

7.2 Appendix 2: Total number of population and household in each ward and number of surveyed households

Wards	Total Population	Total Household	No. of Surveyed Households
1	3,363	961	35
2	3,802	1,183	43
3	5,836	1,543	56
4	1,749	543	20
5	3,731	1,157	42
6	7,572	2,075	76
7	3,142	942	34
8	2,278	766	28
9	3,239	994	36
Total	**34,712**	**10,164**	**370**

7.3 Appendix 3: List of Participants on SFD Survey Orientation



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

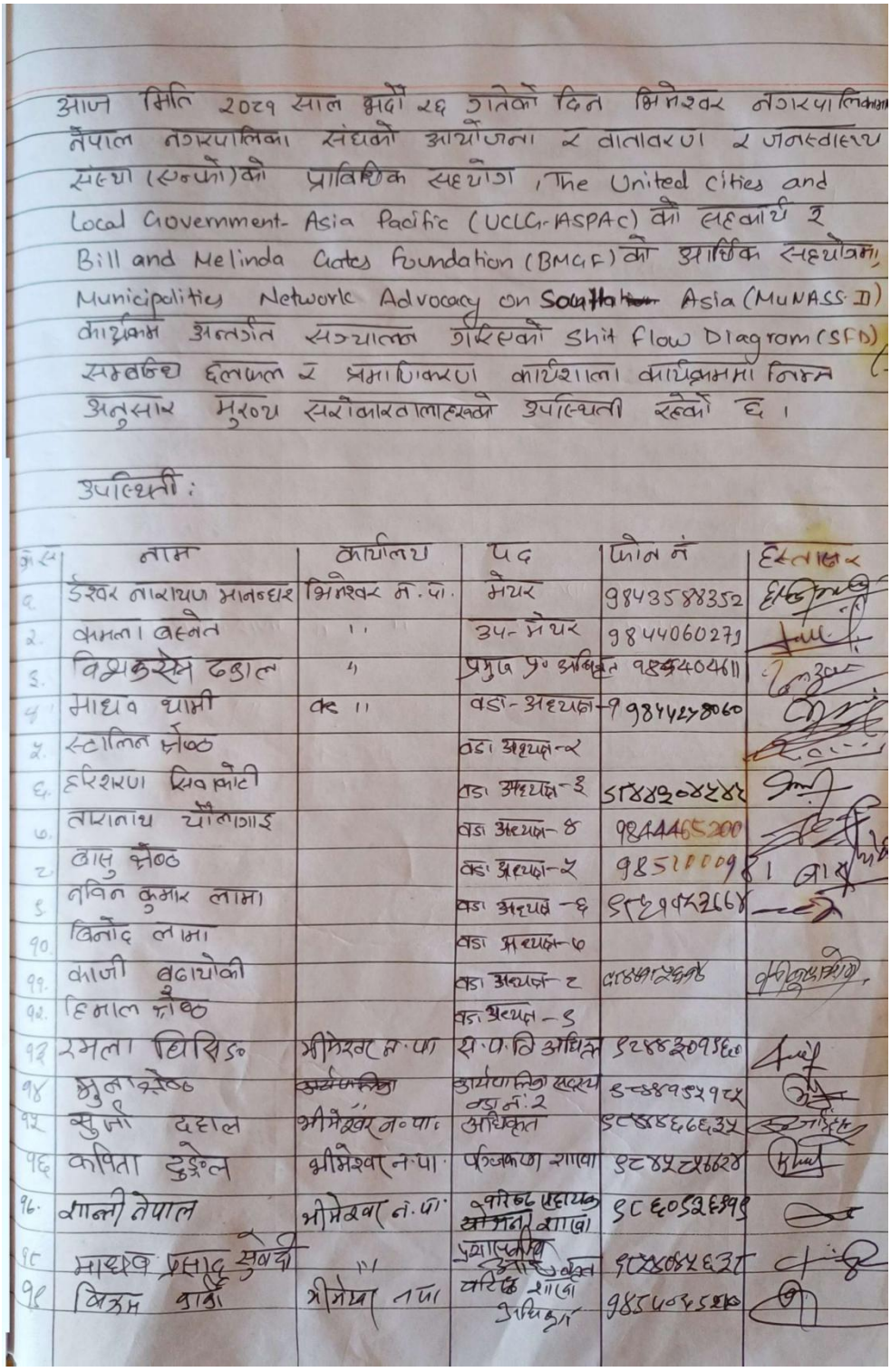
1- Dalit
2- Brahmin/Chettri/Thakuri
3- Janajati
4- Muslim
5- Madhesi
6- Others

