GOVERNMENT OF GHANA

COMMUNITY WATER AND SANITATION AGENCY

Sanitation and Water Innovation and Performance Programme (SAWIP)

FINAL REPORT
TECHNICAL, FINANCIAL AND MANAGEMENT OPTIONS

CONSULTING SERVICES FOR THE DEVELOPMENT OF TECHNICALLY FEASIBLE, SOCIALLY ACCEPTABLE AND FINANCIALLY VIABLE TOILETS AND FAECAL SLUDGE MANAGEMENT IN SOME RURAL AREAS AND SMALL TOWNS IN GHANA

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BMGF	-	Bill and Melinda Gates Foundation
CWSA -	-	Community Water and Sanitation Agency
DACF	-	District Assemblies Common Fund
DESSAP	-	District Environmental Sanitation Strategy and Action Plan
DEHO	-	District Environmental Health Officer
EHA	-	Environmental Health Assistant
EHO	-	Environmental Health Officer
EPA	-	Environmental Protection Agency
ESPA	-	Environmental Service Providers Association
FSM	-	Faecal Sludge Management
GPRS	-	Growth and Poverty Reduction Strategy II
GRA	-	Ghana Revenue Authority
GSGDA	-	Ghana Shared Growth and Development Agenda
GSS	-	Ghana Statistical Service
GWCL	-	Ghana Water Company Limited
HH	-	Household
JHS	-	Junior High School
JMP	-	Joint Monitoring Programme
KVIP	-	Kumasi Ventilated Improved Pit
LI	-	Legislative Instrument
MDG	-	Millennium Development Goal
MLGRD	-	Ministry of Local Government & Rural Development
MLNR	-	Ministry of Lands and Natural Resources
MMDA-	-	Metropolitan, Municipal and District Assembly
NESSAP	-	National Environmental Sanitation Strategy and Action Plan
NPHC	-	National Population and Housing Census
O&M	-	Operation and Maintenance
ODF	-	Open Defecation-free
PPP	-	Public Private Partnership
SAWIP -	-	Sanitation and Water Innovation and Performance Programme
SAWiSTRA	-	Sanitation and Water in Small Towns and Rural Areas
SEA	-	Strategic Environmental Assessment
SFD	-	Shit-Flow Diagram
SHS	-	Senior High School
SPSS	-	Statistical Package for Social Sciences
SWAp	-	Sector Wide Approach
SWC	-	Small Works Contractor
SWOT -		Strength, Weakness, Opportunity and Threat
ToRs	-	Terms of Reference
UN	-	United Nations
UNICEF	-	United Nations Children's Fund
VIP	-	Ventilated Improved Pit
WASH	-	Water, Sanitation and Hygiene
WC	-	Water Closet
WHO	-	World Health Organisation

EXECUTIVE SUMMARY

Project Background

The Community Water and Sanitation Agency (CWSA) as part of the Sanitation and Water Innovation and Performance Programme (SAWIP) with funding from the Bill and Melinda Gates Foundation (BMGF), is seeking to develop low-cost and locally suitable technologies for households latrines and sustainable faecal sludge management (FSM) schemes in small towns and rural communities. In line with this, the CWSA engaged Holix Consult/WasteCare Associates-Joint Venture (JV) to undertake feasibility studies to appraise existing sanitation facilities and services (especially faecal sludge management) in selected small towns and rural communities and propose sustainable household facilities promotion and faecal sludge management options for piloting. The survey is in three communities each in Western, Central, Eastern and Volta Regions of Ghana.

The objective of the assignment is to provide an overview of sanitation technologies in use for households and institutions as well as for public facilities in rural communities, small towns and peri-urban areas, and the sludge management practices associated with them; propose additional options for FSM for consideration where the existing practices are considered deficient; study existing private and public options for FSM, including national policy and strategy, management, business and operating models for faecal sludge collection, transportation, treatment and disposal/re-use.

The scope of this assignment includes baseline assessment of the existing private and public Water, Sanitation and Hygiene (WASH) facilities and services (including faecal sludge management-collection, transport and disposal); an environmental, technical and financial assessment of facility and service options, assessment of at least two (2) FSM business models, proposal on appropriate household sanitation facilities and FSM technologies and development of a scaling-up mechanism.

The Technical, Financial and Management Options (TFMO) Report is the fourth (4^{th}) and the final in a series of reports to be prepared as part of this assignment, three of which have been submitted namely; (i) Inception Report, (ii) Baseline Report, (iii) Socio-economic and Environmental Report.

The TFMO report fulfils objective (c) of this assignment which states that "Study existing private and public options for FSM, including national policy and strategy, management, business and operating models for faecal sludge collection, transportation, treatment and disposal/re-use and a review of international best practice may be required".

The report is structured as follows;

***Executive Summary*:** this section summarises the key issues presented in this report.

Chapter One - ***Introduction*:** this section presents the general project background information and expected deliverables.

Chapter Two - ***Approach and Methodology*:** the approach and methodology, field data collection tools and procedure are presented in this section of the report. The selection of the project districts

and communities were based on an initial set of criteria provided by the Client. The final list was based on additional criteria presented by the Consultant and reviewed in consultation with Regional Offices of the CWSA. The selected study regions, districts and communities are as presented in Table ES1 below.

Table ES1: List of study communities

Region	District	Community	Projected Population (2014)
Central	Komenda Edina Eguafo Abirem	Edina Essaman	1,946
	Gomoa West	Dago	6,802
	Hemang Lower Denkyira	Twifo Hemang	9,472
Western	Wassa Amenfi East	Adesu	1,403
	Jomoro	Tikobo No.2	5,625
	Sefwi Wiawso	Sefwi Asawinso	20,385
Volta	Ho West	Kpedze	2,666
	Nkwanta North	Sibi Hill Top	4,252
	Ketu North	Dzodze	26,786
Eastern	Upper Manya Krobo	Akateng	1,750
	Birim North	New Abirem	7,341
	Afram Plains North	Donkorkrom	9,821

Chapter Three - ***Overview of Sanitation and Faecal Sludge Management*****:** this section covers national development policy framework, trends in sanitation coverage, existing policies and regulations on faecal sludge management**.** The main documents reviewed included;

- Ghana Shared Growth and Development Agenda (GSGDA II, 2014 – 2017); (GSGDA, 2010 -2013), the Growth and Poverty Reduction Strategy II (GPRS II, 2007 - 2009); Ghana Poverty Reduction Strategy (GPRS I, 2004 - 2006).
- National Population and Housing Census (2010)
- Environmental Sanitation Policy (Revised, 2010), (ESP 2010)
- The National Water Policy (NWP), 2007
- The Rural Sanitation Model and Strategy, 2012
- The Sanitation and Water for All (SWA) Compact, 2010
- The MDG Acceleration Framework (MAF) on Sanitation, 2011
- The National Environmental Sanitation Strategy and Action Plan (NESSAP 2011)
- The Strategic Environmental Sanitation Investment Plan (SESIP), 2012
- DESSAPs from selected districts within the program regions.

Chapter Four- ***Existing Sanitation and Water Situation***: the existing sanitation and water situation in the selected communities are discussed in this chapter. Table ES2 gives a snapshot of the sanitation situation, while Table ES3 shows the related faecal sludge flows in the study communities.

Table ES2 Snapshot of sanitation situation

Region	Central			Western			Volta			Eastern			
District	Komenda Edina Eguafo Abirem	Gomoa West	Hemang Lower Denkyira	Wassa Amenfi East	Jomoro	Sefwi Wiawso	Ho West	Nkwanta North	Ketu North	Upper Manya Krobo		Birim North	Afram Plains North
Community	Edina Essaman	Dago	Twifo Hemang	Adesu	Tikobo No.2	Sefwi Asawinso	Kpedze	Sibi Hill Top	Dzodze	Akateng		New Abirem	Donkorkrom
Those with Household Toilet	22.20%	61.30%	69.40%	49.50%	36.90%	77.90%	46.10%	4.20%	50.30%	19.70%		80.00%	40.70%
Uses Neighbour's Household Toilet	5.60%	4.60%	24.50%	15.2%	4.40%	8.50%	5.00%	-	5.40%	6.00%		7.10%	6.80%
Uses Public Toilet	72.20%	10.70%	0.40%	31.30%	10.60%	12.50%	48.50%	-	41.60%	47.30%		12.60%	34.80%
Practise Open Defecation	-	23.40%	5.70%	4%	48.10%	1.10%	0.40%	95.80%	2.70%	25.5%	1.50%	0.30%	17.70%
Percentage (%) Household Toilet Deficit	77.80%	38.70%	30.60%	50.50%	63.10%	22.10%	53.90%	95.80%	49.70%	80.30%		20.00%	59.30%

Table ES3: Estimated volumes of faecal material desludged and transported for disposal based on share of population using toilet facilities (2015)

Share of Population Using Toilet Facilities (Base Year 2015)													
Region			Central			Western			Volta			Eastern		
District			Komenda Edina Eguafo Abirem	Gomoa West	Hemang Lower Denkyira	Wassa Amenfi East	Jomoro	Sefwi Wiawso	Ho West	Nkwanta North	Ketu North	Upper Manya Krobo	Birim North	Afram Plains North
Community			Edina Essaman	Dago	Twifo Hemang	Adesu	Tikobo No.2	Sefwi Asawinso	Kpedze	Sibi Hill Top	Dzodze	Akateng	New Abirem	Donkorkrom
Project Population (Base Year 2015)			2,006	6,972	13,356	1,445	5,805	20,793	2,733	4,358	27,295	1,787	7,495	10,175
Share of Household	Per Capita Faecal Sludge Generation													
	WC/flush	1.0 l/cap•day	61	171	677	61	43	713	510	-	2,952	-	474	451
Those Without Household Latrine	Population Using Neighbour's Household Toilet	0.2 l/cap•day	22	64	654	44	51	353	27	-	295	21	106	138
	Population Using Public Toilet	2.0 l/cap•day	2,897	1,492	107	905	1,231	5,198	2,651	-	22,709	1,737	1,889	7,082
Total Faecal Sludge Generated			3,057	4,995	4,298	1,227	5,933	9,705	3,355	6,299	29,217	2,442	3,607	11,111
Total Faecal Sludge Desludge and Transported			2,980	1,727	1,438	1,009	1,325	6,264	3,189	-	25,956	1,759	2,469	7,672
Percentage (%) of Faecal Sludge Desludge and Transported			97%	35%	33%	82%	22%	65%	95%	0%	89%	72%	68%	69%

Facility types for faecal sludge generation in the communities show that public toilets generate the largest amount of sludge due to high reliance on public toilets by households. The path of faecal sludge flows from generation to disposal show that public toilets and water closets are emptied, collected, transported and discharged into the environment without treatment. Figure ES1 shows a sample Flow Diagram for Edina Essaman located in KEEA, Central Region.

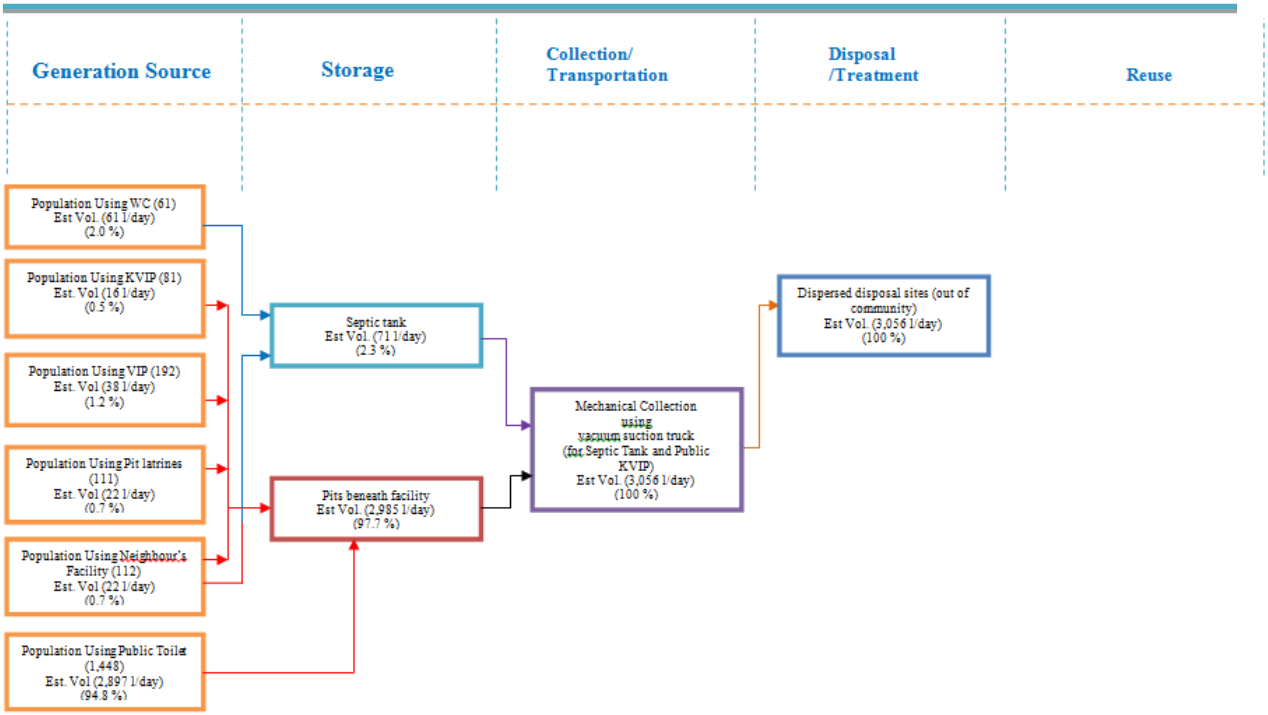

Figure ES1: Shit Flow Diagram (SFD) for Edina Essaman

The water supply resources available in the selected study communities are presented in Table ES4 below.

Table ES4 Available water supply resources in the study communities

Region	District	Community	Water Supply Source/Facilities
Western	Wassa Amenfi East	Adesu	• Two (2) community boreholes. • One (1) stand pipe tapped from a polytank.
	Jomoro	Tikobo No.2	• Borehole with hand pump • Mechanized water system • Stream but unavailable during dry seasons
	Sefwi Wiawso	Sefwi Asawinso	• Pipe borne water supply from GWCL (Kwanyako Water Works) • Hand dug wells (39 No.) • 1 borehole with hand pump • River/stream
Central	Komenda Edina Eguafo Abirem	Edina Essaman	• Piped borne water supply from the Brimso Water Works. Most residents are connected to the water network system • Household hand dug wells • Household mechanized boreholes
	Gomoa West	Dago	• Pipe borne water supply from GWCL (Kwanyako Water Works) with three (3) standpipes. The water quality is inadequate (sometimes salty and turbid)
	Twifo Hemang Lower Denkyira	Hemang	• Small Town Water Supply System (Sekyere Hemang Water Works) • Boreholes with hand pump • Hand dug wells
Eastern	Upper Manya Krobo	Akateng	• Pipe borne water supply from Safe Water Network System with no household connection.

Region	District	Community	Water Supply Source/Facilities
			The community has three (3) water vending points • 2No. Boreholes with handpump • Afram river
	Birim North	New Abirem	• Mechanised borehole system connected to houses, institutions and communal standpipes. Reliable water supply and is managed by a community water and sanitation management team (WSMT). Household survey results indicate the water is salty. • Alternative water sources include- River Afosu, household wells and boreholes with handpump.
	Afram Plains North	Donkorkrom	• Mechanised Water Supply System • Boreholes with hand pump • Water from river (Atakorah) mostly used for washing and sometimes cooking
Volta	Ho West	Kpedze	• Untreated pipe borne water with four (4) public standpipes • River Taale
	Nkwanta North	Sibi Hill Top	• Pipe borne water supply from Kpassa-Damanko Water Supply with six (6) public standpipes • Sibi Stream • No household water connection
	Ketu North	Dzodze	• Mechanised borehole system with about 865 houses connected to the pipe borne system and with 67 public standpipes • Rainwater harvesting • Boreholes with handpumps • Kplipka river

Chapter Five - ***Marketability Analysis*****:** discusses the availability and flows of faecal sludge, the demand for emptying services and the institutional arrangements for the management of collection and desludging services. This section of the report also presents the potential flows of sludge from individual communities, and the considerations for strategic location of treatment/re-use facilities to serve catchment areas of 25km radius of each community (e.g. Akateng, Sekesua and Edina Essaman). The report also presents the consideration of larger communities as sludge treatment reception centres for the surrounding communities to achieve economic viable volumes for siting of treatment/re-use facilities (e.g. Dzodze).

Chapter Six - ***Service Delivery Models***: this chapter discusses models for household latrine promotion and construction, public toilet management, emptying services and treatment, disposal and reuse of faecal sludge. The linkages between stakeholders are important ingredient for sustaining private sector-led demand driven service delivery. The report presents the linkages among service providers, business support services, financial and MMDAs for each of the service models. The linkages were generally found not to be effective due to the predominantly project driven nature of current service delivery. Proposals are made for improving effectiveness of the linkages.

Chapter Seven - ***Business Models*****:** discusses the business models for household latrine promotion and construction, public toilet management, emptying services and treatment, disposal and reuse of faecal sludge. Tables ES6, ES7 and Figure ES2 present the business model canvases for the listed models. It also presents the analyses supporting the selection of ADT as the preferred treatment and reuse option by considering *performance of existing treatment plants, National policy on treatment and reuse, the quantities and availability of faecal sludge in the communities* and *operation and Maintenance.* Table ES5 shows the feasible options for locating ADT plants within the communities.

Table ES5: Options for Locating ADT Plants

Option	Facility Type	Advantage	Disadvantage	Remarks
Bio-digester (ADT Plants)	Single Household System	•No desludging of faecal sludge and therefore related cost is eliminated •Underground construction minimises land use	•Cost per household is high •Requires expert design and skilled construction	•Effluent still to be treated before final discharge /e-use
	Centralised System with Multiple Households	•Low Operating Cost •No desludging of faecal sludge and therefore related cost is eliminated •Generation of renewable valuable energy source	•Cost for gas transmission and utilisation can increase cost •Requires expert design and skilled construction	•Effluent still to be treated before final discharge /e-use
Coupling Bio-digesters to Existing Public Toilets	KVIP	•Not Applicable		•Modification of pits required to overcome difficulty of desludging of multiple pits.
	Aqua Privy	•Generation of renewable valuable energy source •No desludging of faecal sludge and therefore related cost is eliminated	•Central vent pipe allows escape of methane gas •Existing water seal to prevent effective trapping of biogas	•Coupling biogas plants to existing public toilets has limiting factor
	WC/Flush Toilet	•Septic tank can easily be reticulation into the proposed bio-digester	•The plant will require large space which is limited	
Stand-Alone facility at outskirt of community	Bio-digester (ADT plant)	•Low Operating Cost •Generation of renewable valuable energy source •Availability of land •Environmental health threats are reduced. •Haulage distance, time and cost of faecal sludge is reduced.	•Low faecal sludge volumes from the rural communities and small towns may not sustain economic operations of the bio-digesters. •Low cost recovery and so requires other complementary investment such as water	•This is a feasible option for peri-urban communities and other communities with high transient population.
Stand-Alone facility located within 25km radius catchment area	Bio-digester (ADT plant)	•Availability of land •Generation of renewable valuable energy source •Availability of large volumes of faecal sludge creates opportunity for financially viable operations. •Environmental health threats are reduced. •Communities in addition to the study communities will also benefit from the facility.	•Requires expert design and skilled construction •Requires higher investment cost. •Haulage distance, time and cost of faecal sludge may increase. •Low cost recovery and so requires other complementary investment such as water	•This option is feasible but will require further studies to determine the quantities of sludge and the location of facility

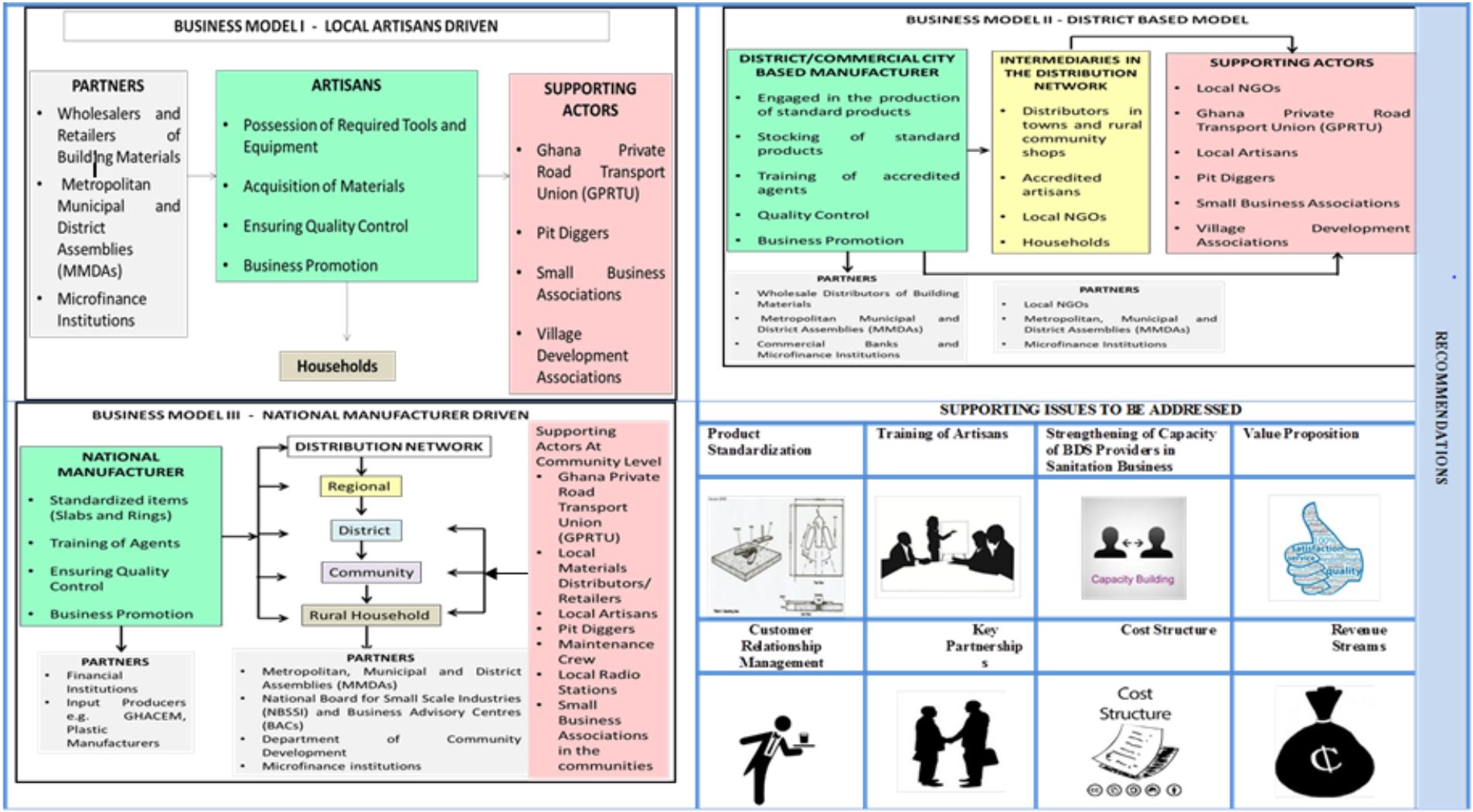

Figure ES2: Adopted Business Models

Source: UNICEF-GOG WASH Programme, Vol. 1 Assessment Report on Applying Business Solution and Micro-finance to Rural Sanitation Delivery in Ghana, 2014 by CDC Consult Limited, Accra, Ghana

Table ES6: Business Model Faecal Sludge Collection and Transport

<table>
<tr><th>KEY PARTNERS</th><th>KEY ACTIVITIES</th><th>VALUE PROPOSITIONS</th><th>CUSTOMER RELATIONSHIPS</th><th>CUSTOMER SEGMENTS</th></tr>
<tr><td rowspan="2">1. MMDAs
2. Spare Parts Suppliers
3. Mechanical Workshop Owners.
4. Fuel Station Operators</td><td> 
1. Cesspit Emptier Truck owner procures truck for the operation of faecal sludge desludging services.
2. Truck owner engages Truck driver to render service to the public and account for operations.
3. Truck driver engages assistants and delivers service to customers..
4. Truck drive charges service fees and desludges faecal sludge and disposes of sludge at designated locations.
5. Truck driver pays truck owner weekly sales.
6.Truck owner pays driver pays driver monthly salary
7. Truck driver pays assistants daily allowance and monthly salary.</td><td rowspan="2"> 
1. Providing reliable and affordable cesspit emptier services for customers.
3. Clean environment.
2. Reducing environmental pollution and degradation by disposing of faecal sludge at designated locations.</td><td>1. Cesspit Emptier Truck drivers maintain phone contacts with regular customers for service delivery.

2. Telephone contact numbers are inscribed on the trucks for the public to contact for service

3. Trucks are packed at designated locations for personal contact by the public.</td><td rowspan="2">1. Households
2. Public Latrines
3. Commercial and Institutional Latrines</td></tr>
<tr><td>KEY RESOURCES
1. Cesspit Emptier Truck.
2. Well trained driver s and assistants</td><td>CHANNELS OF DISTRIBUTION
Telephone and personal contacts.</td></tr>
<tr><td colspan="2">COST STRUCTURE
Capital cost of Truck
Spare parts, fuel and lubricants
Business registration fees
Truck Owner’s Weekly fees
Truck Driver’s Salary
Driver’s Assistant’s daily allowances and salaries.</td><td colspan="3">REVENUE STREAMS
Desludging service fees
Truck Owner’s Weekly fees
Truck Driver’s Salary</td></tr>
</table>

Table ES7: PPP Business Model

<table>
<tr><td colspan="2">  </td><td colspan="2">   </td><td>  </td></tr>
<tr><td>KEY PARTNERS</td><td>KEY ACTIVITIES</td><td>VALUE PROPOSITIONS</td><td>CUSTOMER RELATIONSHIPS</td><td>CUSTOMER SEGMENTS</td></tr>
<tr><td rowspan="2">1. MMDAs-to prepare proposals and/ or raise funds and invite private sector to form company under PPP arrangement.
2. Private sector investors-to provide funds to partner MMDA to form company under PPP arrangement.
3. Cesspit Emptier Service Providers-to supply faecal sludge desludged from generators.
4. Middle Level Works Contractors to construct the biogas plant and install accessories.</td><td>1. Reception of faecal sludge and control feed to digester.
2.producing biogas and slurry for sale.
3. Selling gas to customers.
4. Banking daily sales in bank
5. Paying for o & m expenses.</td><td rowspan="2">1 .Promoting a clean environment.
2.Reducing environmental pollution and degradation
3.Sustaining the health and well-being of communities
3. Increasing socio-economic activities and gains in the environmental sanitation value chain.
4.Increasing agricultural output
5. Construction of a biogas plant to process faecal sludge, produce biogas and slurry.
6.Selling biogas and slurry for profit and the recoupment of capital</td><td>1. Companies to advertise products- gas and slurry availability on radio and personal contacts
2. MMDAs to sensitise communities and promote use of gas and slurry usage
3. MMDAs to pass bye-laws to compel service providers to discharge waste collected at the biogas plant.</td><td rowspan="2">1. Household kitchens
2.Restaurants
3. Small scale farmers
4. Cesspit emptier truck drivers.</td></tr>
<tr><td>KEY RESOURCES
1. Biogas plant and accessories
2. Faecal sludge</td><td>CHANNELS of Distribution
1.Sales point for gas and slurry at Biogas plant premises</td></tr>
<tr><td colspan="2"> 
COST STRUCTURE
Company formation costs
Lease of Land
Biogas Digester
Temporary structures for operations
Operations & Maintenance (O&M)</td><td colspan="3"> 
REVENUE STREAMS
Stated Capital
Sale of biogas
Tipping Fees
Sale of slurry</td></tr>
</table>

Chapter Eight- **Conclusions and Recommendations:** the final chapter presents the main conclusions and recommendations of the study. The key issues are as follows.

Conclusions

Household Latrine Promotion and Construction

The incidence of open defecation is high in the study communities and reliance on public toilets is prevalent in spite of efforts by MMDAs, NGOs and CBOs through the introduction of subsidies and micro-finance credit schemes. There is need for the review of repayment schedule of credit schemes to match the income patterns of households to enhance service delivery. The linkages among household toilets service providers, business support, financial services providers and MMDAs are currently not effective due to mostly project driven interventions. Additionally, enforcement management by MMDAs was ineffective as gains of CLTS interventions are not yielding the expected increase in ownership of household toilets.

Faecal Sludge Emptying Services

Whereas emptying, collection and transportation services by private operators of emptier trucks were found to be existent, the practice of manual emptying is still prevalent in the study communities. In addition, direct discharge of faecal sludge through both manual and mechanised emptying causes environmental pollution.

Public Toilet Management

There is a high dependence on public toilets by households which affect the hygienic standards of the facilities. Most public toilets are also not disability- and old-age friendly. These situations further portray the ineffectiveness of enforcement management by the MMDAs.

Treatment, Disposal and Re-use of Faecal Sludge

None of the study communities has a facility for treating faecal sludge apart from Edina Essaman which biomethanation plant is currently not functioning. The faecal sludge flows from the communities are generally low and therefore require appropriate treatment options that can handle small batch flows adequately such as Anaerobic Digestion Treatment (ADT) technology.

Recommendations

Household Facility Promotion and Construction

The up-scaling of improved sanitation facilities for households using the models identified in the UNICEF study of 50 communities and the modified Small Works Contractor (SWC) model can be adopted for the promotion and construction of household latrines while taking into account the other recommendations regarding business linkages and institutional arrangements for sustaining private sector-led demand driven service delivery. The business model for the modified Small Works Contractor (SWC) option is shown in Table ES8.

Table ES8: Proposed SWC Business Model for Household Sanitation Facility Promotion and Construction

<table>
<tr><th>KEY PARTNERS</th><th>KEY ACTIVITIES</th><th>VALUE PROPOSITIONS</th><th>CUSTOMER RELATIONSHIPS</th><th>CUSTOMER SEGMENTS</th></tr>
<tr><td rowspan="2"> 
1.MMDAs
2.NGOs
3. Hardware Suppliers
4. Transport sector operators
5.Commercial Banks
6. Rural Banks.
7.Microfinance Institutions</td><td> 
1 Marketing of Household Latrines
2. Households secure funds to construct household toilets
3. Household engages small works contractor to construct household latrine.
4.Artisans /households procure materials for construction
5.Artisans construct household toilets
6. Household settles balance of facility cost.
7. Small works contractor pays artisans labour costs</td><td rowspan="2"> 
1. Promoting a clean environment.
2.Reducing environmental pollution and degradation
3.Sustaining the health and well-being of communities
3. Increasing socio-economic activities and gains in the environmental sanitation value chain.
4.Increasing agricultural output
5. Constructing household KVIP toilets.
6. Utilising humus from decomposed faeces for backyard gardening to supplement home domestic budget.</td><td> 

1. Small works contractor and artisans move from house to house to market toilets
2. Artisans maintain contact within the community for future engagements</td><td rowspan="2">Households</td></tr>
<tr><td>KEY RESOURCES
Well trained household artisans.
Efficient Hand tools
Toilet construction materials</td><td>CHANNELS OF DISTRIBUTION
 

House-to-house canvassing</td></tr>
<tr><td colspan="2">COST STRUCTURE
 
Toilet construction materials
Small work contractor’s fees
Artisan commission</td><td colspan="3">REVENUE STREAMS
 
Household savings
Micro finance loans and advances
Small works contractor’s profit
Household Artisan’s commission</td></tr>
</table>

From the study, households’ incomes and earning patterns varied. It is therefore important to study households’ income earning patterns in order to match repayment schedules of credit schemes to enhance households subscription to credit schemes.

The strengthening of enforcement management by MMDAs is critical to the improvement in household latrine promotion and construction. Very importantly, attention should be given to houses with large numbers of households in compound houses with central courtyards as this influences the type and number of facilities in a house.

Public Toilet Management

- Making the facility disability- and old-age -friendly by providing special compartments, accessibility ramps, seats and other special fixtures to aid the use of the facility.
- Continuous inspection of the facility to ensuring all hygienic and environmental standards are maintained and sustained.
- Compliance with all the terms and provisions of the Ministry of Local Government & Rural Development (MLGRD) Guidelines for the Provision, Operations & Maintenance of Public Toilets (2003)

Collection, Desludging, Transportation and Disposal

From the study one of the major shortcomings is the practice of manual emptying of latrines which poses both health and environmental hazards. The introduction of small motorised pit emptying, collection and transportation machinery and equipment will help to abate the practice of manual emptying and improve haulage to designated points of disposal.

The business model for small scale desludging services is provided in Table ES9 below.

Table ES9: Proposed business model for small scale desludging services

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITIONS	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
1. MMDAs 2. Spare Parts Suppliers 3. Mechanical Workshop Owners. 4. Fuel Station Operators 5. Equipment Owner 4. Equipment Operator	 1. Small Mechanised Emptying Machinery owner procures equipment. 2. Equipment owner engages equipment operator to render service. 3. Operator engages assistants and delivers service to customers. 4. Operator charges service fees and collects faecal sludge to designated locations. 5. Operator pays owner weekly sales.	1. Providing reliable and affordable cesspit emptier services for households over relying on pit latrines and KVIPs. 2. Reducing environmental pollution and degradation by disposing of faecal sludge at designated locations.	1. Operators maintain phone contacts with regular customers for service delivery. 2. Telephone contact numbers are inscribed on the trucks for the public to contact for service 3. Small Mechanised Emptying Machinery move in the community for personal contacts.	1. Households 2. Bio-digester Operators

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITIONS	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
	6.Owner pays operator monthly salary 7. Operator pays assistants daily allowance and monthly salary.			
	KEY RESOURCES 1. Small Mechanised Emptying Machinery. 2. Well trained operators and assistants		**CHANNELS OF DISTRIBUTION** Telephone and personal contacts.	

COST STRUCTURE	REVENUE STREAMS
Capital cost of Small Mechanised Emptying Machinery Spare parts, fuel and lubricants Business registration fees Owner's Weekly fees Operator's Salary Operator's Assistant's daily allowances and salaries.	Desludging service fees Owner's Weekly fees Operator's Salary

Central government agencies in collaboration with MMDAs, NGOs and CBOs should carry out intensive public education on the impact of unsafe return of excreta to the environment. Private sector operators should be sensitised on the potential business opportunities within this service segment.

Treatment, Disposal and Re-use of Faecal Sludge

The recommended option for treatment and re-use of faecal sludge is the ADT system. Figure ES3 shows a diagram of the collection, transportation and treatment pathways for the biogas reactor scheme.

The estimated sizes of ADT systems and the related costs for the study communities are provided in Table ES10 below to serve as a guide for the installation of the facilities.

Table ES 10: Details of Size and Costs of ADT plants for the Study Communities

Region	District	Community	Est. Daily FS Collected and Transported for disposal flow/ (m^3) (a)	Estimated Design Vol. for Digester (b)	Estimated Cost of Digester @ US$ 20,000/(m^3) (c)
Central	Komenda Edina Eguafo Abirem	Edina Essaman	3.0[1]	150	60,000.00
	Gomoa West	Dago	2.0	100	40,000.00
	Hemang Lower Denkyira	Twifo Hemang	1.0	50	20,000.00

[1] There is a pilot 5m^3 capacity bio-digester plant located in Edina Essaman to serve the community and surrounding areas in the municipality. The indicated total cost for the proposed bio-digester plants is therefore exclusive of Edina Essaman.

Region	District	Community	Est. Daily FS Collected and Transported for disposal flow/ (m^3) (a)	Estimated Design Vol. for Digester (b)	Estimated Cost of Digester @ US$ 20,000/(m^3) (c)
Central	Komenda Edina Eguafo Abirem	Edina Essaman	3.0[1]	150	60,000.00
	Gomoa West	Dago	2.0	100	40,000.00
	Hemang Lower Denkyira	Twifo Hemang	1.0	50	20,000.00
Western	Wassa Amenfi East	Adesu	1.0	50	20,000.00
	Jomoro	Tikobo No.2	1.5	75	30,000.00
	Sefwi Wiawso	Sefwi Asawinso	6.0	300	120,000.00
Volta	Ho West	Kpedze	3.5	175	70,000.00
	Nkwanta North	Sibi Hill Top	0.0	0	-
	Ketu North	Dzodze	30.0	1500	600,000.00
Eastern	Upper Manya Krobo	Akateng	2.0	100	40,000.00
	Birim North	New Abirem	2.5	125	50,000.00
	Afram Plains North	Donkorkrom	8.0	400	160,000.00
Total					**1,150,000.00**

Notes:
Cost Analysis based on similar bio-digester schemes.
Estimated daily of faecal sludge to be treated per community.
Volume of digester dome based on retention period of 25 – 35 days
Estimated cost of bio-digester based on US$15,0000 – US$20,000 per m^3

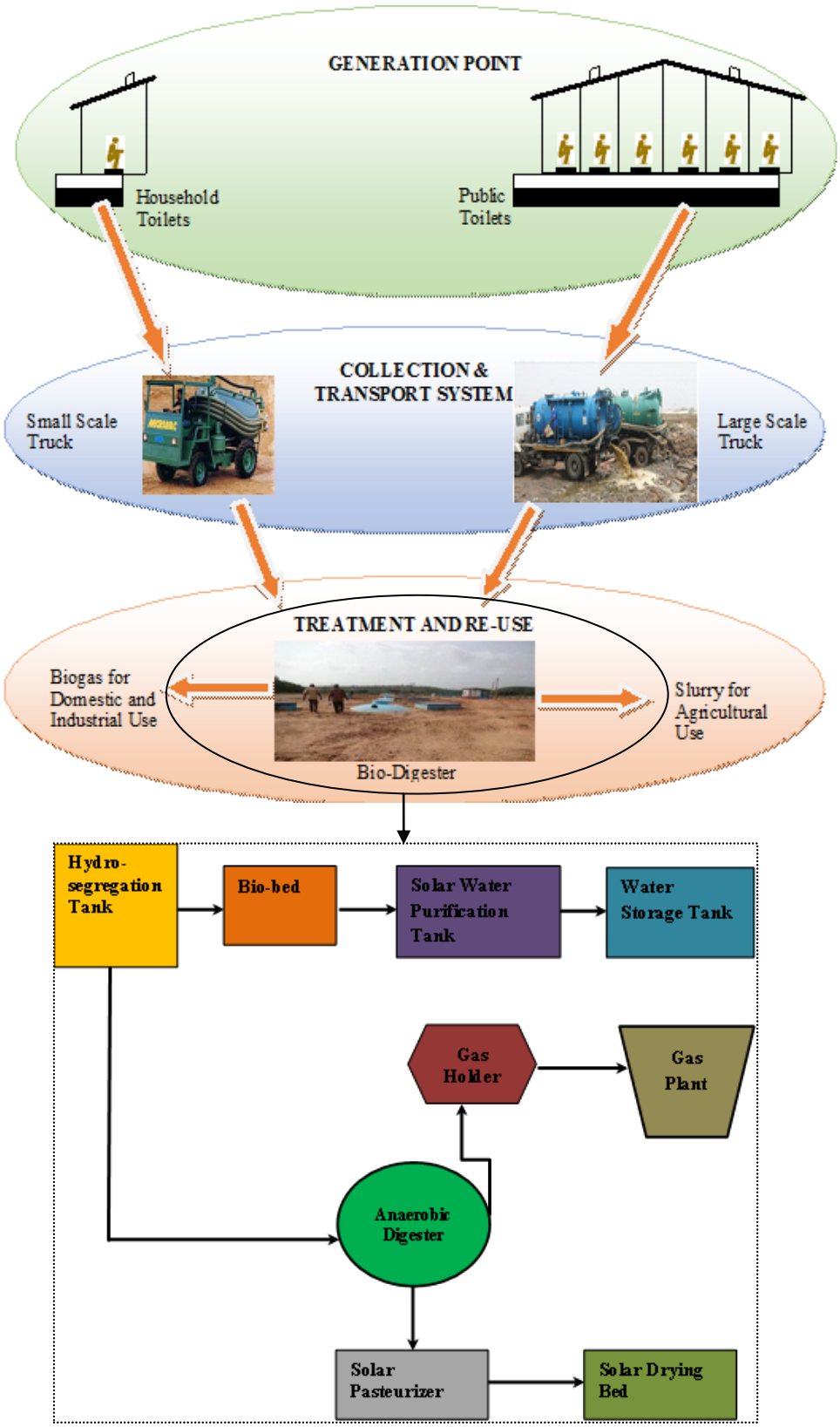

Figure ES3: Flow Diagram for Faecal Sludge Collection, Treatment and Re-use (Anaerobic Digestion Treatment scheme)

Institutional Governance, Regulatory Support for PPP in Improved Services Delivery

In order to enhance service delivery, and sustain private sector-led demand driven approaches for all segments of the faecal sludge management chain appropriate institutional governance and regulatory support is critical. Likewise, providing the necessary enabling elements that strengthen the linkages among households, faecal sludge management service providers, business support services, financial institutions, Ministries Departments and Agencies (MDAs) and MMDAs is important.

Table ES11 below presents potential public and private organisations to partner in any future investment plans.

Table ES11: Potential Public and Private Partner Organisations

Public Institutions	**Private Organisations**
Community Water and Sanitation Agency (CWSA) MMDAs ARB Apex Bank Public Technical and Vocational Training Institutes	Environmental Service Providers Association (ESPA) Commercial Banks Rural Banks Microfinance Institutions Private Technical and vocational Training Institutes.

From the study critical linkages that require attention include the following:

Enhanced business support services have been found to be a critical missing link in faecal sludge management services delivery. The important role played by CWSA in the provision of technical assistance and facilitation to MMDAs in the implementation of water and sanitation projects places it in a unique position to provide technical advisory services in the provision of business support to private sector-led demand driven services. An assessment of CWSA's strength in playing such a role will be useful in this direction. MMDAs will be required to establish business support services desk to facilitate the operations of all the identified stakeholders.

In view of huge deficit of household latrines ownership and high open defecation rates (Table ES12 in the study communities (which are a reflection of country-wide situation) a network of financial institutions with a focus on rural financial services is necessary for nurturing and sustaining support to households and service providers. From the study, financial service providers including ARB Apex Bank, commercial, rural banks and microfinance institutions play a major role in provision of loans and credits to the private sector for service delivery.

Table ES12: Incidence of Open Defecation on Public and Neighbours Household Toilet

Community	Households with Toilet Facility	Households using Neighbour's Household Toilet	Households using Public Toilet	Households Practicing Open Defecation	ODF Ranking
Edina Essaman	22.20%	5.60%	72.20%	0%	1st
New Abirem	80.00%	7.10%	12.60%	0.30%	2nd
Kpedze	46.10%	5.00%	48.50%	0.40%	3rd
Sefwi Asawinso	77.90%	8.50%	12.50%	1.10%	4th
Dzodze	50.30%	5.40%	41.60%	2.70%	5th
Adesu	49.50%	15.2%	31.30%	4%	6th
Twifo Hemang	69.40%	24.50%	0.40%	5.70%	7th
Donkorkrom	40.70%	6.80%	34.80%	17.70%	8th
Dago	61.30%	4.60%	10.70%	23.40%	9th
Akateng	19.70%	6.00%	47.30%	25.5%	10th
Tikobo No.2	36.90%	4.40%	10.60%	48.10%	11th
Sibi Hill Top	4.20%	0%	0%	95.80%	12th

To achieve wide coverage (that could be replicated country-wide) and the relatively small amounts of credits required especially for household latrine construction it is recommended that funds earmarked for latrine promotion should be allocated to ARB Apex Bank for onwards lending to rural and microfinance institutions.

Many private service providers operate under registration and permitting by MMDAs. The Environmental Service Providers Association (ESPA) as an umbrella organisation of private operators engages the Government and MMDAs on national issues and negotiates user fees and tariffs for environmental services. ESPA can play lead advocacy and sensitisation roles for securing private and government investments for private sector-led demand driven services delivery.

Improving the skills and knowledge of sector personnel on new and emerging technologies is critical for sustaining service delivery. Public and Private Technical/Vocational Training Institutions play important roles in this regard. These institutions collaboratively working together with CWSA, ESHD (MLGRD), ESPA and MMDAs need to develop and implement specific training programmes for all stakeholders on new and emerging technologies such as ecological sanitation and ADT systems, as well as skills development in the management of treatment facilities.