Attendance Sheet

Program: SFD orientation of Bhimeshwor Municipality
Date: 2080-11-22 to 2080-11-23
Venue: Bhimeshwor Municipality Hall

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Age	Gender	Ethnicity
1.	Netto kumari khadka	Bhimeshor.M.3	Enumerator	9861601234	Netto kur.	Netto kur	26	Female	Chettri 2
2.	Sarishma Khadka	Bhimeshwor5	"	9864110399	[illegible]	[illegible]	24	Female	2
3.	Rubi Bhujel	7	"	9816873313	Rubi	Rubi	22	"	3
4	Bindiya Khadka	2	"	9849138839	[illegible]	[illegible]	19	"	2
5	Alisha Lama	6	"	9866506507	[illegible]	[illegible]	24	"	3
6	Kalpana Chaulagain	4	"	9841307727	[illegible]	[illegible]	39	"	2
7	RAMILA PATHAK	1	"	9804852990	Ram	Ram	38	"	2
8	NIYUTA Basnet	8	"	9866400755	[illegible]	[illegible]	18	"	2
9	Indira Khatri	9	"	9866400524	[illegible]	[illegible]	22	"	2

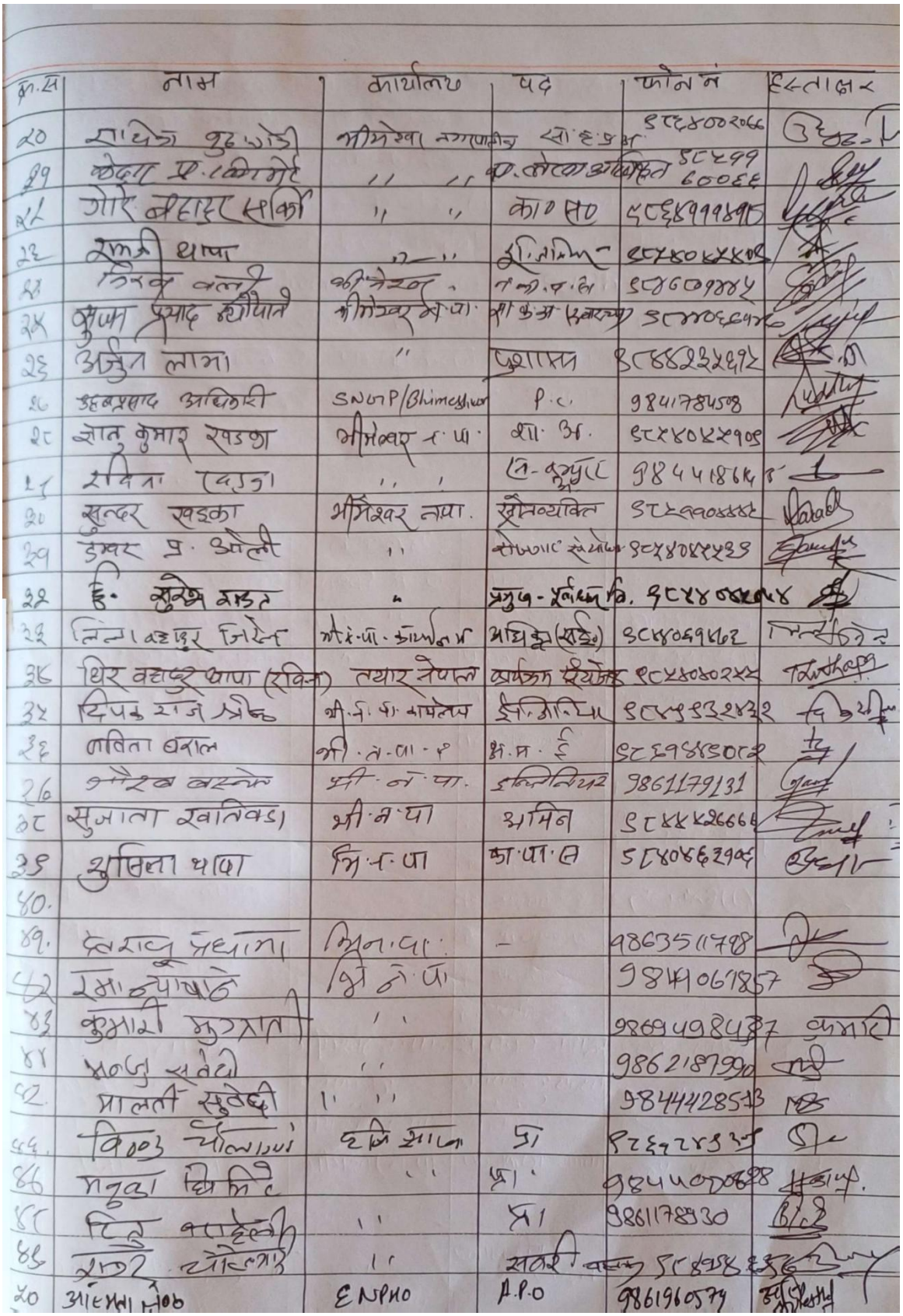
7.4 Appendix 4: List of Participants in Sharing and Validation Workshop



आज मिति २०८१ साल भदौ २६ गतेको दिन भिमेश्वर नगरपालिका नेपाल नगरपालिका संघको आयोजना र दातावरण र जलवायु संस्था (स्नप्रो)को प्राविधिक सहयोग, The United cities and Local Government- Asia Pacific (UCLG-ASPAC) को सहकार्य र Bill and Melinda Gates Foundation (BMGF) को आर्थिक सहयोगमा Municipalities Network Advocacy on Sanitation Asia (MuNASS II) कार्यक्रम अन्तर्गत सञ्चालन गरिएको Shit Flow Diagram (SFD) सम्बन्धि छलफल र प्रमाणिकरण कार्यशाला कार्यक्रममा निम्न अनुसार मुख्य सरोकारवालाहरुको उपस्थिती रहेको छ।

उपस्थिती:

क्र.स.	नाम	कार्यालय	पद	फोन नं	हस्ताक्षर
१.	ईश्वर नारायण मानन्धर	भिमेश्वर न.पा.	मेयर	9843588352	
२.	कमला खत्री	"	उप-मेयर	9844060271	
३.	विश्वकर्मा दहाल	"	प्रमुख प्र० अधिकृत	9852404611	
४.	माधव धामी	"	वडा-अध्यक्ष-१	9841427060	
५.	कलावति शेष्ठ		वडा अध्यक्ष-२		
६.	हरिशरण शिवकोटी		वडा अध्यक्ष-३	5184920484	
७.	तारानाथ चौलागाई		वडा अध्यक्ष-४	9844465200	
८.	बासु शेष्ठ		वडा अध्यक्ष-५	9851000981	
९.	नविन कुमार लामा		वडा अध्यक्ष-६	9852194526	
१०.	विनोद लामा		वडा अध्यक्ष-७		
११.	बाजी बढायोकी		वडा अध्यक्ष-८	9848425696	
१२.	हिमाल शेष्ठ		वडा अध्यक्ष-९		
१३	रमला घिमिरे	भीमेश्वर न.पा	ए.प.नि अधिकृत	9848309866	
१४	मुना शेष्ठ		कार्यपालिका सदस्य वडा नं:2	9-8849529	
१५	सुनी दहाल	भीमेश्वर न.पा.	अधिकृत	9852866632	
१६	कविता डुङ्गेल	भीमेश्वर न.पा.	पञ्जिकरण शाखा	9852852828	
१७	ज्ञानी नेपाल	भीमेश्वर न.पा.	~~वरिष्ठ सहायक~~ ~~लेखापढी शाखा~~ प्रशासकीय	9852652895	
१८	माधव प्रसाद सुवेदी	"	~~प्रशासकीय~~ अधिकृत वरिष्ठ लेखा अधिकृत	9852854631	
१९	विक्रम बर्दी	भीमेश्वर न.पा.		9851085890	