1. PROJECT BACKGROUND

1.1 Introduction

The Community Water and Sanitation Agency (CWSA) has received funding from the Bill and Melinda Gates Foundation (BMGF) to explore innovative sanitation interventions of the Sanitation and Water in Small Towns and Rural Areas (SAWiSTRA) program.

The SAWiSTRA program as a whole has four main objectives:

- Objective 1: Develop a programmatic approach to wide-scale implementation of water, sanitation and hygiene education schemes in small towns and rural areas, and participate in the development of the Sector Wide Approach (SWAp) for water and sanitation;
- Objective 2: Increase sustained access to water supply in rural and small towns;
- Objective 3: Increase sustained access to sanitation in rural and small towns and build Water Supply, Sanitation and Hygiene (WASH) facilities in institutional settings, such as schools, health centres and community toilets;
- Objective 4: Build capacity and provide institutional support.

To contribute to the achievement of the Objective 3 above, a Sanitation and Water Innovation and Performance Programme (SAWIP) facility has been developed to encourage innovation for segments of the sanitation sector that are still under-developed in small towns and rural areas (such as the development of low-cost and locally suitable technologies for individual latrines in rural Ghana or faecal sludge management (FSM)) and where innovation needs to take place before scaling up pilots. Consequently, BMGF is investing in the SAWIP Facility in order to contribute to the improvement of sanitation delivery in Ghana.

The ultimate impact of the project is to contribute to the elimination of open defecation in Ghana as well as to making a marked reduction in the spread of water and sanitation associated diseases and prevention of environmental degradation, among others.

1.2 Project Overview

Downstream sanitation services, including pit latrine emptying, transport of sludge, treatment and safe disposal are currently inadequate in small towns and rural communities in Ghana, whereas some pilot initiatives have been conducted in large towns. The lack of such services represents a significant issue particularly in small towns which are growing rapidly and need to identify solutions for handling overflowing latrines. There is a strong need for innovation in this area, not only from a technological point of view but also with respect to business models that can cope with relatively low population densities with associated low volumes of faecal sludge generation (existing initiatives in Ghana, such as reuse for aquaculture requires high urban densities to operate with any prospects of profitability). The needed innovation, if successful, could bring interesting results for all small towns in Ghana and beyond the national borders.

This feasibility therefore seeks to appraise the production of septic/faecal sludge from various sources such as household, institutional and public toilets as well as the collection, transport, disposal and management of same. Additionally, business models in use by stakeholders/small scale contractors/artisans in the sector, if any, are to be studied. Management models for the various options proposed will also be developed for piloting in selected small towns and peri-urban areas.

The survey is being carried out in three (3) selected communities in each of the programme regions (Western, Central, Eastern and Volta Regions).

1.3 Objectives

The objectives of the feasibility study are:

a) Provide an overview of sanitation technologies in use for households and institutions as well as for public facilities in rural communities, small towns and peri-urban areas, and the sludge management practices associated with them;
b) Propose additional options for FSM for consideration where the existing practices are considered deficient;
c) Study existing private and public options for FSM, including national policy and strategy, management, business and operating models for faecal sludge collection, transportation, treatment and disposal/re-use. A review of international best practice may be required.

1.4 Scope of Services

The scope of services for the assignment includes:

a) A thorough assessment and proposal of the various technological options for toilet facilities in Ghana for use by households and institutions.
b) A thorough assessment and proposal of the various options and management strategies for the public toilets for use by transient populations in markets and lorry parks/transport terminals.
c) An assessment of the strategies for emptying pits or tanks when full.
d) An assessment of the technological options for the transportation of the sludge.
e) An assessment of the technically feasible and financially viable options for the final treatment and disposal of faecal sludge.
f) An assessment of the potential for re-use of faecal sludge for other purposes including for agriculture, aqua-culture, fuel or any other income generating activity that would provide some finance for management of faecal sludge in the community for sustainability and in an environmentally safe manner.
g) An assessment based on at least two case-studies of business models in place for sludge hauling and for artisans/small scale contractors in the sanitation sector
h) Development of a scaling-up mechanism

1.5 Expected Outputs

The expected outputs of the assignment include the following:

a) An inception report including an updated work programme and selection of communities for survey.
b) Baseline report in selected communities (Draft & Final)
c) Socio-Cultural and Environmental Report (Draft & Final)
d) Technical, Financial and Management Options Report (Draft & Final)

The first three reports have been submitted in accordance with the Terms of Reference. This report, titled Technical, Financial and Management Options (TFMOs) for toilets and faecal sludge in selected study communities based on the results of the assessment carried out is last of the series of report as required under this assignment.

1.6 Structure of the Report

This report is in fulfilment of the ToR and is described under the following sections;

Executive Summary	-	This section summarises the key issues presented in this report.
Chapter One	-	***Introduction:*** This section presents the general project background information and expected deliverables.
Chapter Two	-	***Approach and Methodology:*** The approach and methodology, field data collection tools and procedure are presented in this section of the report.
Chapter Three	-	***Overview of Sanitation and Faecal Sludge Management:*** This section covers national development policy framework, trends in sanitation coverage, existing policies and regulations on faecal sludge management.
Chapter Four	-	***Existing Sanitation and Water Situation:*** The existing sanitation and water situation in the selected communities are discussed in this chapter.
Chapter Five	-	***Marketability Analysis:*** discusses the availability and flows of faecal sludge, the demand for emptying services and institutional arrangements for the management of collection and desludging services.
Chapter Six	-	***Service Delivery Model***: this chapter discusses models for household latrine promotion and construction, public toilet management, emptying services and treatment, disposal and reuse of faecal sludge.
Chapter Seven	-	***Business Models:*** this chapter analyses business models for household latrine promotion and construction, public toilet management, emptying services and treatment, disposal and reuse of faecal sludge.

2. APPROACH AND METHODOLGY

2.1 Literature Review

Literature was reviewed to obtain information relevant to the assignment among which are the following:

- Household Sample Surveys in Developing and Transition Countries (UN, 2005)
- Strategic Environmental Assessment (SEA) Practical Guide for Water and Environmental Sanitation (EPA, 2006)
- Local Government Act, 1994 (Act 462)
- Environmental Sanitation Policy (ESP Revised , 2010)
- Environmental Protection Act, 1994 (Act 490)
- Environmental Assessment Regulations, 1999 (LI 1652)
- National Environmental Sanitation Strategy and Action Plan, (NESSAP, 2010)
- District Environmental Sanitation Strategy and Action Plan (DESSAP) of survey districts
- Rural Sanitation Model and Strategy (MLGRD/UNICEF 2012)
- Local Government Service Act, 2003 (Act 656)
- Local Government (Departments of District Assemblies) (Commencement) Instrument, 2009 (L.I. 2009)
- District Economic Profiles of selected communities.

Information gathered from the review was used to inform the development of the assessment and audit tools and related procedures that were followed.

2.2 Selection of Project Districts and Communities

The project study communities were selected based on the criteria provided in the ToRs as well as additional criteria proposed by the consultant as presented in Table 2.1 below.

Table 2.1: Criteria for Selection of Study Communities

ToR's Selection Criteria	Consultant's Additional Selection Criteria
• Geographic spread • Different cultural settings • Different social settings • Different economic settings • One (1) community with population below 2,000 • One (1) community with population between 2,000 and 7,500 • One (1) community with population above 7,500.	• District Administrative/jurisdictional status • Ecological Zoning (See Figure 2.1 below) • Ideally be within 25km catchment radius from an urban (and larger) community • Preferably be an agro-based/dominantly farming community with the potential to utilise by-products from faecal sludge • Incidence and pattern of faecal-oral diseases (ODF Certified and non-ODF) • Facility type and distribution should support small scale decentralised faecal sludge treatment • Be a peri-/urban community and preferably with high transient population due to it being either a major market hub, transport corridor, industrial town or mining town (growth town)

The map showing the ecological zones of Ghana which was used in the selection of the project study districts and communities, is presented in Figure 2.1 below.

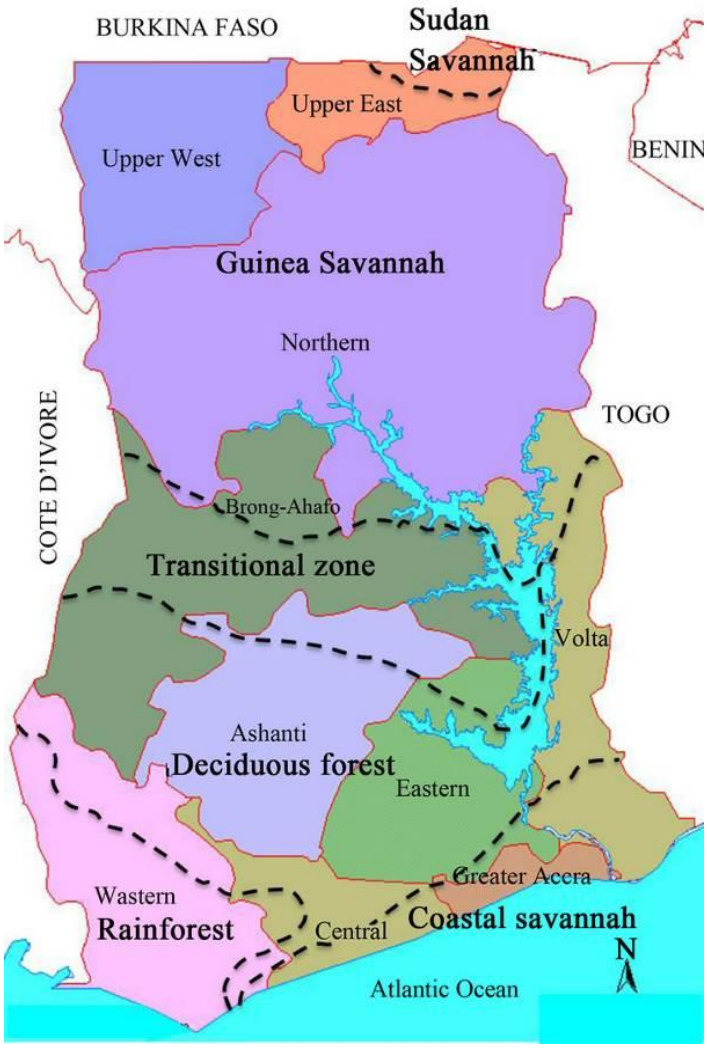

Figure 2.1: Ecological Zones of Ghana

Based on the above selection criteria, the beneficiary district and communities were selected as presented in Table 2.2 below.

Table 2.2: Selection of Study Communities

Location	Selection Criteria	Selected Beneficiary		
Regions	The project beneficiary regions were pre-selected by the Client (CWSA)	Western, Central, Eastern and Volta Regions of Ghana.		
Districts	The districts were selected based on their respective administrative/jurisdiction status and ecological zoning. The clustering of the MMDAs into ecological was done in conformity to the 'geographic spread' criterion indicated above. The ecological location criterion was included since it has bearing on the appropriate of sanitation facilities.	Central	Komenda Edina Eguafo Abirem	
			Gomoa West	
			Hemang Lower Denkyira	
		Western	Wassa Amenfi East	
			Jomoro	
			Sefwi Wiawso	
		Eastern	Upper Manya Krobo	
			Birim North	
			Afram Plains North	
		Volta	Ho West	
			Nkwanta North	
			Ketu North	
Communities	Selection of the final study communities was based on a mix of criteria indicated in the Client's ToRs and the Consultant's additional proposal. One (1) community representing a population threshold was selected from each region.	Central	Komenda Edina Eguafo Abirem	Edina Essaman
			Gomoa West	Dego
			Hemang Lower Denkyira	Twifo Hemang
		Western	Wassa Amenfi East	Adesu
			Jomoro	Tikobo No.2
			Sefwi Wiawso	Sefwi Asawinso
		Eastern	Upper Manya Krobo	Akateng
			Birim North	New Abirem
			Afram Plains North	Donkorkrom
		Volta	Ho West	Kpedze
			Nkwanta North	Sibi Hill Top
			Ketu North	Dzodze
Note: The selection of the study districts and communities were done in collaboration with the Regional CWSA Offices and approved by the Client as part of inception studies.				

The detailed criteria for the selection of each community are presented in Table 2.3 below.

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Table 2.3: Check List and Selection Criteria for Selected Beneficiary Study Regions, Districts and Communities

			CRITERIA																	
Region	District	Community	Population			Is a typical rural community	Is a peri-urban community	Peri-urban community and with high transient population or preferably a growth town	Within 25km catchment radius from an urban (and larger) community	Agro-based/ farming community with the potential to utilise by-products from faecal sludge	Agro-based/farming community engaged in an identifiable commercial crop production	Existing or potential for urban agriculture/aquaculture, cash/commercial crop farming using wastewater/ faecal sludge by-products	Facility type and distribution support small scale decentralised faecal sludge treatment (Growth town)	Located in the Coastal Savannah ecological zone	Located in the Rainforest ecological zone	Located in the Rainforest ecological zone with Shoreline	Located in the Deciduous Forest ecological Zone	Located in the Transitional ecological zone	Located in the Guinea Savanah ecological zone	Incidence and pattern of faecal-oral diseases
			<2000	2000-7500	>7500															
Central	Komenda Edina Eguafo Abirem	Edina Essaman	1,946			√			√		√		√	√						
	Gomoa West	Dego		6,082			√		√	√			√	√						
	Hemang Lower Denkyira	Twifo Hemang			9,472			√			√		√		√					
Western	Wassa Amenfi East	Adesu	1,403			√			√	√							√			
	Jomoro	Tikobo No.2		5,625			√		√		√					√				
	Sefwi Wiawso	Sefwi Asawinso			20,385			√				√	√				√			

CRITERIA

Region	District	Community	Population			Is a typical rural community	Is a peri-urban community	Peri-urban community and with high transient population or preferably a growth town	Within 25km catchment radius from an urban (and larger) community	Agro-based/ farming community with the potential to utilise by-products from faecal sludge	Agro-based/farming community engaged in an identifiable commercial crop production	Existing or potential for urban agriculture/aquaculture, cash/commercial crop farming using wastewater/ faecal sludge by-products	Facility type and distribution support small scale decentralised faecal sludge treatment (Growth town)	Located in the Coastal Savannah ecological zone	Located in the Rainforest ecological zone	Located in the Rainforest ecological zone with Shoreline	Located in the Deciduous Forest ecological Zone	Located in the Transitional ecological zone	Located in the Guinea Savanah ecological zone	Incidence and pattern of faecal-oral diseases
			<2000	2000-7500	>7500															
Eastern	Upper Manya Krobo	Akateng	1,750			√			√	√							√			
	Birim North	New Abirem		7,341			√		√	√			√				√			
	Afram Plains North	Donkorkrom			9,821			√		√			√					√		
Volta	Ho West	Kpedze		2,666		√			√	√							√			
	Nkwanta North	Sibi Hill Top		4,252		√			√	√							√			
	Ketu North	Dzodze			26,786			√				√	√	√						

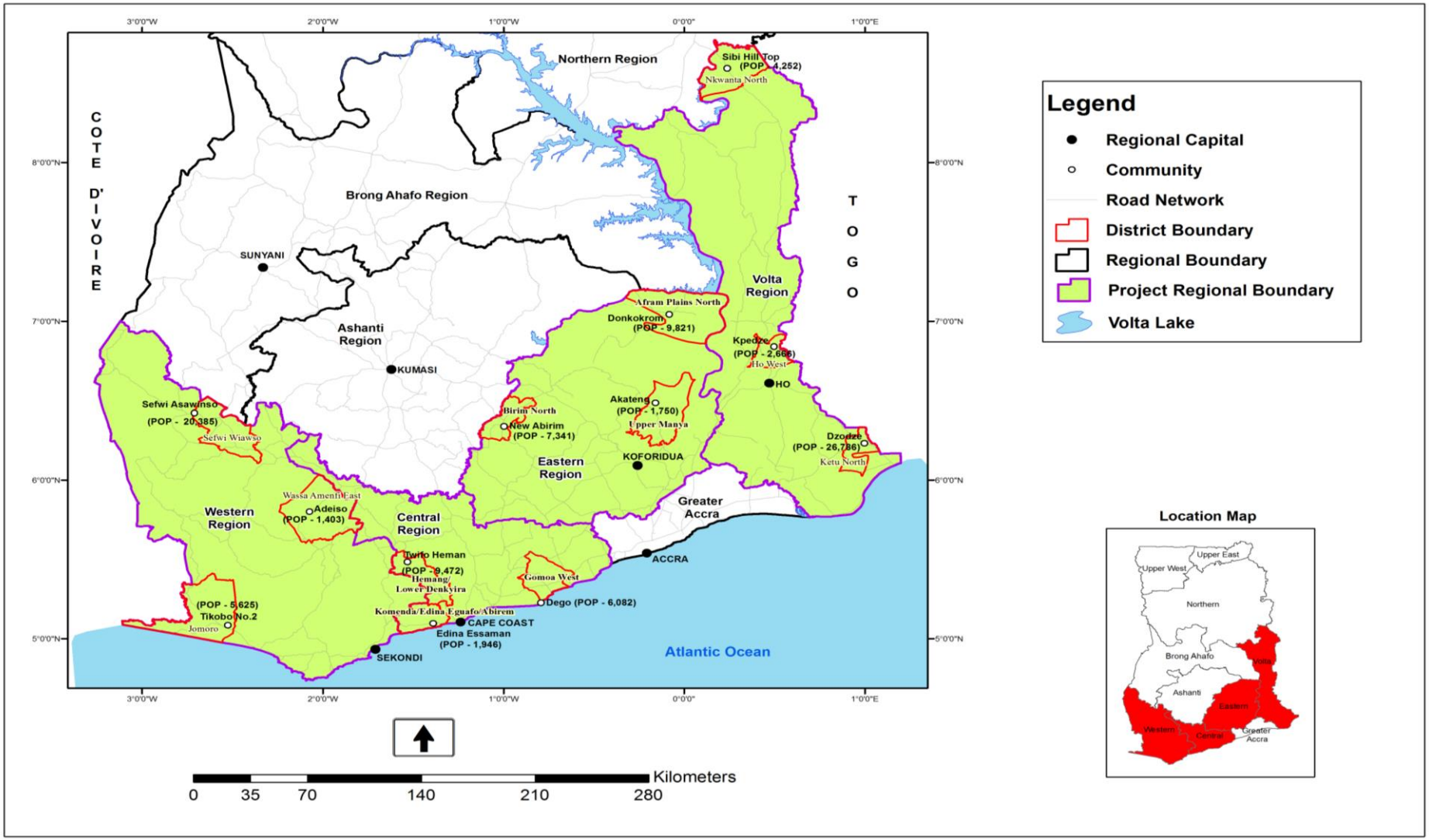


Figure 2.2: Map Showing the Selected Study Regions, Districts and Communities

2.3 Data Collection, Entry and Analysis

The methods used for the collection of primary data, data entry and analysis are indicated below.

2.3.1 Household Sample Design

Applying the Krejcie and Morgan Table for the determination of the sample size, the sample sizes of households interviewed for each community is shown in Table 2.4 below. Details of the sample design approach are described in the Baseline Study Report (Volume II).

Table 2.4: Estimation of Sample Size (No. of Households) for each Community

Region	District	Community	Projected Population (2014)	HH Size (District)	No. of HH	Representative No. of HH ((Based on Krejcie & Morgan table)	Actual No. of HH Interviewed
Central	Komenda Edina Eguafo Abirem	Edina Essaman	1,946	3.9	499	218	220
	Gomoa West	Dago	6,802	4.1	1,659	313	324
	Hemang Lower Denkyira	Twifo Hemang	9,472	4.5	2,105	326	360
Sub-Total			**18,220**		**4,263**	**857**	**904**
Western	Wassa Amenfi East	Adesu	1,403	4.4	319	175	200
	Jomoro	Tikobo No.2	5,625	4.2	1,339	299	300
	Sefwi Wiawso	Sefwi Asawinso	20,385	4.5	4,530	355	360
Sub-Total			**27,413**		**6,188**	**829**	**860**
Eastern	Upper Manya Krobo	Akateng	1,750	4.6	380	192	216
	Birim North	New Abirem	7,341	4.2	1,748	316	324
	Afram Plains North	Donkorkrom	9,821	4.7	2,090	325	332
Sub-Total			**18,912**		**4,218**	**833**	**872**
Volta	Ho West	Kpedze	2,666	3.6	741	254	260
	Nkwanta North	Sibi Hill Top	4,252	6.4	664	244	250
	Ketu North	Dzodze	26,786	3.7	7,239	365	370
Sub-Total			**33,704**		**8,644**	**863**	**880**
Total			**98,249**		**23,313**	**3,382**	**3,516**

2.3.2 Personnel Mobilisation and Training

The field data collection team comprised community animators, survey supervisors and enumerators under the guidance of team leaders. To ensure quality outputs, enumerators were made of Environmental Health Officers (EHOs) and Environmental Health Assistants (EHAs) of the respective districts with the District Environmental Health Officer (DEHO)-their immediate head, as the survey supervisor. The community animator was responsible for collation and validation of field results at the regional level. The enumerators and supervisors were trained on the administering of the questionnaire prior to the fieldwork survey. The training ensured the enumerators had a good understanding of the questions.

2.3.3 Community Entry

The District Environmental Health Officer (DEHO) of the respective district acted as the main entry point to the study district and community. The regional office of the CWSA also provided some facilitative support. Local government authorities with oversight responsibilities of the study communities were briefed on the survey. The community awareness on the survey was facilitated by the local assembly member responsible for study communities.

2.3.4 Data Collection and Quality Control

The survey covered all the electoral areas in each of the study communities and the data collection personnel were varied according to the population. This was done to ensure that findings from the survey are as much as possible representative of the community.

Selection of houses/households for interview was done randomly with one (1) household interviewed per house. The next two (2) houses after each interviewed house were skipped for the next respondent (i.e. every 3rd house was interviewed). This ensured covering maximum number of households within the limited sample size. Only adult representatives of households were interviewed.

2.3.5 Data Entry and Analysis

Data entry was done using the Statistical Package for Social Sciences (SPSS) Software. Routine checks were carried out during data entry to ensure entry errors were avoided. Data analysis was carried out using the SPSS and Microsoft Excel software application.

2.3.6 Summary of Data Collection

A summary of the methodology applied for each stage/component of the study is presented in Table 2.5 below.

Table 2.5 Summary of Methodology for the Study

Studies	Primary Field Data Collection/Activities	Secondary Field Data Collection
Inception Studies	Consultative meeting with client at the National and District level for the selection of the project districts and communities. Finalisation of work plan and scheduling of field activities with the Client Establishment of population of each study community	
Baseline/ Socio-Cultural and Environmental Studies	Questionnaire Design Community Entry and Project Sensitization Zoning of Community Questionnaire Administration Household Survey; - this covered Demographic, socio-cultural and economic characteristics, Excreta/ Liquid (faecal) waste disposal, water supply situation, wastewater and solid waste disposal systems, storm water drainage system, health and hygiene practices, willingness and ability to pay for improved sanitation services, perception on use of treated faecal sludge by-products, etc. Personal Observation: - This covered community profiling, physical inspection of sanitation facilities including toilets, liquid and solid waste dumping sites, watersheds, etc. Validation of primary data	

Studies	Primary Field Data Collection/Activities	Secondary Field Data Collection
Technical, Financial and Management	Review of Data Collected under the Baseline and Socio-cultural and environmental studies.	• Interview of private cesspit emptier truck owners and operators in the collection, transportation and disposal of faecal sludge • Interview KITA for the operations and assessment of its biogas plantof the • Assessment of Biomethanation Plant at Edina Essaman and others. • Inspection and assessment of small scale desludging truck and interview of sole distributor.

3. OVERVIEW OF SANITATION AND FAECAL SLUDGE MANAGEMENT

3.1 Ghana's Medium-Term Development Policy Framework

Ghana's current Medium-Term Development Framework, the Ghana Shared Growth and Development Agenda II (GSGDA II, 2014 – 2017) follows earlier ones including the Shared Growth and Development Agenda I (GSGDA, 2010 -2013), the Growth and Poverty Reduction Strategy II (GPRS II, 2007 - 2009) and the Ghana Poverty Reduction Strategy (GPRS I (2004 - 2006). These frameworks have sustainable development as a central theme and specific sector policies, strategies and programmes to address relevant MDG targets. For example, the policies, plans and programmes of the environmental sanitation sector take into consideration MDG 7 ("Ensure Environmental Sustainability") as well as the effects of other related goals.

Strategies for improving environmental sanitation include promoting physical planning in both rural and urban areas, acquisition of land for final treatment and disposal in major towns and cities, supporting public-private partnerships in waste management and building capacity of Environmental Health and Sanitation Directorate (EHSD) and MMDAs to better manage environmental sanitation.

Further strategies to improve environmental sanitation include:

- restricting the formation of new slums
- ensuring efficient and effective management of flood control and drainage systems; and
- promoting private sector participation in flood control and coastal protection

In adherence to the requirements of sustainable development objectives of the MDGs, Strategic Environmental Assessment (SEA) principles have been applied with due consideration to participatory engagement of stakeholders from all key sectors and ensuring sustainability of policy interventions.

3.2 Global and National Trends in Sanitation Coverage

Global statistics estimate that currently the world is not on track to meet the MDG sanitation target, and 2.5 billion people still lack access to improved sanitation, including 1.2 billion who have no facilities at all particularly in sub-Saharan Africa and Southern Asia (WHO and UNICEF, 2008).

Africa (including Ghana) recorded the least progress, with use of improved sanitation increasing from 26 percent in 1990 to 31 percent in 2006 (WHO and UNICEF, 2008).

The UNICEF/WHO's Joint Monitoring Programme (JMP) coverage estimate for sanitation, derived from household surveys, is that 15% of the population has improved access, with a further 60% using shared facilities and 19% practicing open defecation. The issue of shared toilet facilities in Ghana is a thorny one, given its widespread incidence.

A nationwide study has been commissioned to determine the number of households sharing facilities, and the adequacy and cleanliness of such facilities. Sanitation coverage estimates and targets are depicted in Figure 3.1.

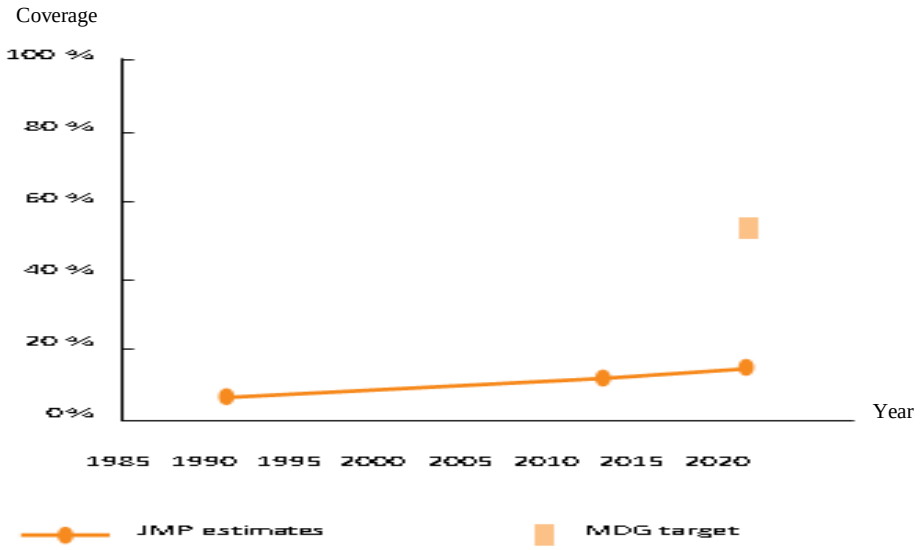


Figure 3.1: Sanitation Coverage Estimates and Target

Going by JMP reports on the measuring progress towards achieving the MDGs, Ghana should have attained 30% as at 2006 and 54% by end of 2015. However Ghana managed to attain only 15% as at 2015 (see Table 3.1 below). This is in recognition of the fact that under the JMP definition of improved sanitation, there is very little chance that Ghana can attain the MDG target of 54% improved access.

Table 3.1: Ghana's Achievement on MDG Target for Basic Sanitation

Country, area or territory	Year	Population (x1,000)	Percentage urban population	Use of sanitation facilities (percentage of population) [1,2]												Progress towards MDG target [3]	Proportion of the 2015 population that gained access since 1990 (%)
				Urban				Rural				Total					
				Improved	Unimproved			Improved	Unimproved			Improved	Unimproved				
					Shared	Other Unimproved	Open Defecation		Shared	Other Unimproved	Open Defecation		Shared	Other Unimproved	Open Defecation		
Ghana	1990 2015	14 629 26 984	36 54	13 20	46 73	31 0	10 7	4 9	20 45	47 12	29 34	7 15	29 60	42 6	22 19	Limited or no progress	11

***S**ource: Progress on Sanitation and Drinking Water – 2015 update and MDG assessment (WHO/UNICEF-JMP Report 2015)*

3.3 Environmental Sanitation Situation in Ghana's Urban and Rural Areas

In Ghana Sanitation coverage is about 20% in urban and about 9% in rural areas (WHO/UNICEF-JMP, 2015). Accra and Kumasi are partly sewered with only Tema and Akosombo being the only towns which are substantially sewered.

Wastewater treatment is hardly ever accorded any resources. Service delivery is also not keeping pace with population growth and demand. Less than 5% of the households in Accra and Kumasi are connected to piped sewerage systems, while 21% use floodwater drains (gutters) as open sewerage that ends up in nearby water bodies (Keraita and Dreschel, 2004.). Some of the urban dwellers discharge their faecal waste into septic tanks while kitchen and other wastes from homes are usually directed into the nearest open drain. As the majority of the urban drains are open, they often serve as defecating areas for households that do not have adequate sanitation facilities.

Snapshot of Existing Treatment Facilities in Ghana

Since 1956, various treatment plants have been installed in Ghana for the treatment of excreta/faecal sludge. Table 3.2 presents a snapshot of the characteristics and status of the facilities in selected communities in Accra, Kumasi and Tema and other institutions.

Table 3.2: Snapshot of the status of selected Sewerage Systems, Accra, Kumasi and Tema

City/ *Location Of System*	Type Of Facility	Year	Management Responsibility	Financing For O & M	Condition
Accra					
Accra Central Sewerage Scheme	Con./Sewer Outfall(Sea)	1973	GWSC-ATMA	Sewer Tariff/Govt	Low-connection. Damaged Outfall
	UASB-Trickling Filter/Secondary Clarifier/Sludge Beds	2000		Subvention	Broken down pumps, under rehabilitation
37 Military Hospital	Trickling Filter/Sedimentation	1972	Min. of Defence/MOH	Govt. Subvention	Broken sewers/reconstruction
University of Ghana(UG)	Trickling Filter + drain field	1967	Health Services, UG	Govt. Subvention	Damaged Filter. Reconstruction
Achimota School	Trickling Filter/Waste stabilization ponds	1968	Ghana Education Service	Govt. Subvention	Damaged Filter. Encroachment
Burma Camp	Trickling Filter + Waste Stabilization Pond	1972	Ministry of Defence	Govt. Subvention	Damaged Filter. Reconstruction
MATS, Teshie	Trickling Filer + Drain field	1972	Ministry of Defence	Govt. Subvention	Damaged Filter. Reconstruction
Labone Estates	Activated Sludge	1974	PWD	Sewer Tariff/Govt	Damaged Filter/ Reconstruction
Ministries (Accra Beach)	Activated Sludge	1972	PWD	Govt. Subvention	Damaged. Reconstruction
State House	Activated Sludge	1974	PWD	Govt. Subvention	Damaged. Reconstruction
Mental Hospital	Trickling Filter	1971	MOH/PWD	Govt. Subvention	Damaged. Reconstruction
Accra High School	Activated Sludge	1970	GES/PWD	Govt.	Damaged.

City/ *Location Of System*	Type Of Facility	Year	Management Responsibility	Financing For O & M	Condition
				Subvention	Reconstruction
Roman Ridge	Inhoff Tank	1973	PWD	Govt. Subvention	Damaged. Reconstructed 2004/Additional trickling Filter Bed
Dansoman Estates	Communal Septic Tanks	1975	SHC/AESC Hydro	Min. of Works & Housing /Govt.	Septic Tanks need Rehab.
KorleBu Teaching Hosp	Imhoff Tank + Trickling Filter	1954	MOH/PWD	Govt. Subvention	Rehabilitated 1990
Presec School	Stabilization Pond	1976	GES/PWD	Govt. Subvention	Damaged, need rehab/refitting
Teshie/Nungua Estates	Trickling Filter	1977	SHC/AESC Hydro	MWH/Govt.	Damaged, need Reconstruction
Trade Fair Site, Labadi	Trickling Filter	1972	PWD	MWH/Govt.	Damaged., need Reconstruction
Labadi Beach Hotel	Packaged Plant	1992	Beach Hotel Ltd	Hotel Tariff	Functional
Golden Tulip Hotel	Packaged Plant	1993	Golden Tulip Hotel	Hotel Tariff	Functional
Teshie-Nungua (Fertilizer)	Faecal Sludge Treatment Plant (FSTP)	1994	AMA-WMD	AMA	Decommissioned and closed
Kumasi					
Teaching Hospital/City Hotel/4BN Barracks	Trickling Filter(1956 - 1962); Oxidation Pond (1962 -	1956	KATH/KMA	Min. of Health/Govt. Subvention	choked /punched sewers/silted up pond. Reconstruction required.
University Campus(UST)	Trickling Filter	1967	Health Services (UST)	Govt. Subvention	Damaged Trickling filter/pump station
Ahinsan/Chirapatre /Kwadso Low-Cost Housing	Communal Septic Tank-Filter Beds/rehab. Waste stabilization ponds (WSPs)	1975 2002	AESC Hydro/SHC KMA	Community KMA	Communal Septic tanks out of use. New community WSPs
Asafo	Simplified Sewerage/Waste Stabilization Ponds	1994	KMA/Contractor	KMA	Functional, expanded to cater for KATH
Asokore-Mampong Buobai	*FSTP*	2002	KMA	KMA	Out-of-use. Encroachment of buffer zone/filled primary anaerobic ponds.
Oti/Dompoase Landfill	*Septage & Faecal Sludge Treatment Plant*	2004	KMA	KMA	Non-functional primary settling ponds
Tema					
Planned Communities & Industrial Estates	Chemical Treatment (1996 -, Aerated Lagoons)	1973	Tema Devp. Corp.	Tariff/TMA	Damaged Pumping stations, Chem. plant & choked sewers. Rehab. New Aeration lagoons constructed (1996) – non-functional. Outfall to SEA

Notes: KMA- Kumasi Metropolitan Assembly; AESC - Architectural & Engineering Services Corp.; MOH - Ministry of Health; GES - Ghana Education Service; MWH-Ministry of Works & Housing; PWD-Public Works Department; UST-University of Science &Tech; KATH - Komfo Anokye Teaching Hospital; UG - University of Ghana; TMA - Tema Municipal Assembly.

From the above table almost all the plants with the exception of four (4) plants are not operational due to operation and maintenance and other technical problems. The experience from the use of settling ponds for faecal sludge treatment has been chequered.

Further detail status of environmental sanitation including faecal sludge management is provided in the National Environmental Sanitation Strategy and Action Plan (NESSAP, MLGRD, 2010), the Micro-Cluster Indicator Survey (MICS) reports, the Ghana Living Standards Survey (GLSS) rounds of reports as well as the report of the 2010 Ghana Housing and Population Census.

3.4 Existing Policies and Regulations on Faecal Sludge Management

Guidelines for the planning of improvements in the management of faecal sludge is provided in the National Environmental Sanitation Policy (ESP), (Revised 2010) and National Environmental Sanitation Strategy and Action Plan (NESSAP 2010). The ESP (2010) provides the policy direction on institutional management, excreta disposal facilities and sewerage and septage removal. The NESSAP 2010 on the other hand outlines strategies and plans to facilitate the implementation of the policy directives. Individual Metropolitan, Municipal and District Assemblies (MMDAs) are also required to develop their own District Environmental Sanitation Strategy and Action Plans (DESSAPs) which should clearly indicate their local strategies and interventions for the management of faecal sludge taking into consideration the proposed measures and actions of national policy.

Table 3.3 below presents guidelines from the Environmental Sanitation Policy (Revised 2010) with regard to faecal sludge management in Ghana whereas Table 3.4 presents the action plans indicated in the NESSAP 2010 to be achieved within the defined period.

Table 3.3: Environmental Sanitation Policy (Revised 2010) Guidelines Related to Faecal Sludge Management

Component of FSM	Policy Directive
General Management of Liquid (Excreta) Waste	➢ District Assemblies shall ensure the availability of facilities for the safe handling and disposal of human excreta (nightsoil and sewage), industrial waste, animal manure, industrial sewage and domestic/commercial wastewaters. These include excreta disposal facilities and systems for the conveyance (sewerage, vehicular, manual), treatment and final disposal of liquid wastes. ➢ The District Assemblies shall have authority to regulate, control, and co-ordinate the activities of all agencies involved in liquid waste management services ➢ MLGRD shall issue technical guidelines from time to time specifying which technologies may be used, including design parameters and recommended operating procedures.
Excreta Disposal Facilities	➢ Recommended technologies are the water closet and septic tank system, the pour flush latrine (where water is used for anal cleansing), the ventilated improved pit latrine (VIP), the aqua privy, and any other proven technologies recommended by Ministry of Local Government and Rural Development (MLGRD). Bucket (pan) and open trench latrines are actively discouraged and must be phased out as they do not meet minimum sanitary standards. ➢ District Assemblies shall regulate technologies for domestic toilets by legislation and application of the building code ➢ Assemblies shall arrange for the provision of public facilities in central business districts, major commercial and light industrial areas, local markets and public transport terminals (lorry/bus stations). ➢ District Assemblies shall promote the construction and use of household toilets, including the conversion of pan latrines to approved types. ➢ District Assemblies shall transfer management and maintenance of all public toilets to the private sector, either by franchising existing facilities or granting concessions for the construction and operation of new ones.
Sewerage and Septage Removal	➢ District Assemblies shall ensure the hygienic transfer of liquid wastes from the point of generation to the point of treatment and disposal. ➢ Desludging of septic tanks and VIPs shall be regulated by the Assemblies, but in general carried out by the private sector ➢ Small scale sewerage systems may be provided for high density areas where other on-site options are not technically feasible, institutions (schools, colleges etc.), and small estate developments. ➢ Simplified and small-bore sewerage systems will be adopted to cater for other areas including low-income high-density housing areas. ➢ In order to ensure adequate hygienic standards, equipment and protective clothing for staff should be inspected regularly. ➢ Staff should also be adequately trained and provided with vaccinations and regular medical check-ups. ➢ Assemblies may establish licensing systems to facilitate enforcement.
Treatment and Disposal Systems	<u>On-site Systems</u>: ➢ Acceptable technologies include VIP latrines and septic tanks with soakaways or subsurface drainfields. ➢ For both the technologies mentioned, sludge must be periodically removed. This should be done by tanker service in the case of septic tanks and single pit VIPs. ➢ Where the user population is low to allow sufficient time for sludge digestion prior to manual removal, alternating pit VIP (KVIP) can be used. <u>Off-site Systems:</u> ➢ Waste stabilisation ponds are the recommended technology for the treatment of large volumes of nightsoil and septage. ➢ Other methods such as ponding and co-composting with municipal solid waste may be considered for daily volumes of less than 50 cubic metres. ➢ Where there is no reasonable alternative, marine disposal of sewage shall be permitted, provided primary treatment to an acceptable standard is provided. ➢ "Conventional" sewage treatment technologies (eg. trickling filters, activated sludge, etc.) shall only be used where there are limitations on the use of waste stabilisation ponds. ➢ District Assemblies shall adopt such systems taking due consideration of the capital and replacement costs, operation and maintenance costs and skilled manpower requirements.

Table 3.4: Strategic Interventions with direct impact on Faecal Sludge Management as indicated in NESSAP 2010

Objective	Measure	Responsibilities	
		Lead Agency	Support Agencies
A1: To formally establish environmental sanitation as a sub-sector in the development planning system with clearly defined institutional mandates	Reinforce the role of the private sector in service delivery Increase the proportion of public toilets provided by private sector through BOT, BOO from…to ….by 2015 Implement full franchise management of all MMDAs built facilities by 2015 Implement 100% private desludging services by 2015 Support installation of bio-digesters and packaged plants by private operators	MMDAs	MLGRD
B6: To enable effective community participation in the sitting of environmental sanitation facilities	Develop participatory tools for identification and selection of sites (for excreta treatment and disposal) in accordance with strategic environmental assessment principles	MLGRD	Environmental Health and Sanitation Directorate (EHSD)/Environmental Protection Agency (EPA)
C1: To develop legislation in support of institutional structures required for managing environmental sanitation	Identify appropriate legislation on the acquisition of land (incl expropriation) for treatment and disposal sites and develop procedures to facilitate site valuation, negotiation and payment of compensation	MLGRD	Ministry of Lands and Natural Resources (MLNR)
C2: To make available to all sector actors updated sector-wide standards, laws and regulations on environmental sanitation	Develop regulation to support waste reduction, re-use, recycling and recovery	MLGRD	EPA/Ministry of Trade and Industry (MoTI)
C3: To mainstream alternative uses of wastes (liquid and solid) through appropriate technologies and incentives	Enforce legislations/regulations/bye-laws prohibiting the dumping of wastes in wet lands and water courses (including drains), commencing from 2008	MLGRD	EPA/MLNR/Ministry of Water Resources Works and Housing (MWRWH)
D1: To ensure sustainable financing of environmental sanitation services	Apply direct cost recovery from all users as far as possible covering all operating and capital costs, for services such as liquid and solid waste collection, public toilets, issuance of permits etc. MMDAs shall set tariffs with full participation of private sector service providers and users (to be revised once a year) MMDAs shall implement differential tariffs to ensure overall cost recovery	MMDAs MMDAs MMDAs	MLGRD/Ministry of Finance and Economic Planning (MoFEP) Private Operators/User-Groups MLGRD/MoFEP
E1: To effectively contain and decrease	Ensure that the bulk of environmental sanitation services shall be provided by the private sector	MLGRD	MMDAs

Objective	Measure	Responsibilities	
		Lead Agency	Support Agencies
the negative impact from poor environmental sanitation	under regulation by the public sector agencies		
	MMDAs shall maintain adequate capacity to intervene and provide the services in the event of failure of the private sector to deliver services due to industrial actions in their establishments or other reasons	MMDAs	EHSD
	Ensure that services meet the needs of specific target groups including vulnerable people, women and children and the poor	MMDAs	MLGRD/Town and Country Planning Department (TCPD)
	Ensure that sites for treatment and disposal of wastes (landfills, composting facilities, **waste stabilisation ponds, trickling filters, septage treatment plants**, etc.) are located so as not to create safety and health hazards or aesthetic problems in the surrounding area	MMDAs	EPA
E2: To support adequate treatment and final disposal of all wastes	Ensure that development and sitting of communal storage and transfer depots, **treatment and disposal facilities** (includes facilities for liquid waste management) conform to statutory land-use norms and regulations	MMDAs	MLGRD/TCPD
	Ensure acquisition of appropriate sites for treatment and disposal facilities (landfills, composting facilities, waste stabilisation ponds, trickling filters, septage treatment plants, etc.) using participatory principles including SEA	MMDAs	MLGRD/EPA
	Ensure that treatment and disposal facilities are provided and used in accordance with prescribed standards including the preparation of Environmental Impact Assessments	MMDAs	MLGRD/EPA
E3: Ensure adequate systems for managing wastewater treatment, re-use and disposal	Ensure adequate systems for managing wastewater treatment, re-use and disposal	MMDAs EPA	MLGRD/EHSD MLNR
E4: To support remedial strategies for all wetlands and water courses under threat from indiscriminate disposal of waste	Identify all environmentally sensitive areas such as wetlands and water courses prone to impact from waste-abuse	MMDAs	MLGRD/MWRWH-
	Provide adequate targeted services in areas close to wetlands, water courses and other vulnerable water resources prone to waste-abuse	MMDAs	Water Resources Commission (WRC)
E5: To meet the needs of vulnerable and physically challenged individuals in provision of services	Ensure adequate options of facilities are available for all segments of the population especially vulnerable and physically challenged persons		MoWAC (Ministry of Women and Children Affairs, now Ministry of Gender and Social Protection)/Ministry of Health (MoH)
F1: To develop an effective framework	Examine and assess the capabilities of existing research and service institutions and provide	MLGRD	Ministry of Education (MoE)/Institute of

Objective	Measure	Responsibilities	
		Lead Agency	Support Agencies
for capturing, reporting of sector statistics and performance to users at all levels	appropriate support for research on environmental sanitation Develop framework for tracking the volumes and types of waste streams generated from all segments of the economy	MLGRD	Local Government Studies (ILGS) EHSD/Centre for Scientific and Industrial Research (CSIR)/Private Sector
G2: To strengthen capacity to implement M&E	Assess capacity for implementing M&E at all levels Establish/strengthen structures for effective M&E including mechanisms for DA- and community-level monitoring	MLGRD	EHSD/National Environmental Sanitation Policy Coordinating Committee (NESPoCC)

From the above, MMDAs are to largely bear the responsibility of faecal sludge management with guidance from the ministry (MLGRD) and some support from other allied ministries and agencies. However, most MMDAs have been unable to adequately implement these policy directives and strategic actions mainly due to lack of funds and dedicated direction of purpose.