क्र.सं	नाम	कार्यालय	पद	फोन नं	हस्ताक्षर
20	राजेश कुमार भोडी	भीमेश्वर नगरपालिका	सो.इ.अ.	9851002066	
21	छेदा ए.किमरे	" "	क.लेखा अधिकृत	9851 600522	
22	गोरे बहादुर सर्की	" "	का.स.ए	9851999189	
23	रामरी थापा	" "	डि.ओभिसि	9851XXXXXX	
24	विरक वली	भीमेश्वर न.पा.	न.प्र.अ.	9851009884	
25	पुष्प प्रसाद न्यौपाने	भीमेश्वर न.पा.	वा.कं.अ.(प्रकाश)	9851XXXXXX	
26	अर्जुन लामा	"	प्रशासन	9851822621	
27	हरिप्रसाद अधिकारी	SWM/Bhimeshwor	P.C.	9841784598	
28	ज्ञान कुमार खड्का	भीमेश्वर न.पा.	शा. अ.	9851XXX905	
29	रविन्द्र पौडेल	" "	ले-कुपुरुट	9844186	
30	सुन्दर खड्का	भीमेश्वर नपा.	सौमन्यकित	9851XXXXXX	
31	ईश्वर प्र. ओली	"	सोभ्याट सेवायोजक	9851XXXXXX	
32	ई. सुरेश बस्नेत	"	प्रमुख-पूर्वाधार वि.	9851XXXXXX	
33	लिला बहादुर निरौला	भी.न.पा. डम्पिङ्ग	अधिकृत (सर्भेयर)	9851049462	
34	थिर बहादुर थापा (रविन)	तयार नेपाल	व्यवस्था सैयोजक	9851XXXXXX	
35	दिपक राज प्रेरक	भी.न.पा. वायरलेस	इलेक्ट्रोनिक्स	9851933283	
36	नविता बराल	भी.न.पा.प	इ.प्र.ई	9851948502	
37	मोहम्मद बस्नेत	भी.न.पा.	इलेक्ट्रिसियन	9861179131	
38	सुजाता खतिवडा	भी.न.पा	अमिन	9851XX26666	
39	शुशिला थापा	भि.न.पा	का.पा.स	9851086294	
40.					
41.	देवराज प्रधान	भि.न.पा.	-	9863511788	
42	रमा न्यौपाने	भि.ने.पा.		9841061857	
43	कुमारी मुखिया	"		9869498437	कुमारी
44	मनोज सुवेदी	"		9862187990	
45	पार्वती सुवेदी	" "		9844428513	
46	विष्णु चौलागाई	दक्षि आला	प्र	9851283	
47	मनुका घिमिरे	"	प्र.	9841000888	
48	दिपु पाण्डेली	"	प्र।	9851178830	
49	रमेश चौलागाई	"	सवारी चालक	9851	
50	आस्था भण्डारी	ENPHO	A.P.O	9861960579	

SFD Bhimeshwor Municipality, Nepal, 2025

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