3.5 Management Structure for Liquid Waste

In accordance with the Local Government Act, 1993 (Act 462), MMDAs are responsible for the management of environmental sanitation services either directly or through their agents including private operators.

Their responsibilities for liquid waste or excreta management are specified in various legislative instruments (LIs) establishing the assemblies. These include:

- Establishing, installing, building and controlling public latrines, lavatories, urinals and wash places
- Licensing of persons to build and operate public latrines, lavatories, urinals, wash places and related services
- Monitoring and reporting on the activities of operators
- Establishing, maintaining and carrying out services for the removal of night soils from buildings and for the disposal and treatment.
- Advising on the regulation and the provision of services for the removal and treatment of night soil by authorized or licensed private sector operators.

Figure 3.2 below shows the generic management structure in place for environmental sanitation delivery in Ghana.

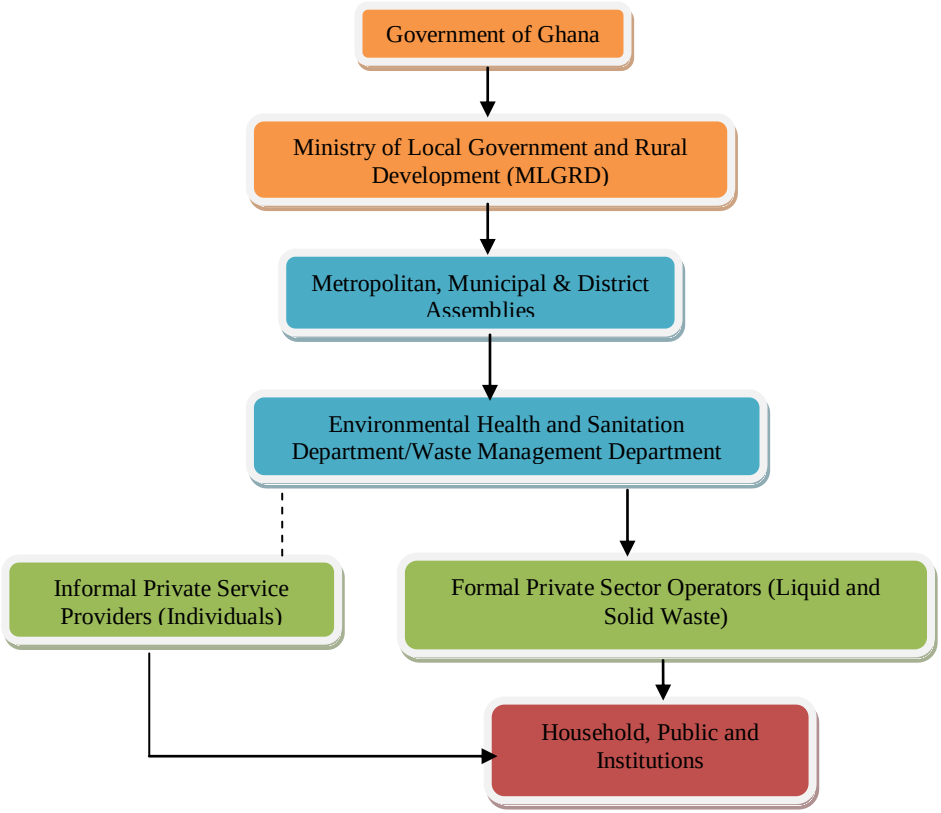


Figure 3.2: Management Structure for Environmental Sanitation Delivery

3.6 Socio-Cultural Norms and Traditional Beliefs on Toilet Facilities, Excreta/Faecal Sludge and Re-Use of Treated Faecal Sludge

In Ghana, socio-cultural beliefs and societal norms largely vary among communities, ethnic tribes, religions, locations (e.g. rural/urban areas, coastal/in-land areas) etc.; although there exists some commonalities. These beliefs and norms define the thinking and behaviour of the inhabitants of the communities.

Recent studies have established the fact that, socio-cultural beliefs, values and practices have a direct impact on sanitation. In most cases, these beliefs have been identified as barriers to improving access to sanitation and hence the inclusion of Behavioural Change Communication (BCC) as an integral component of recent sanitation policies, plans and project/programmes aimed at reducing open-defecation by improving access.

The National Environmental Sanitation Strategy and Action Plan (NESSAP, 2010) and Rural Sanitation Model and Strategy (RSMS, 2012) take cognizance of this and have proposed specific strategies to be carried out.

The practice of open defecation for example is a norm (observed) in both rural and urban areas though more prominent in the former. Even though the inability to build and own household toilets may be identified as a key factor, there are cases where individuals or groups of people are reluctant to construct their own facilities or use public facilities due to some socio-cultural beliefs.

Box 3.1 below presents examples of socio-cultural beliefs/taboos in some parts of Ghana that influence the practice of open defecation and are likely barriers to improving sanitation based on research study by WaterAid.

Box 3.1: Example of Socio-cultural Beliefs that Influence Sanitation

- In the Kwahu North district, a significant number of respondents preferred open defecation because they believed it prevented them from smelling unpleasant
- In Ghana, fear of being possessed by demons or losing your magical powers is the leading cause of open defecation across all the areas where the study was carried out. Nearly half of the respondents in Tamale believed that public toilets are surrounded by evil spirits and therefore should be avoided.
- A significant group of respondents in the Wa East district believing that latrine use will strip the user of their magical powers

Source: Towards Total Sanitation -Socio-cultural Barriers and Triggers to Total Sanitation in West Africa, WaterAid, 2009.

Another common practice with regard to toilet usage is the sharing of toilet facilities. This practice has been attributed to the compound-housing pattern which is in turn due to the extended-family lifestyle of Ghanaians. It is common to both rural and urban communities. According to the National Population and Housing Census (NPHC 2010), 51.5% of Ghanaians live in compound houses which usually consist of more than one household and may be related or unrelated. They are therefore likely to share toilet facilities especially in the urban areas where there is limited space for construction of household facilities.

The reliance on public toilets by households has become a norm in most communities. The NPHC 2010 indicates that 34.6% of the populations use public toilets as their main places of convenience although they are originally targeted at transient populations. The practice puts enormous pressure on these facilities and therefore they easily deteriorate. Although some households tend to use the public facilities due to their inability to afford their own household toilets, others do not deem it as a need and are unwilling to spend money constructing their own facilities.

Some owners (landlords) of premises without toilets also do not see the provision of these facilities as necessary and are therefore reluctant to construct them even if requested by their tenants. In some cases, the landlords convert existing toilet facilities into rooms for rental forcing their tenants to rely on public toilets. This practice is very common in densely populated communities.

The perception of human excreta as something ‘bad’ or repugnant cuts across socio-cultural boundaries and religions. For example, eating with the left-hand which is perceived as ‘anal cleansing (toilet) hand’ is frowned upon in most parts of the country.

People are therefore reluctant or feel ashamed to be associated with anything related to human excreta. In some cases, people engaged in providing desludging services (especially manual pit emptiers) are often looked down upon.

Generally, most people view the odour and appearance of human excreta as very repulsive and therefore any by-product generated from faecal sludge is considered unwholesome for use for any purposes. There is the general societal norm that touching or handling fresh excreta or faecal sludge should be avoided. Very little is known by most people of the potential socio-economic gains that can be derived from the treatment of faecal sludge.

An extensive national community-based Behavioral Change Communication (BCC) programme is needed to change the perceptions and practices of people towards sanitation if access is to be improved and sustained. The process will however be gradual since changing the perceptions and practices/attitudes rooted in socio-cultural beliefs requires much time to achieve

4. EXISTING ENVIRONMENTAL SANITATION AND WATER SITUATION IN THE SELECTED COMMUNITIES

This chapter presents the details of all aspects of water and sanitation facilities and services in the selected communities.

4.1 Existing Sanitation Situation

The existing situation on the availability and usage of household toilets in the study communities are provided below.

4.1.1 Toilet Facilities and Usage

Toilets identified in the study communities include pit latrines, VIPs, KVIPs and WCs. These are household, public or institutional toilets. Households without access to these facilities resort to open defecation. This practice is prevalent in all communities apart from Edina Essaman which has no record of open defecation though the community depend largely on public toilets with Sibi Hill Top as the worst case. Transient population (visitors, traders, etc.) rely on public toilets or engage in open defecation. Open defecation in most of the selected study communities happens in the following locations:

- Open fields, usually near farms
- Next to water bodies
- Open land areas near residences

The practice of open defecation is largely as a result of inadequate household toilet facilities, poorly maintained public toilets and non-affordability of public toilet user fee (tariff).

The share of households and population using the toilet facilities are as presented in Tables 4.1 and 4.2 respectively

Table 4.1 Share of Households Using Toilet Facilities

Share of Households Using Toilet Facilities (Year 2014)														
Region		Central			Western			Volta			Eastern			
District		Komenda Edina Eguafo Abirem	Gomoa West	Hemang Lower Denkyira	Wassa Amenfi East	Jomoro	Sefwi Wiawso	Ho West	Nkwanta North	Ketu North	Upper Manya Krobo		Birim North	Afram Plains North
Community		Edina Essaman	Dago	Twifo Hemang	Adesu	Tikobo No.2	Sefwi Asawinso	Kpedze	Sibi Hill Top	Dzodze	Akateng		New Abirem	Donkorkrom
Those with Household Toilet		22.20%	61.30%	69.40%	49.50%	36.90%	77.90%	46.10%	4.20%	50.30%	19.70%		80.00%	40.70%
Share of Household	WC/flush	13.60%	4.00%	7.30%	8.50%	2.00%	4.40%	40.50%	-	21.50%	-		7.90%	10.90%
	KVIP	18.20%	30.00%	2.40%	4.30%	6.90%	4.40%	13.50%	-	30.10%	43.20%		22.20%	75.00%
	VIP	43.20%	42.00%	31.50%	28.70%	38.60%	27.00%	26.10%	87.50%	38.20%	35.20%		41.70%	9.40%
	Pit latrine	25%	24.00%	58.80%	58.50%	52.50%	64.20%	18.90%	12.50%	10.20%	21.60%		28.20%	4.70%
	Pan Latrine	0%	0%	0%	0%	0%	0%	1.00%	0%	0%	0%		0%	0%
Those Without Household Latrine	Uses Neighbour's Household Toilet	5.60%	4.60%	24.50%	15.2%	4.40%	8.50%	5.00%	-	5.40%	6.00%		7.10%	6.80%
	Uses Public Toilet	72.20%	10.70%	0.40%	31.30%	10.60%	12.50%	48.50%	-	41.60%	47.30%	1.50%	12.60%	34.80%
	Practise Open Defecation	-	23.40%	5.70%	4%	48.10%	1.10%	0.40%	95.80%	2.70%	25.5%		0.30%	17.70%

[2]

[2] In Akateng 1.5% of households without latrines use both public toilets and also practice open defecation

Table 4.2: Share of Population Using Toilet Facilities

Share of Population Using Toilet Facilities (Year 2014)														
Region		**Central**			**Western**			**Volta**			**Eastern**			
District		**Komenda Edina Eguafo Abirem**	**Gomoa West**	**Hemang Lower Denkyira**	**Wassa Amenfi East**	**Jomoro**	**Sefwi Wiawso**	**Ho West**	**Nkwanta North**	**Ketu North**	**Upper Manya Krobo**		**Birim North**	**Afram Plains North**
Community		**Edina Essaman**	**Dago**	**Twifo Hemang**	**Adesu**	**Tikobo No.2**	**Sefwi Asawinso**	**Kpedze**	**Sibi Hill Top**	**Dzodze**	**Akateng**		**New Abirem**	**Donkorkrom**
Project Population (2014)		1,946	6,802	9,472	1,403	5,625	20,385	2,666	4,252	26,786	1,750		7,341	9,821
Share of Household	**Population of those with Household Toilet**	432	4170	6574	694	2076	15880	1229	179	13473	345		5873	3997
	WC/flush	59	167	480	59	42	699	498	0	2897	-		464	436
	KVIP	79	1251	158	30	143	699	166	0	4055	149		1304	2998
	VIP	187	1751	2071	199	801	4288	321	156	5147	121		2449	376
	Pit latrine	108	1001	3865	406	1090	10195	232	22	1374	74		1656	188
	Pan Latrine	0	0	0	0	0	0	12	0	0	0		0	0
Those Without Household Latrine	**Population Using Neighbour's Household Toilet**	109	313	2321	213	248	1733	133	-	1446	105		521	668
	Population Using Public Toilet	1405	728	38	439	596	2548	1293	-	11143	828	26	925	3418
	Population Practising Open Defecation	-	1592	540	56	2706	224	11	4073	723	446		22	1738

KVIPs were identified as the most common public toilet facility in the study communities. In peri-urban communities where water supply is available, flush toilets are also used. WC toilet facilities are commonly provided in newly constructed buildings in newly developing areas of the selected study communities. The institutional toilet facilities were mainly KVIPs and WCs. Table 4.3 shows the facility types used as household, public and institutional toilets.

Table 4.3: Toilet Facility Type and Use

Region	District	Community	Toilet Facilities
			Household Type
Central	Komenda Edina Eguafo Abirem	Edina Essaman	WC/Flush, KVIP, VIP, Pit Latrine
	Gomoa West	Dago	WC, KVIP, VIP, Pit Latrine
	Hemang Lower Denkyira	Twifo Hemang	WC, KVIP, VIP, Pit Latrine
Western	Wassa Amenfi East	Adesu	WC/Flush, KVIP, VIP, Pit Latrine
	Jomoro	Tikobo No.2	WC, KVIP, VIP, Pit Latrine
	Sefwi Wiawso	Sefwi Asawinso	WC, KVIP, VIP, Pit Latrine
Volta	Ho West	Kpedze	WC/Flush, KVIP, VIP, Pit Latrine, Pan Latrine
	Nkwanta North	Sibi Hill Top	VIP, Pit Latrine
	Ketu North	Dzodze	WC, KVIP, VIP, Pit Latrine
Eastern	Upper Manya Krobo	Akateng	KVIP, VIP, Pit Latrine
	Birim North	New Abirem	WC, KVIP, VIP, Pit Latrine
	Afram Plains North	Donkorkrom	WC, KVIP, VIP, Pit Latrine

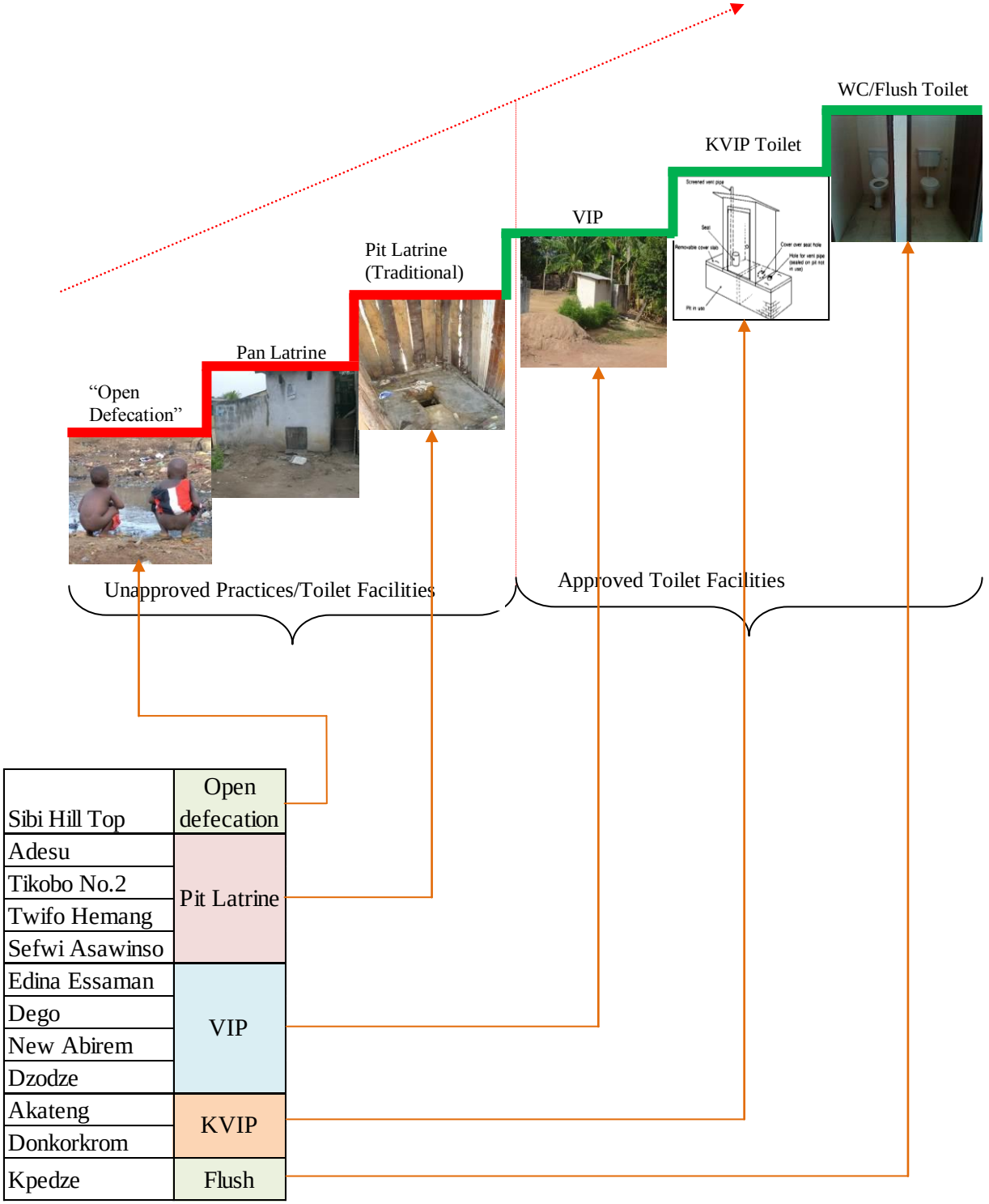
Apart from flush toilets which are water-based (wet systems), all the other facilities (KVIP, VIP, Pit Latrine, pan latrine) are non-water types (dry systems).

4.1.2 Sanitation Ladder of Study Communities

The sanitation ladder shown in Figure 4.1 below is a pictorial presentation of progression of type of excreta disposal/treatment methods from open defecation to an advanced form of toilet facilities used. Also indicated in the figure is the mapping of the most commonly used facilities in the various communities. The choice of household type of toilet facility is largely influenced by the economic status, availability of land, socio-cultural values and operation & maintenance requirements. Table 4.4 presents the share of population and the toilet facilities commonly used.

Table 4.4: Share of Household Toilet Facility Use

Region	District	Community	<2000	2000-7500	>7500	Community Description	Share of Household Toilet Facilities (For Households with Household Toilet Facilities)					Most widely used household toilet
							Flush	KVIP	VIP	Pit latrine	Pan Latrine	
Central	Komenda Edina Eguafo Abirem	Edina Essaman	1,946			Rural Communities	13.60%	18.20%	43.20%	25%	-	VIP
Western	Wassa Amenfi East	Adesu	1,403				8.50%	4.30%	28.70%	58.50%	-	Pit Latrine
Eastern	Upper Manya Krobo	Akateng	1,750				-	43.20%	35.20%	21.60%	-	KVIP
Volta	Ho West	Kpedze		2,666		Small Town	40.50%	13.50%	26.10%	18.90%	1%	Flush
Central	Gomoa West	Dego		6,082			4.00%	30.00%	42.00%	24.00%	-	VIP
Western	Jomoro	Tikobo No.2		5,625			2.00%	6.90%	38.60%	52.50%	-	Pit Latrine
Eastern	Birim North	New Abirem		7,341			7.90%	22.20%	41.70%	28.20%	-	VIP
Volta	Nkwanta North	Sibi Hill Top		4,252			-	-	87.50%	12.50%	-	VIP
Central	Hemang Lower Denkyira	Twifo Hemang			9,472	Peri-Urban Communities	7.30%	2.40%	31.50%	58.80%	-	Pit Latrine
Western	Sefwi Wiawso	Sefwi Asawinso			20,385		4.40%	4.40%	27.00%	64.20%	-	Pit Latrine
Eastern	Afram Plains North	Donkorkrom			9,821		10.90%	75.00%	9.40%	4.70%	-	KVIP
Volta	Ketu North	Dzodze			26,786		21.50%	30.10%	38.20%	10.20%	-	VIP



Sibi Hill Top	Open defecation
Adesu	Pit Latrine
Tikobo No.2	
Twifo Hemang	
Sefwi Asawinso	
Edina Essaman	VIP
Dego	
New Abirem	
Dzodze	
Akateng	KVIP
Donkorkrom	
Kpedze	Flush

Figure 4.1: Communities' Household Toilet Facilities Mapping on Sanitation Ladder

4.1.3 Management of Human Excreta/Faecal Sludge

Storage of Excreta

Pits (either lined or unlined) are dug directly under the privy room as in the case of pit latrines and VIPs or off-set for KVIP to receive fresh human excreta (night soil). For flush toilets, holding tanks are provided for the storage of fresh human excreta including water for flushing.

Emptying of Faecal Sludge

Household toilets, usually VIP and pit latrines generally generate small volumes of faecal sludge which is emptied manually when full by householders themselves or work gangs for a fee. The tools commonly used for digging out stabilized faecal sludge include buckets, shovels, etc. The emptied faecal matter is either buried or disposed-off on open grounds within the community and thereby causing public health and environmental problems. The manual method of pit emptying is associated with appreciable health hazards to the people tasked to undertake the pit emptying.

From the field studies conducted, the choice of manual method of emptying is mainly due to the fact that it is cheaper and the service is readily available since those engaged in it are mostly resident in the community.

On the other hand, for public and institutional toilets such as KVIP, flush toilets and households using flush toilets with holding tanks which generate large volumes of faecal sludge, the mechanized means of desludging is used. In line with the national policy for private sector participation, cesspit emptiers are mostly privately owned and operated. However, Komenda Edina Eguafo Abirem and Twifo Hemang Lower Denkyira Municipal Assemblies also provide desludging services.

In terms of frequency of desludging, usually household toilet facilities are desludged averagely once every two years while the public toilets are desludged once every two months. Institutional toilets are desludged twice every year. The desludging fee varies from one community to another and depends on the haulage distance and the size of the cesspit emptier truck. Examples of desludging fees are indicated in Table 4.5 below. The cesspit emptier truck capacities range between $6m^3$ - $15m^3$.

The management/owners of the public and household toilets engage cesspit emptying services when the toilets are full. In some cases, the cesspit emptier operators delay in providing services due to the following;

- increased demand for emptying services for e.g. during rainy seasons,
- distance to the service location,
- availability of nearby disposal site,
- condition of the vehicle (age, breakdown, etc.) and
- nature of roads, etc.

The district assemblies regulate the operations of both private and public cesspit service providers in line with existing by-laws.

Transportation (Haulage) of Faecal Sludge

Once the faecal sludge is desludged from the storage pit/holding tank, it is transported to designated locations for disposal. There are no transfer stations for faecal sludge in any of the selected study community.

For the manual means of emptying, the faecal sludge is transported using equipment such as hand-carts (push truck), wheelbarrows, etc. The haulage distances are relatively short ranging between 5m to 1km depending on the available site for final disposal. In most cases, for household VIP toilets and pit latrines, new pits are dug next or close to the existing pit and the faecal sludge buried in a new pit.

In the case of mechanised desludging, the faecal sludge is transported by cesspit emptier trucks to designated or unapproved disposal sites. Generally, the haulage distance for transporting the faecal sludge is between 1km and 30km. From the field studies, most service providers are not stationed in the communities resulting in high service charges due to long distances from the point of desludging to the final disposal sites.

Disposal, Treatment and Re-Use of Faecal Sludge

Facilities emptied manually are often disposed-off in the open or in specially dug shallow pits. For faecal sludge disposed-off in the open, rainwater washes it off into water bodies and cause water pollution.

The faecal sludge buried in new pits is mostly covered with soil. In most cases, the pits are shallow and therefore do not have enough cover to prevent odour emission and cause health risk to the people living around the pits.

With the exception of Edina Essaman which has a Biomethanation Sewage Treatment Plant (currently un-operational due to unresolved use of land, plant ownership/management oversight issues), there are no faecal sludge treatment/disposal facilities in the remaining communities. Table 4.5 presents a profile of faecal sludge management in the communities.

Table 4.5 -Management Profile of Faecal Sludge

Region	District	Community	Service Provider	Cost of Desludging Per/truck (GH₵)	Disposal Site of Faecal Sludge	Management of Disposal Site	Treatment of Faecal Sludge	Re-Use of Faecal Sludge	Cost of Disposal of Faecal Site
Central	Komenda Edina Eguafo Abirem	Edina Essaman	KEEA Municipal Assembly ZoomLion Cesspool Services Provider University of Cape Coast Waste Services Cape Coast Municipal Assembly	50-180	Biomethanation and Sewage Treatment Plant at Edina Essaman (Currently out of operation due to litigation on the land)	KEEA Municipal Assembly	Yes	Liquefied Nature Gas and Organic Fertilizer	Nil
	Gomoa West	Dago	Private cesspit emptying service providers from Winneba, Kasoa and Swedru.	80	Dispersed disposal sites (Outskirt of community)	-	No	No	Nil
	Hemang Lower Denkyira	Twifo Hemang	Hemang Lower Denkyira District Assembly	140	Designated site outside the community	District Assembly	No	No	Nil
Western	Wassa Amenfi East	Adesu	Private cesspit emptying service providers from Wassa Akropong	200-300	Designated site outside the community	-	No	No	Nil
	Jomoro	Tikobo No.2	Private cesspit emptying service providers from Half Assini and Elubo. Note: Jomoro Municipal Assembly has cesspit emptying truck but the vehicle is often broken-down and is currently out of operation.	150-200	Dispersed disposal site (outskirt of community)	-	No	No	Nil
	Sefwi Wiawso	Sefwi Asawinso	Private cesspit emptying service providers from Kumasi and Bibiani	200-350	Dispersed disposal sites (out of community)	-	No	No	Nil
Volta	Ho West	Kpedze	Ho Municipal Assembly Private cesspit emptying service providers from Ho	100-400	disposal site in Ho	Ho Municipal Assembly	No	No	Nil
	Nkwanta North	Sibi Hill Top	-	-	-	-	No	No	Nil
	Ketu North	Dzodze	Private cesspit emptying service providers from Dzodze and from Ho Hohoe Municipal Assembly	300-350	Designated Disposal Site Outskirt of Community	Ketu North District Assembly	No	No	Nil
Eastern	Upper Manya Krobo	Akateng	Private cesspit emptying service providers from Somanya, Begro or Koforidua	300-450	Dispersed disposal site outside the Akateng (in Koforidua, Begoro or Somaya).	-	No	No	Nil
	Birim North	New Abirem	Private cesspit emptying service provider (Known as Samuel Amofa Company Ltd	500	Dispersed disposal site outside New Abirem	-	No	No	Nil
	Afram Plains North	Donkorkrom	Private cesspit emptying service provider (e.g. ZoomLion Ghana Ltd Cesspit Services) from Koforidua	500	Designated disposal site (outskirt of community)	-	No	No	Nil

4.1.4 Adequacy of Toilet Facilities and Management Practices

Adequacy of Toilets Facilities

From Table 4.4 above, the share of improved toilets increased from 7% in 1990 to 15% in 2015, while the proportion of shared facilities increased from 29% to 60% over the same period. Since shared facilities are considered as unimproved, this implies that the population that depends on shared facilities has increased by 31% over the period. It is note-worthy that over the same period open defecation decreased by only 3%.

From the field survey of the selected communities, the proportion of households without improved toilet facilities range from 20% for New Abirem to 96% for Sibi Hill Top. The estimated required number of household toilet and public toilet facilities for the selected study communities in the year 2014, 2015 (base year), 2025 and 2030 is presented in Table 4.14 below.

Table 4.6: Household and Public Toilet Facility Deficit in the Selected Study Communities

Region		Central			Western			Volta			Eastern			
District		Komenda Edina Eguafo Abirem	Gomoa West	Hemang Lower Denkyira	Wassa Amenfi East	Jomoro	Sefwi Wiawso	Ho West	Nkwanta North	Ketu North	Upper Manya Krobo		Birim North	Afram Plains North
Community		Edina Essaman	Dago	Twifo Hemang	Adesu	Tikobo No.2	Sefwi Asawinso	Kpedze	Sibi Hill Top	Dzodze	Akateng		New Abirem	Donkorkrom
Those with Household Toilet		22.20%	61.30%	69.40%	49.50%	36.90%	77.90%	46.10%	4.20%	50.30%	19.70%		80.00%	40.70%
TOILET FACILITY DEFICIT = Those Without Household Latrine	Uses Neighbour's Household Toilet	5.60%	4.60%	24.50%	15.2%	4.40%	8.50%	5.00%	-	5.40%	6.00%		7.10%	6.80%
	Uses Public Toilet	72.20%	10.70%	0.40%	31.30%	10.60%	12.50%	48.50%	-	41.60%	47.30%	1.50%	12.60%	34.80%
	Practise Open Defecation	-	23.40%	5.70%	4%	48.10%	1.10%	0.40%	95.80%	2.70%	25.5%		0.30%	17.70%
Percentage (%) Household Toilet Deficit		77.80%	38.70%	30.60%	50.50%	63.10%	22.10%	53.90%	95.80%	49.70%	80.30%		20.00%	59.30%
Household Size (2014)		3.9	4.1	4.5	4.4	4.2	4.5	3.6	6.4	3.7	4.6		4.2	4.7
Projected Population (2014)		1,946	6,802	9,472	1,403	5,625	20,385	2,666	4,252	26,786	1,750		7,341	9,821
Number of Household Toilet Deficit (2014)		388	642	644	161	845	1001	399	636	3598	3598		350	1239
Public Toilet Squarthole Requirement (10% of Population/50)		4	14	19	3	11	41	5	9	54	4		15	20
No. of Existing Toilets Squatholes		10	30	20	10	10	50	40	10	100	30		10	10
Total Toilet Toilet Squathole Deficit (2014)		-	-	-	-	1	-	-	-	-	-		5	10
Projected Population (2015)		2006	6972	13356	1,445	5805	20793	2733	4358	27295	1,787		7495	10175
Number of Household Toilet Deficit (2015)		400	658	908	166	872	1021	409	652	3666	3666		357	1284
Public Toilet Squarthole Requirement (10% of Population/50)		4	14	27	3	12	42	5	9	55	4		15	20
No. of Existing Toilets Squatholes		10	30	20	10	10	50	40	10	100	30		10	10
Total Toilet Toilet Squathole Deficit (2015)				7		2					-		5	10
Projected Population (2025)		2723	8925	19960	1942	7954	25346	3498	5579	32948	2,199		9227	14491
Number of Household Toilet Deficit (2025)		543	842	1357	223	1195	1245	524	835	4426	4426		439	1828
Public Toilet Squarthole Requirement (10% of Population/50)		5	18	40	4	16	51	7	11	66	4		18	29
No. of Existing Toilets Squatholes		10	30	20	10	10	50	40	10	100	30		10	10
Total Toilet Toilet Squathole Deficit (2025)				20		6	1		1		-		8	19
Projected Population (2030)		3172	10098	24402	2251	9311	27984	3958	6312	36199	2,440		10237	17295
Number of Household Toilet Deficit (2015)		633	953	1659	258	1399	1374	593	945	4862	4862		487	2182
Public Toilet Squarthole Requirement (10% of Population/50)		6	20	49	5	19	56	8	13	72	5		20	35
No. of Existing Toilets Squatholes		10	30	20	10	10	50	40	10	100	30		10	10
Total Toilet Toilet Squathole Deficit (2030)				29		9	6		3		-		10	25

The inadequacy of household latrines was attributed to high cost associated with construction (material and labour), operation and maintenance cost and lack of environmental health education on the need to own household toilets, availability of space for construction of the toilet facility, etc. It was also observed that the inadequacy of household toilet facilities is the direct cause, to a large extent of the practice of open defecation in the selected study communities. There is therefore the need for intensive education and intervention programmes to promote the construction of improved household latrines in the selected study communities.

From the field studies, most community members expressed willingness to own household toilet facilities if their current economic status improves or if they are provided with loan facilities. However, to ensure sustenance of any latrine ownership drive it is important to make available financing mechanisms with favorable credit terms which match ability to pay for loans considering the income earning patterns of the households.

Public toilets which are supposed to serve transient population, lorry parks and market centres are currently largely patronized by members of the selected study communities due to lack of household toilet facilities. The high dependence on public toilets by community members put enormous pressure on these facilities and contributes to poor maintenance practices.

Management of Faecal Sludge

Table 4.7 presents the general overview of deficiencies in the management of faecal sludge and the impacts created. There is therefore the need to institute effective management system for handing faecal sludge in the selected study communities.

Table 4.7: Overview of Management Practices of Faecal Sludge

Aspect of Faecal Sludge Management	Bottleneck	Current Situation	Impacts
Emptying	• Inappropriate emptying equipment and technology • Manual, non-mechanised emptying for some household latrines • Poor service management • High cost of services for pit emptying • Lack of information (e.g. on how KVIP and septic tanks work)	• Overflowing pits • Emptying frequency often very low • Indiscriminate disposal of faecal sludge. • Misuse of KVIP and Septic tanks	• Health hazards from openly disposed faecal sludge
Haulage	• Most of the smaller communities do not have any public/private cesspit emptying service providers within the community • Private cesspit empting service providers seek short haulage distance and time and unapproved dumping sites	• Private cesspit service providers come from neighbouring larger towns • Private cesspit empting service providers dump faecal sludge in an uncontrolled manner at the shortest possible distance in cases where there are no designated disposal sites	• High cost of desludging services due to long travel distance
Disposal and Treatment	• Lack of disposal/treatment facilities • No enforcement of sanctions for indiscriminate disposal of faecal sludge • Lack of funds to invest in treatment (by MMDAs) • Where faecal sludge treatment plant exists as in the case of the Biomethanation and Sewage Treatment Plant at Edina Essaman at Komenda Edina Eguafo Abirem District, the capacity of the treatment plant was identified as low (i.e. 5m^3/day). Also private cesspit empting service providers are reluctant to pay for treatment fees • Lack of effect planning	• Faecal sludge is disposed of untreated at either dispersed or designated disposal sites	• Potential pollution of surface and (shallow) groundwater and related health hazard

4.1.5 Operation and Maintenance of Toilet Facilities

Household Toilets

From the field survey, household toilet facilities are maintained by household members mostly women and children. The primary aim of the maintenance is to keep the toilet facility clean and hygienic. Generally, household toilet facilities are locked to prevent stray animals and unauthorized usage. Among the maintenance activities commonly carried out for the toilet facilities include;

- sweeping,
- disposal of anal cleansing material
- mopping of toilet seat (especially WC), squat-slabs ((for VIP and KVIP) and the floor with water and disinfectant
- putting of ash into pit latrines to prevent odour and also reduce the volume of sludge in the pit and in some cases the addition of kerosene to the fresh human excreta to remove the gases built-up in the pit
- Emptying of pit/holding tank when full.

The operation and maintenance activities are carried out daily or periodically depending on the type of toilet facility, number of users, etc.

Local traditional equipment/materials commonly used for the maintenance of the household toilet facilities include broom, scrubbing brush, bucket, disinfectant, etc. Flush toilets with septic tanks and KVIPs for household, public and institutional use are mostly desludged when full by cesspit emptiers owned by private and public entities. Household toilet facilities such as VIPs and KVIPs are sometimes emptied by manual means using shovels, wheelbarrow, etc.

Most households provide receptacle (bins, baskets, old buckets etc.) in the privy rooms for storage of anal cleansing materials. In situations where waste baskets are not available in the privy rooms, the anal cleansing material is either placed on the floor or dropped into the pit. Anal cleansing materials kept in a receptacle or on the floor are collected and either burnt, buried or disposed-off at a refuse dump.

Private individuals or group of individuals are often engaged by households to empty the toilet facilities (mostly, pan and pit latrine, VIP and KVIP) when full while cesspit emptying trucks are engaged to desludge septic tanks. Household members and neighbours sharing household toilet facilities do not pay any user fee to the owners.

Public Toilets

The field survey indicates that most of the public toilets were constructed by the district assemblies and are managed by private operators on behalf of the district assemblies under franchise agreements which are in line with the Environmental Sanitation Policy (Revised 2010). There are however few

public toilets which are owned and managed by private persons in some of the selected study communities such as Donkorkrom.

The private operators also engage caretakers under sub-franchise agreements for the daily operation and maintenance of the public toilet facilities including cleaning, collection of user fees, provision of anal cleansing materials, water for hand-washing, etc. The number of operational staff (attendants and cleaners) depends on the size of the facility and the number of people who use the facility daily. The public toilets are usually opened to the public from 4:30 GMT and closed at 20:00 GMT daily depending on the location and level of patronage.

The anal cleansing materials usually newspapers and toilet rolls are provided by the attendant upon payment of the toilet-user fee (tariff) set by the management of the public toilet. The user-fees for public toilet in the selected study communities are as presented in Table 4.8 below.

Table 4.8: Public Toilet User Fees

District	Komenda Edina Eguafo Abirem	Gomoa West	Hemang Lower Denkyira	Wassa Amenfi East	Jomoro	Sefwi Wiawso	Upper Manya Krobo	Birim North	Afram Plains North	Ho West	Nkwanta North	Ketu North
Community	Edina Essaman	Dego	Twifo Hemang	Adesu	Tikobo No.2	Sefwi Asawinso	Akateng	New Abirem	Donkorkrom	Kpedze	Sibi Hill Top	Dzodze
Present Public Toilet User Fee (GHp)	20	20	30 and 50	20 to 50	20 to 50	30	20 to 50	20 to 50	30	20 to 50	-	10 to 20

The anal cleansing material is stored in baskets or plastic dustbins and in some cases on the bare floor in the privy rooms and periodically (usually daily) burnt by the cleaners.

The toilet facilities are desludged when full by cesspit emptying trucks at fees as indicated in Table 4.8 above. In some instances water is added to the solidified faecal matter to soften it for easy suction by the trucks.

Institutional Toilets

Most of institutional toilet facilities are managed by the owner-institutions. The institution provides all the logistics such as anal cleansing material, water, waste basket, cleaning equipment, etc. for the daily operation and maintenance of the facility. The institutional toilet facility usually serves only members of the institutions and visitors who visit the institutions

It was observed that the hygienic conditions of the institutional toilets are better maintained than the public toilets. The toilet facilities are desludged when full by cesspit emptying trucks.

4.1.6 Characteristics of Faecal Sludge and Production Capacity

Per Capita and Consistency of Faecal Sludge

Table 4.9 below presents the per capita production of human excreta including its chemical composition.

Table 4.9: Human Excreta: Per Capita Quantities and their Resource Value (Strauss 1985)

Parameter	**Faeces**	**Urine**	**Excreta**
Quantity and consistency			
a. Gram/cap·day (wet)	250	1,200	1,450
b. Gram/cap·day (dry)	50	60	110
c. Including 0.35 litres for anal cleansing, gram/cap·day (wet)			1,800
d. m^3/cap·year (upon storage and digestion for ≥ 1 year in pits or vaults in hot climate)			0.04-0.07
e. Water content [%]			50 - 95
Chemical composition	% of dry solids		
Organic matter	92	75	83
C	48	13	29
N	4-7	14-18	9-12
P_2O_5	4	3.7	3.8
K_2O	1.6	3.7	2.7

Comparison of different sources of N, P, K: % of dry solids			
	N	P_2O_5	K_2O
Human excreta	9-12	3.8	2.7
• Plant matter	1 - 11	0.5 - 2.8	1.1 - 11
• Pig manure	4 - 6	3 - 4	2.5 - 3
Cow manure	2.5	1.8	1.4

Source: Stauss M. and Montangero A., 2001. Faecal Sludge Treatment. EAWAG/ SANDEC.

Table 4.10 below presents values for daily per capita volumes and loads of organic matter, solids and nutrients in faecal sludges collected from septic tanks and pit latrines, as well as from low or zero-flush, un-sewered public toilets. Values for fresh excreta are given for comparative purposes.

Table 4.10: Daily Per Capita Volumes, BOD, TS, and TKN Quantities of Different Types of Faecal Sludge.

Parameter	Septage [1]	Public toilet sludge [1]	Pit latrine sludge [2]	Fresh excreta
BOD [g/cap•day]	1	16	8	45
TS [g/cap•day]	14	100	90	110
TKN [g/cap•day]	0.8	8	5	10
Volume [l/cap•day]	1	2 (includes water for toilet cleansing)	0.15 – 0.20	1.5 (faeces and urine

Source: Stauss M. and Montangero A., 2001. Faecal Sludge Treatment. EAWAG/SANDEC.

Note:

Estimates are based on a faecal sludge collection survey conducted in Accra, Ghana. Figures have been estimated on an assumed decomposition process occurring in pit latrines. According to the frequently observed practice, only the top portions of pit latrines (~ 0.7 ...1 m) are presumed to be removed by the suction tankers, since the lower portions have often solidified to an extent that does not allow vacuum emptying. Hence, both per capita volumes and characteristics will range higher than in the material which has undergone more extensive decomposition.

Faecal Sludge Quality and Variability

Table 4.11 shows faecal sludge from on-site sanitation systems in tropical countries and their characteristics, classification and comparison with tropical sewage.

Table 4.11: Faecal sludge from on-site sanitation systems in tropical countries (after Strauss et al. 1997 and Mara 1978)

Item	Type "A" (high-strength)	Type "B" (low-strength)	Sewage - for comparison's sake
Example	Public toilet or bucket latrine sludge	Septage	Tropical sewage
Characterisation	Highly concentrated, for days or weeks only	FS of low concentration; years; more stabilised	
COD mg/l	20,000 - 50,000	< 15,000	500 - 2,500
COD/BOD	5 : 1 .... 10 : 1		2 : 1
NH_4-N mg/l TS	2,000 - 5,000	< 1,000	30 - 70
mg/l SS mg/l	3.5 %	< 3 %	< 1 %
Helm. eggs, no./l	30,000	≅ 7,000	200 - 700
	20,000 - 60,000	≅ 4,000	300 - 2,000

Source: Stauss M. and Montangero A., 2001. Faecal Sludge Treatment. EAWAG/SANDEC.

Organic and solids contents, ammonium and helminth eggs concentrations measured in faecal sludge are normally higher by a factor of 10 or more than in wastewater. Moreover, faecal sludge differs from wastewater by the fact that its quality is subject to high variations. Storage duration, temperature, intrusion of groundwater in septic tanks, performance of septic tanks, and tank emptying technology and pattern are parameters which influence the sludge quality and are therefore responsible for its high variability. Fresh, undigested faecal sludge as produced in public toilets does not lend itself to dewatering. The dewaterability is a varying parameter as well, which is related to the degree of stability.

4.1.7 Quantity of Faecal Sludge Produced

The total quantity of faecal sludge generated by a community is estimated based on the population and the per capita faecal sludge generation volumes indicated in Table 4.10 above, Tables 4.12a, 4.12b, 4.12c and 4.12d present the faecal sludge generated in each of the selected study community. The summary of the faecal sludge production is presented in Table 4.12e

Table 4.12a: Faecal Sludge Generation (Year 2014)

Region			Central			Western			Volta			Eastern		
District			Komenda Edina Eguafo Abirem	Gomoa West	Hemang Lower Denkyira	Wassa Amenfi East	Jomoro	Sefwi Wiawso	Ho West	Nkwanta North	Ketu North	Upper Manya Krobo	Birim North	Afram Plains North
Community			Edina Essaman	Dago	Twifo Hemang	Adesu	Tikobo No.2	Sefwi Asawinso	Kpedze	Sibi Hill Top	Dzodze	Akateng	New Abirem	Donkorkrom
Project Population (2014)			1,946	6,802	9,472	1,403	5,625	20,385	2,666	4,252	26,786	1,750	7,341	9,821
Share of Household	Per Capita Faecal Sludge Generation													
	WC/flush	1.0 l/cap•day	59	167	480	59	42	699	498	-	2,897	-	464	436
	KVIP	0.2 l/cap•day	16	250	32	6	29	140	33	-	811	30	261	600
	VIP	0.2 l/cap•day	37	350	414	40	160	858	64	31	1,029	24	490	75
	Pit latrine	0.2 l/cap•day	22	200	773	81	218	2,039	46	4	275	15	331	38
	Pan Latrine	0.2 l/cap•day	-	-	-	-	-	-	2	-	-	-	-	-
	Sub-Total		**133**	**967**	**1,699**	**186**	**448**	**3,735**	**644**	**36**	**5,012**	**69**	**1,546**	**1,148**
Those Without Household Latrine	**Population Using Neighbour's Household Toilet**	0.2 l/cap•day	22	63	464	43	50	347	27	-	289	21	104	134
	Population Using Public Toilet	2.0 l/cap•day	2,810	1,456	76	878	1,193	5,096	2,586	-	22,286	1,656	1,850	6,835
	Population Practising Open Defecation	1.5 l/cap•day	-	2,388	810	84	4,058	336	16	6,110	1,085	669	33	2,607
Grand Total			**2,965**	**4,873**	**3,048**	**1,191**	**5,749**	**9,514**	**3,273**	**6,146**	**28,672**	**2,392**	**3,533**	**10,724**

Table 4.12b: Faecal Sludge Generation (Base Year 2015)

Region			Central			Western			Volta			Eastern		
District			Komenda Edina Eguafo Abirem	Gomoa West	Hemang Lower Denkyira	Wassa Amenfi East	Jomoro	Sefwi Wiawso	Ho West	Nkwanta North	Ketu North	Upper Manya Krobo	Birim North	Afram Plains North
Community			Edina Essaman	Dago	Twifo Hemang	Adesu	Tikobo No.2	Sefwi Asawinso	Kpedze	Sibi Hill Top	Dzodze	Akateng	New Abirem	Donkorkrom
Project Population (Base Year 2015)			2,006	6,972	13,356	1,445	5,805	20,793	2,733	4,358	27,295	1,787	7,495	10,175
Share of Household	Per Capita Faecal Sludge Generation													
	WC/flush	1.0 l/cap•day	61	171	677	61	43	713	510	-	2,952	-	474	451
	KVIP	0.2 l/cap•day	16	256	44	6	30	143	34	-	827	30	266	621
	VIP	0.2 l/cap•day	38	359	584	41	165	875	66	32	1,049	25	500	78
	Pit latrine	0.2 l/cap•day	22	205	1,090	84	225	2,080	48	5	280	15	338	39
	Pan Latrine	0.2 l/cap•day	-	-	-	-	-	-	3	-	-	-	-	-
	Sub-Total		**138**	**992**	**2,395**	**192**	**463**	**3,810**	**660**	**37**	**5,107**	**70**	**1,578**	**1,189**
Those Without Household Latrine	**Population Using Neighbour's Household Toilet**	0.2 l/cap•day	22	64	654	44	51	353	27	-	295	21	106	138
	Population Using Public Toilet	2.0 l/cap•day	2,897	1,492	107	905	1,231	5,198	2,651	-	22,709	1,691	1,889	7,082
	Population Practising Open Defecation	1.5 l/cap•day	-	2,447	1,142	87	4,188	343	16	6,262	1,105	684	34	2,701
												47		
Grand Total			**3,057**	**4,995**	**4,298**	**1,227**	**5,933**	**9,705**	**3,355**	**6,299**	**29,217**	**2,442**	**3,607**	**11,111**

Table 4.12c: Faecal Sludge Generation (10-Years, 2025)

Share of Population Using Toilet Facilities (10-Years Projection, 2025)														
Region			**Central**			**Western**			**Volta**			**Eastern**		
District			**Komenda Edina Eguafo Abirem**	**Gomoa West**	**Hemang Lower Denkyira**	**Wassa Amenfi East**	**Jomoro**	**Sefwi Wiawso**	**Ho West**	**Nkwanta North**	**Ketu North**	**Upper Manya Krobo**	**Birim North**	**Afram Plains North**
Community			**Edina Essaman**	**Dago**	**Twifo Hemang**	**Adesu**	**Tikobo No.2**	**Sefwi Asawinso**	**Kpedze**	**Sibi Hill Top**	**Dzodze**	**Akateng**	**New Abirem**	**Donkorkrom**
Project Population (10-Years 2025)			2,723	8,925	19,960	1,942	7,954	25,346	3,498	5,579	32,948	2,199	9,227	14,491
Share of Household	**Per Capita Faecal Sludge Generation**													
	WC/flush	1.0 l/cap•day	82	219	1,011	82	59	869	653	-	3,563	-	583	643
	KVIP	0.2 l/cap•day	22	328	66	8	41	174	44	-	998	37	328	885
	VIP	0.2 l/cap•day	52	460	873	55	227	1,066	84	41	1,266	30	616	111
	Pit latrine	0.2 l/cap•day	30	263	1,629	112	308	2,535	61	6	338	19	416	55
	Pan Latrine	0.2 l/cap•day	-	-	-	-	-	-	3	-	-	-	-	-
	Sub-Total		**187**	**1,269**	**3,579**	**258**	**634**	**4,644**	**845**	**47**	**6,165**	**87**	**1,943**	**1,694**
Those Without Household Latrine	**Population Using Neighbour's Household Toilet**	0.2 l/cap•day	30	82	978	59	70	431	35	-	356	26	131	197
	Population Using Public Toilet	2.0 l/cap•day	3,932	1,910	160	1,216	1,686	6,337	3,393	-	27,413	2,080	2,325	10,086
	Population Practising Open Defecation	1.5 l/cap•day	-	3,133	1,707	117	5,739	418	21	8,017	1,334	841	42	3,847
												58		
Grand Total			**4,149**	**6,394**	**6,424**	**1,649**	**8,129**	**11,830**	**4,294**	**8,064**	**35,268**	**3,005**	**4,441**	**15,824**

Table 4.12d: Faecal Sludge Generation (15-Years, 2030)

Region			Central			Western			Volta			Eastern		
District			Komenda Edina Eguafo Abirem	Gomoa West	Hemang Lower Denkyira	Wassa Amenfi East	Jomoro	Sefwi Wiawso	Ho West	Nkwanta North	Ketu North	Upper Manya Krobo	Birim North	Afram Plains North
Community			Edina Essaman	Dago	Twifo Hemang	Adesu	Tikobo No.2	Sefwi Asawinso	Kpedze	Sibi Hill Top	Dzodze	Akateng	New Abirem	Donkorkrom
Project Population (15-Years 2030)			3,172	10,098	24,402	2,251	9,311	27,984	3,958	6,312	36,199	2,440	10,237	17,295
Share of Household	Per Capita Faecal Sludge Generation													
	WC/flush	1.0 l/cap•day	96	248	1,236	95	69	959	739	-	3,915	-	647	767
	KVIP	0.2 l/cap•day	26	371	81	10	47	192	49	-	1,096	42	364	1,056
	VIP	0.2 l/cap•day	61	520	1,067	64	265	1,177	95	46	1,391	34	683	132
	Pit latrine	0.2 l/cap•day	35	297	1,992	130	361	2,799	69	7	371	21	462	66
	Pan Latrine	0.2 l/cap•day	-	-	-	-	-	-	4	-	-	-	-	-
	Sub-Total		**217**	**1,436**	**4,376**	**299**	**742**	**5,127**	**956**	**53**	**6,773**	**96**	**2,156**	**2,022**
Those Without Household Latrine	**Population Using Neighbour's Household Toilet**	0.2 l/cap•day	36	93	1,196	68	82	476	40	-	391	29	145	235
	Population Using Public Toilet	2.0 l/cap•day	4,580	2,161	195	1,409	1,974	6,996	3,839	-	30,118	2,308	2,580	12,037
	Population Practising Open Defecation	1.5 l/cap•day	-	3,544	2,086	135	6,718	462	24	9,070	1,466	933	46	4,592
												64		
Grand Total			**4,833**	**7,234**	**7,853**	**1,911**	**9,516**	**13,061**	**4,859**	**9,123**	**38,748**	**3,335**	**4,927**	**18,886**

Table 4.12e: Summary of Faecal Sludge Generation

Region		Central			Western			Volta			Eastern		
District		Komenda Edina Eguafo Abirem	Gomoa West	Hemang Lower Denkyira	Wassa Amenfi East	Jomoro	Sefwi Wiawso	Ho West	Nkwanta North	Ketu North	Upper Manya Krobo	Birim North	Afram Plains North
Community		Edina Essaman	Dago	Twifo Hemang	Adesu	Tikobo No.2	Sefwi Asawinso	Kpedze	Sibi Hill Top	Dzodze	Akateng	New Abirem	Donkorkrom
		(litres/day)	(litres/day)	(litres/day)	(litres/day)	(litres/day)	(litres/day)	(litres/day)	(litres/day)	(litres/day)	(litres/day)	(litres/day)	(litres/day)
Projected Year	2014	2,965	4,873	3,048	1,191	5,749	9,514	3,273	6,146	28,672	2,392	3,533	10,724
	2015	3,057	4,995	4,298	1,227	5,933	9,705	3,355	6,299	29,217	2,442	3,607	11,111
	2025	4,149	6,394	6,424	1,649	8,129	11,830	4,294	8,064	35,268	3,005	4,441	15,824
	2030	4,833	7,234	7,853	1,911	9,516	13,061	4,859	9,123	38,748	3,335	4,927	18,886
Unit		m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day
Projected Year	2014	2.97	4.87	3.05	1.19	5.75	9.51	3.27	6.15	28.67	2.39	3.53	10.72
	2015	3.06	4.99	4.30	1.23	5.93	9.70	3.35	6.30	29.22	2.44	3.61	11.11
	2025	4.15	6.39	6.42	1.65	8.13	11.83	4.29	8.06	35.27	3.01	4.44	15.82
	2030	4.83	7.23	7.85	1.91	9.52	13.06	4.86	9.12	38.75	3.33	4.93	18.89

Shit Flow Diagrams

The flow of faecal sludge from the point of generation to the final destination for the selected study communities is as presented in Figure 4.2 to Figure 4.13 below.

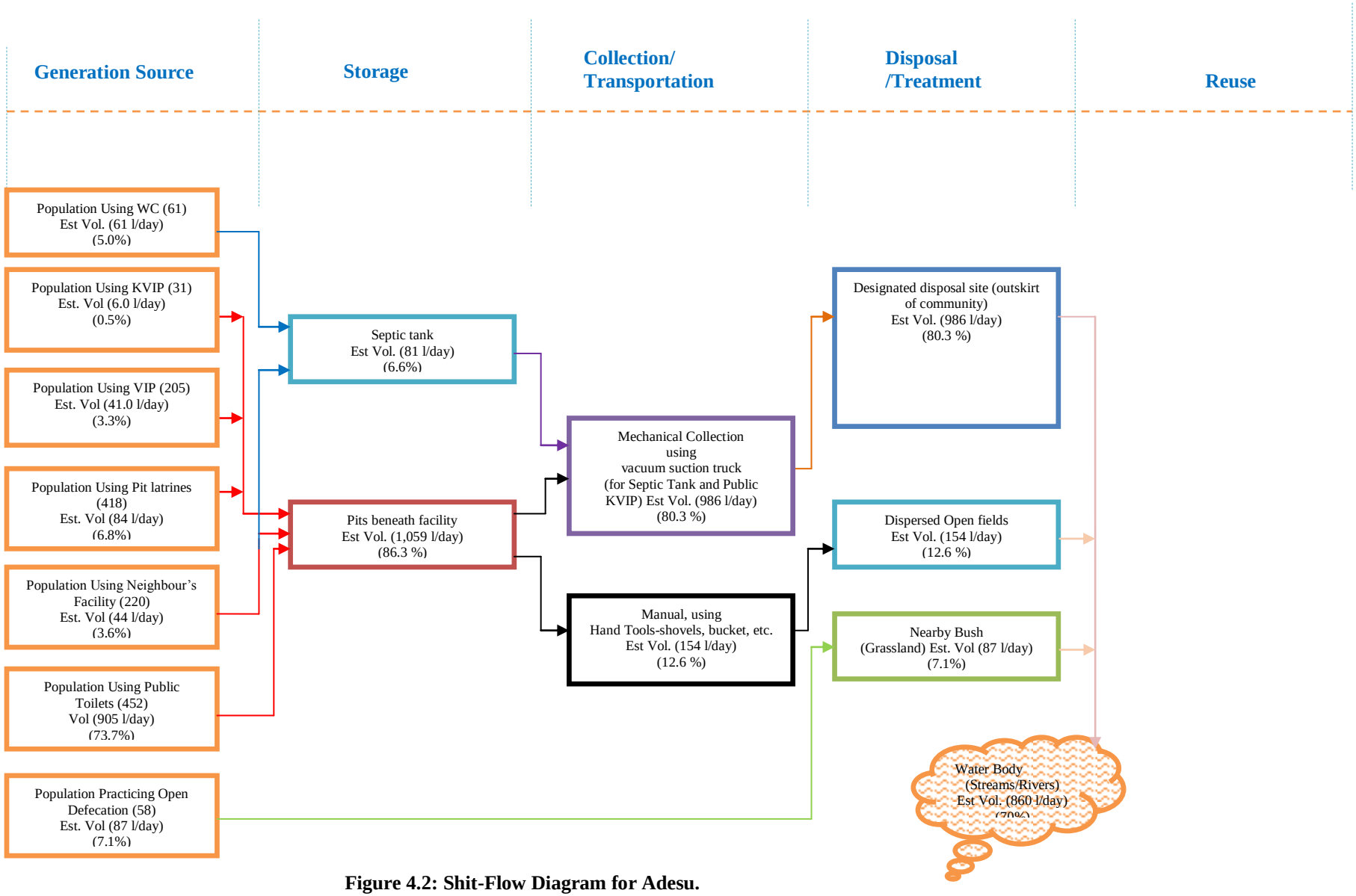


Figure 4.2: Shit-Flow Diagram for Adesu.

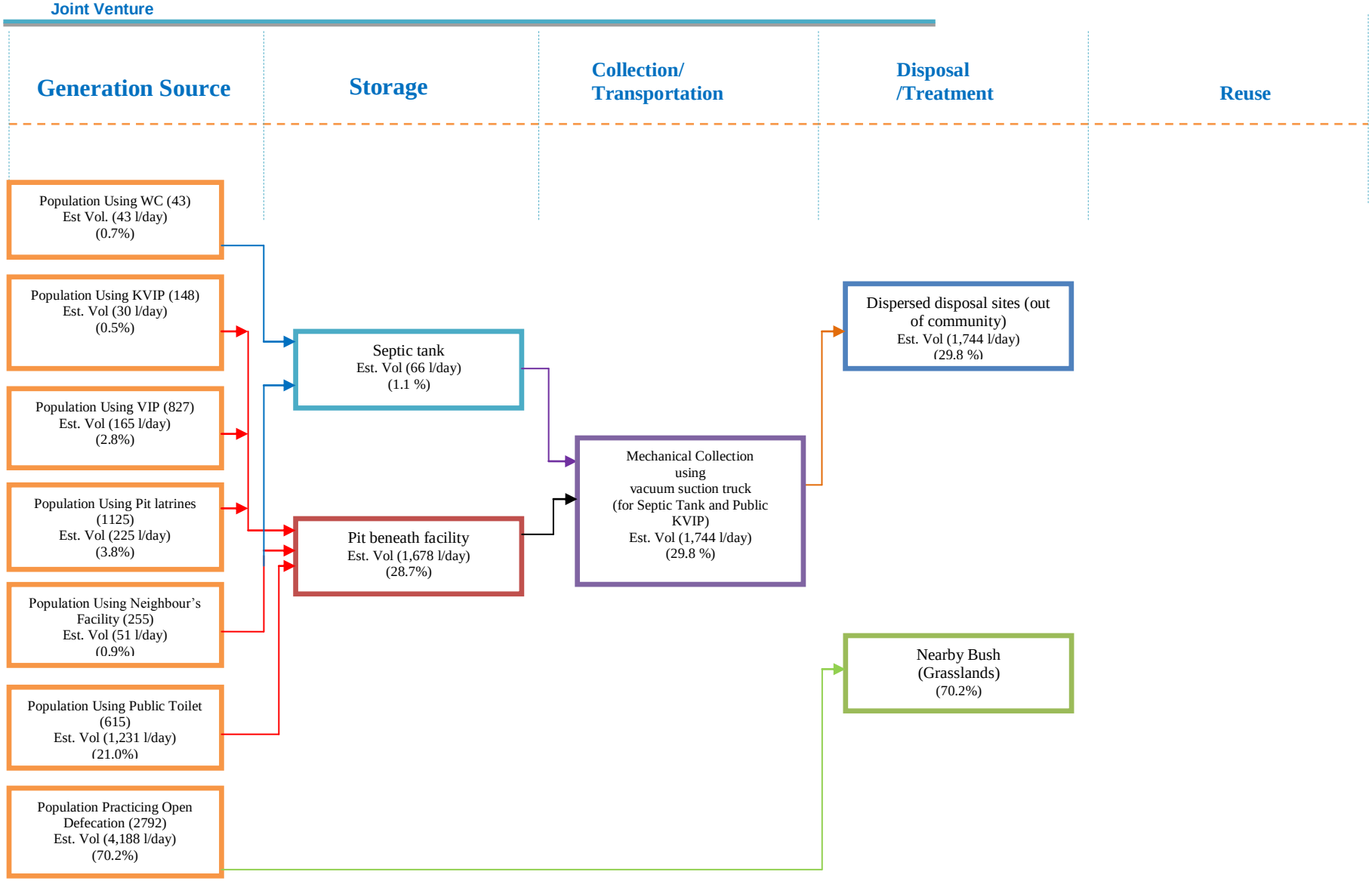


Figure 4.3: Shit-Flow Diagram for Tikobo No.2

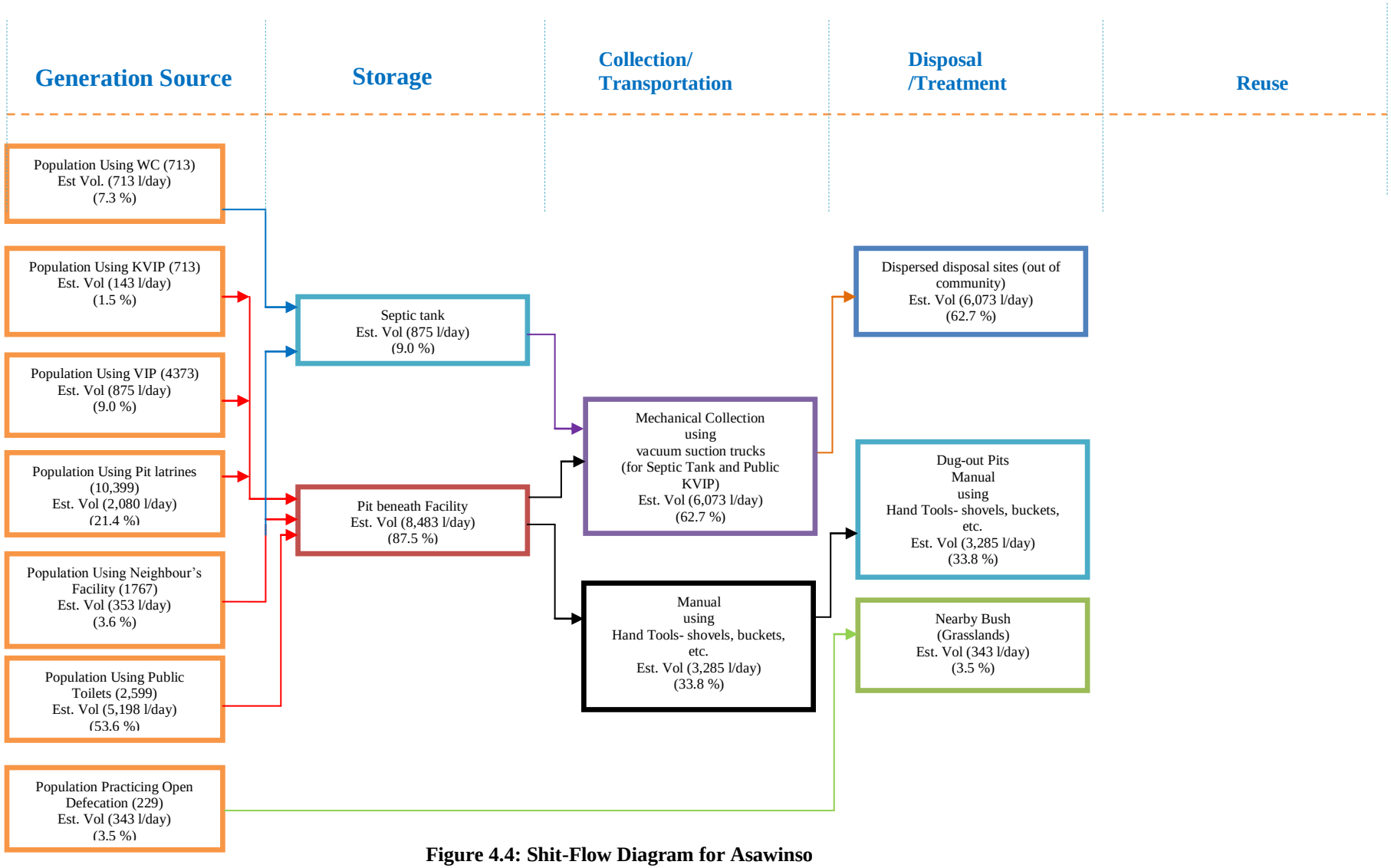


Figure 4.4: Shit-Flow Diagram for Asawinso

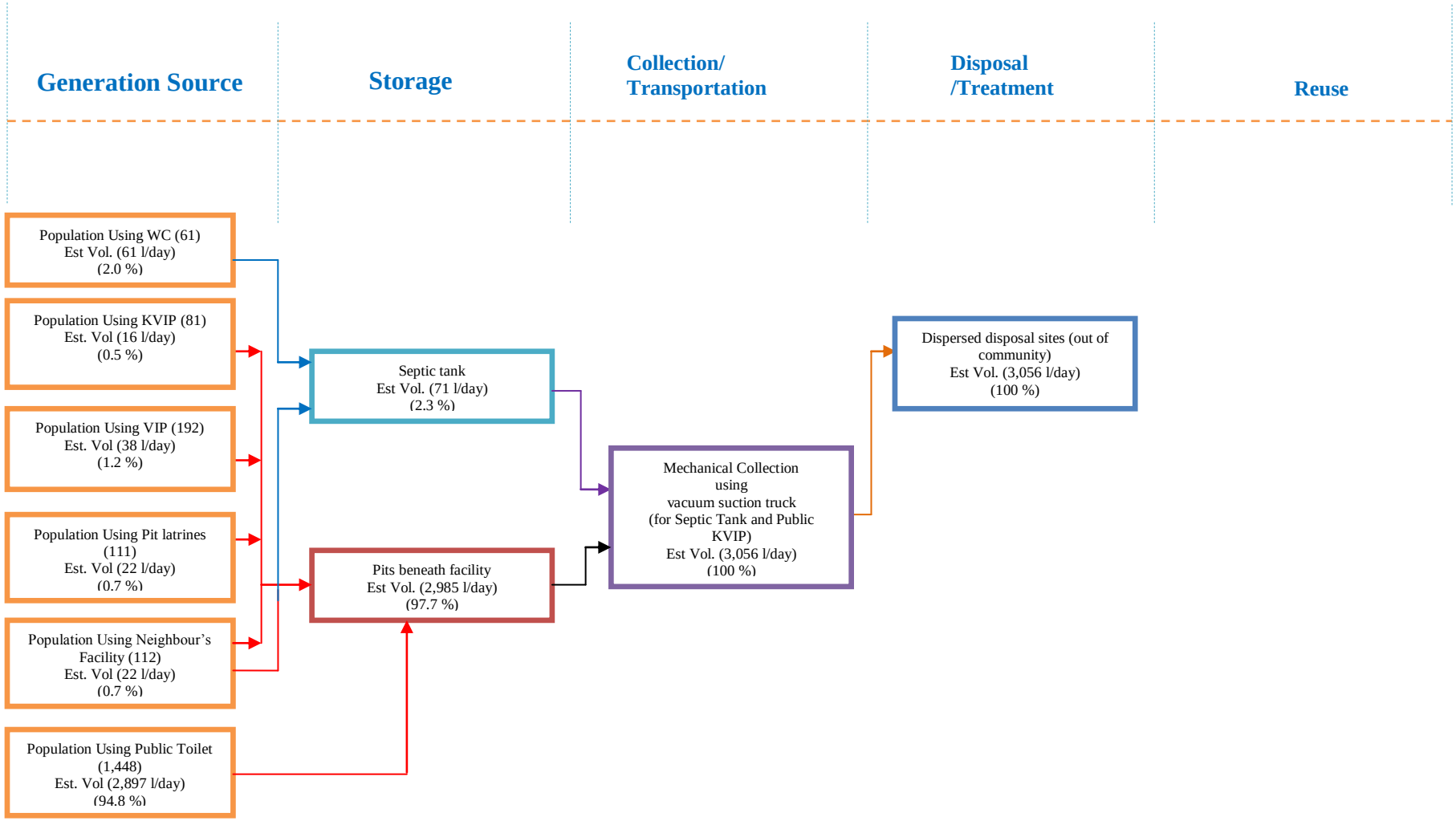


Figure 4.5: Shit-Flow Diagram for Edina Essaman.

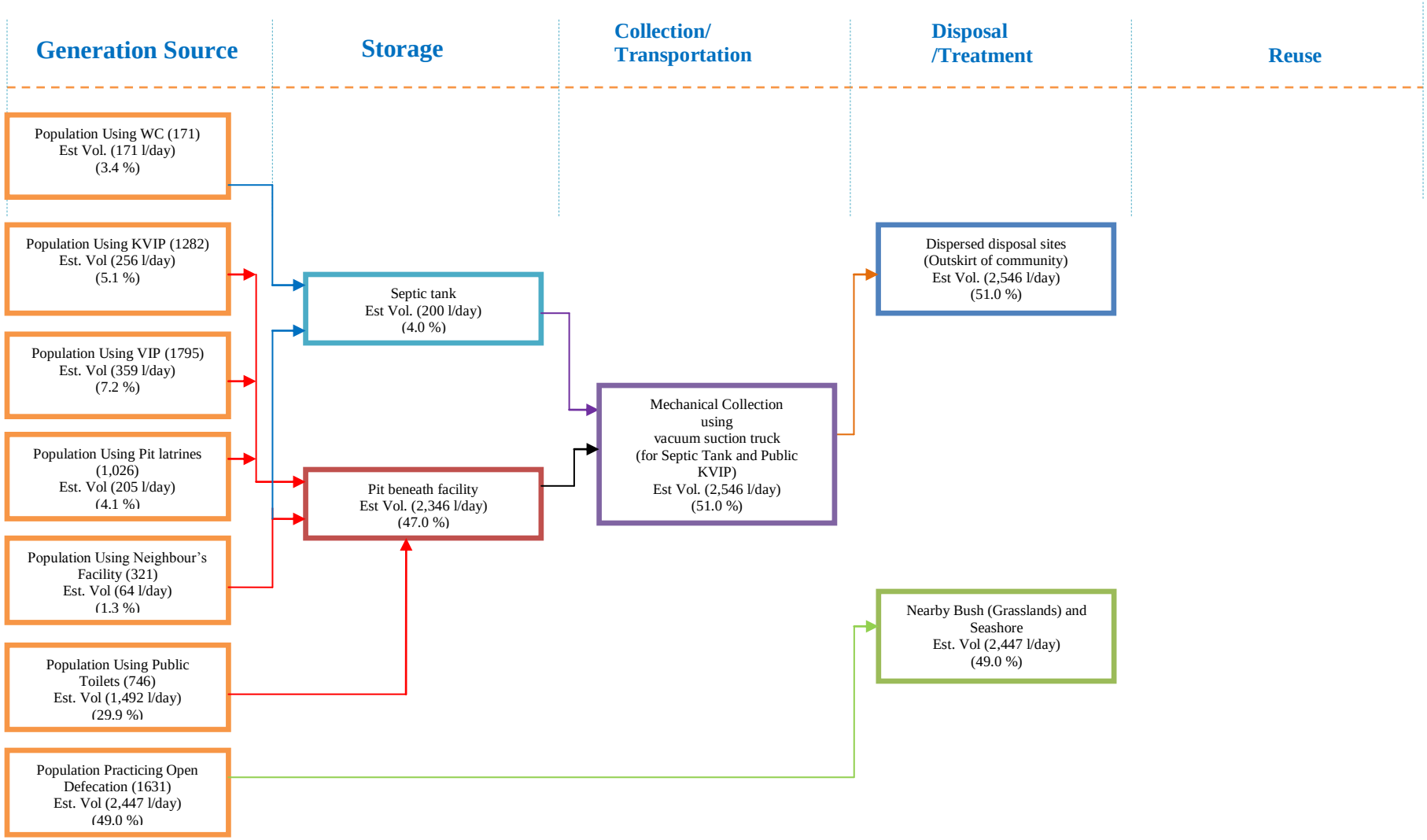


Figure 4.6 Shit-Flow Diagram for Dago

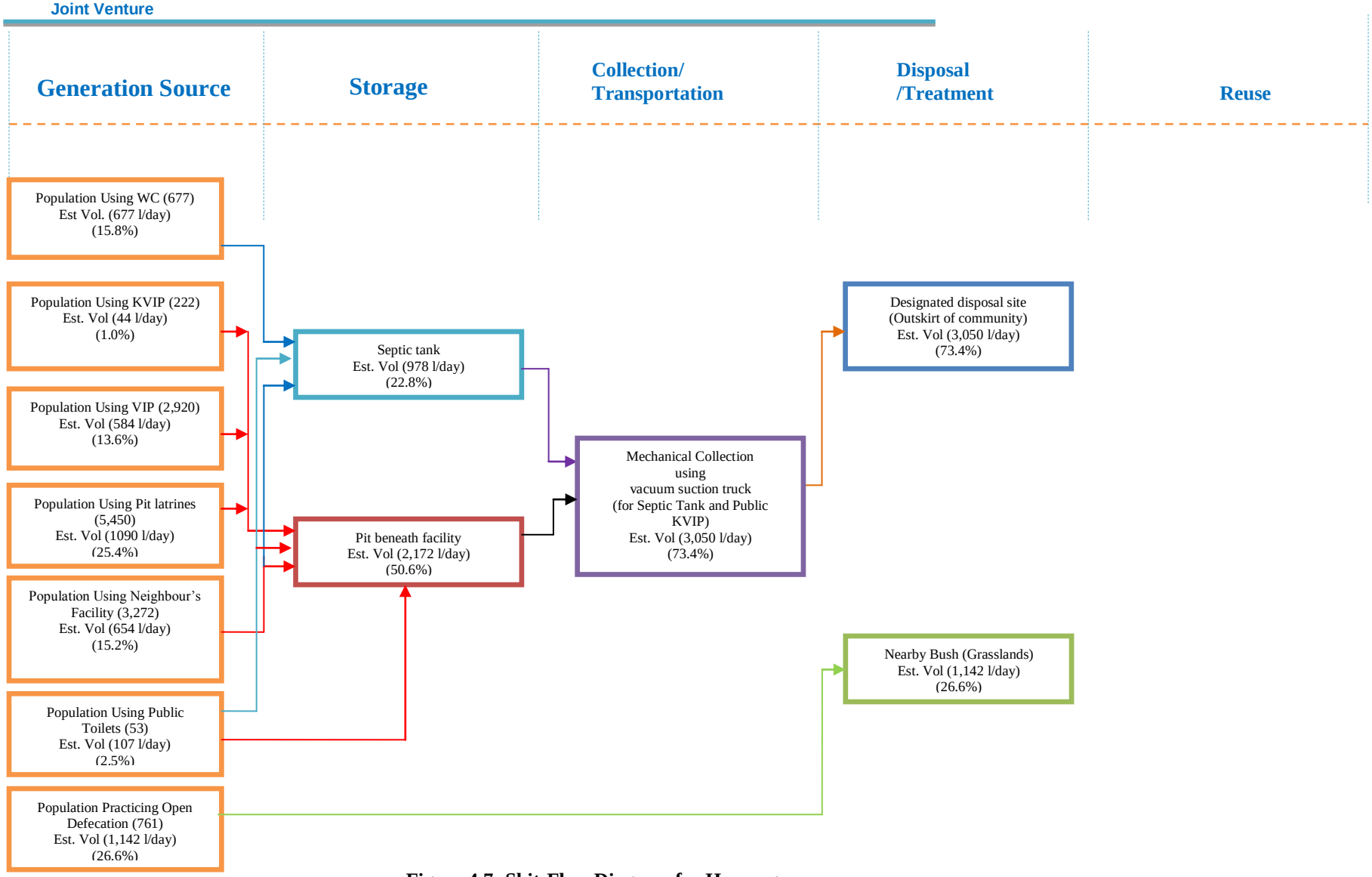


Figure 4.7: Shit-Flow Diagram for Hemang

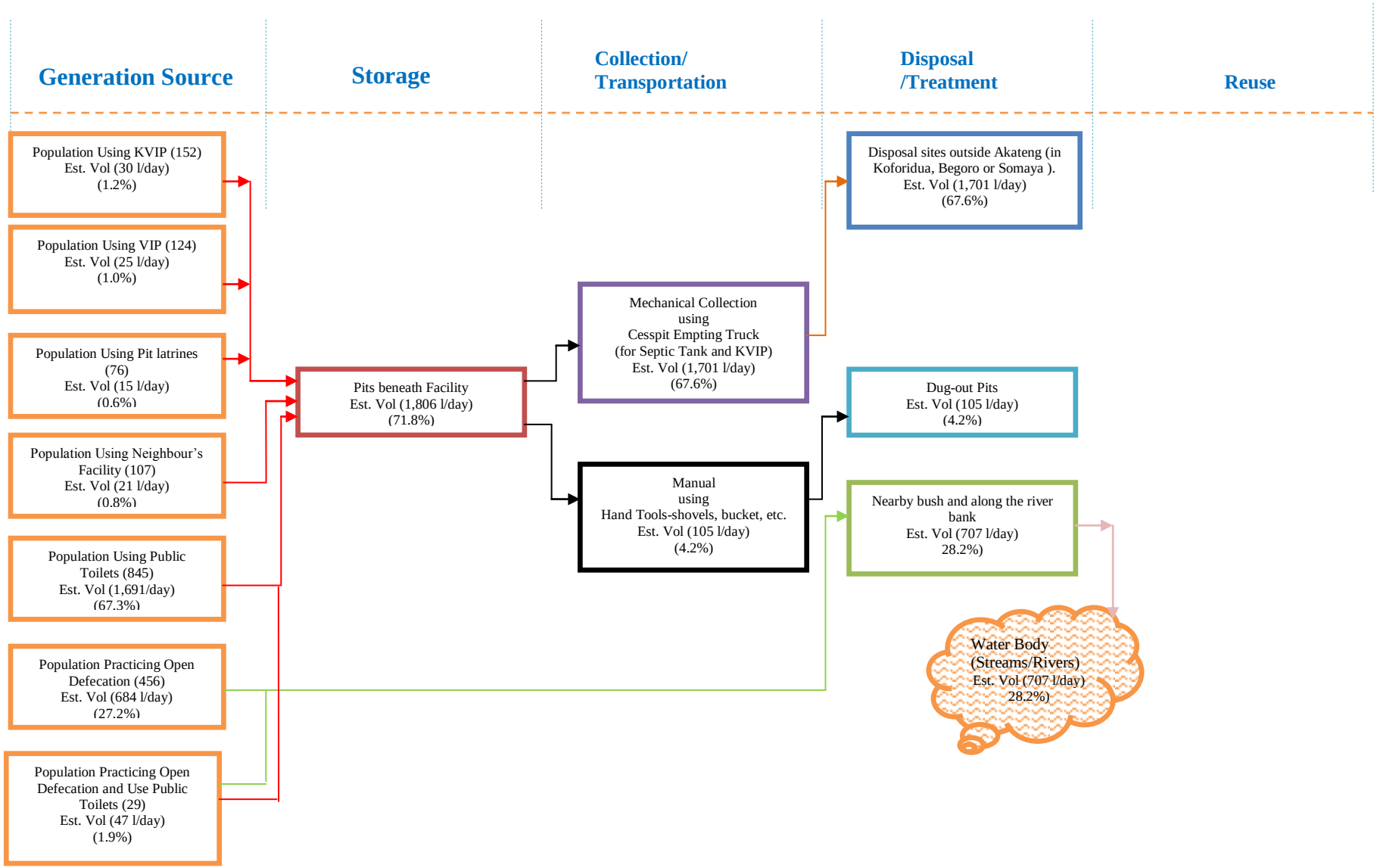


Figure 4.8 Shit-Flow Diagram for Akateng

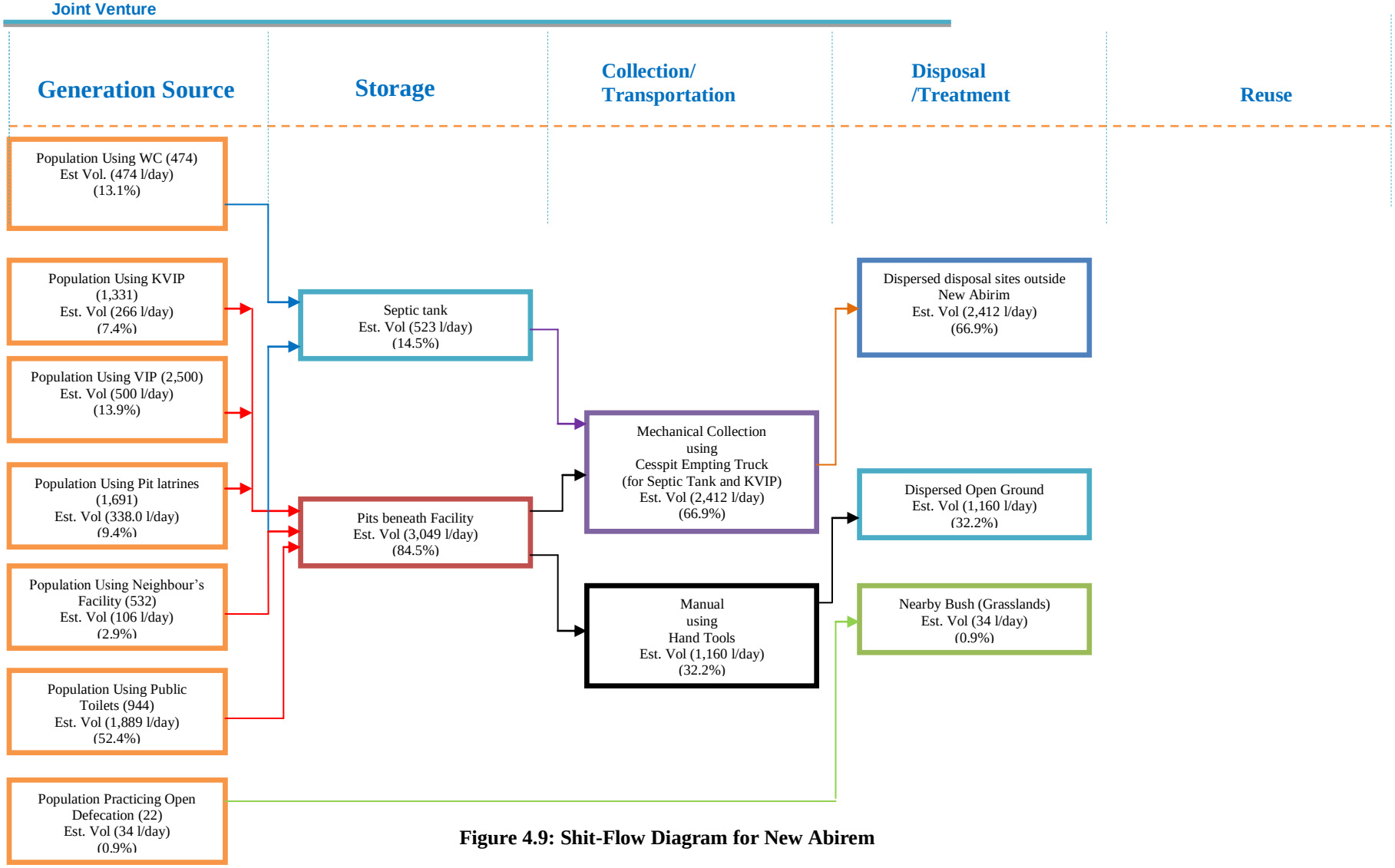


Figure 4.9: Shit-Flow Diagram for New Abirem

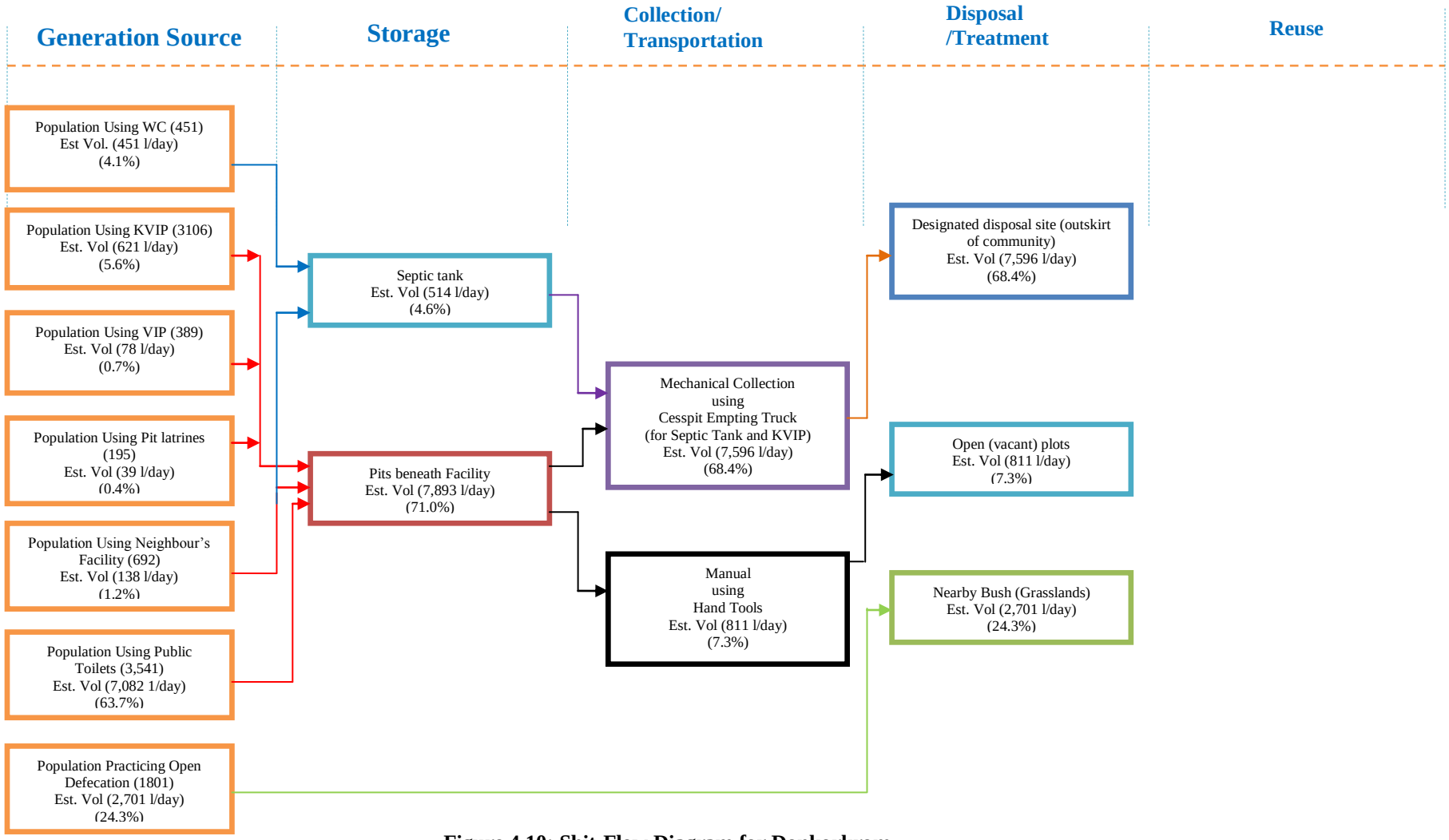


Figure 4.10: Shit-Flow Diagram for Donkorkrom

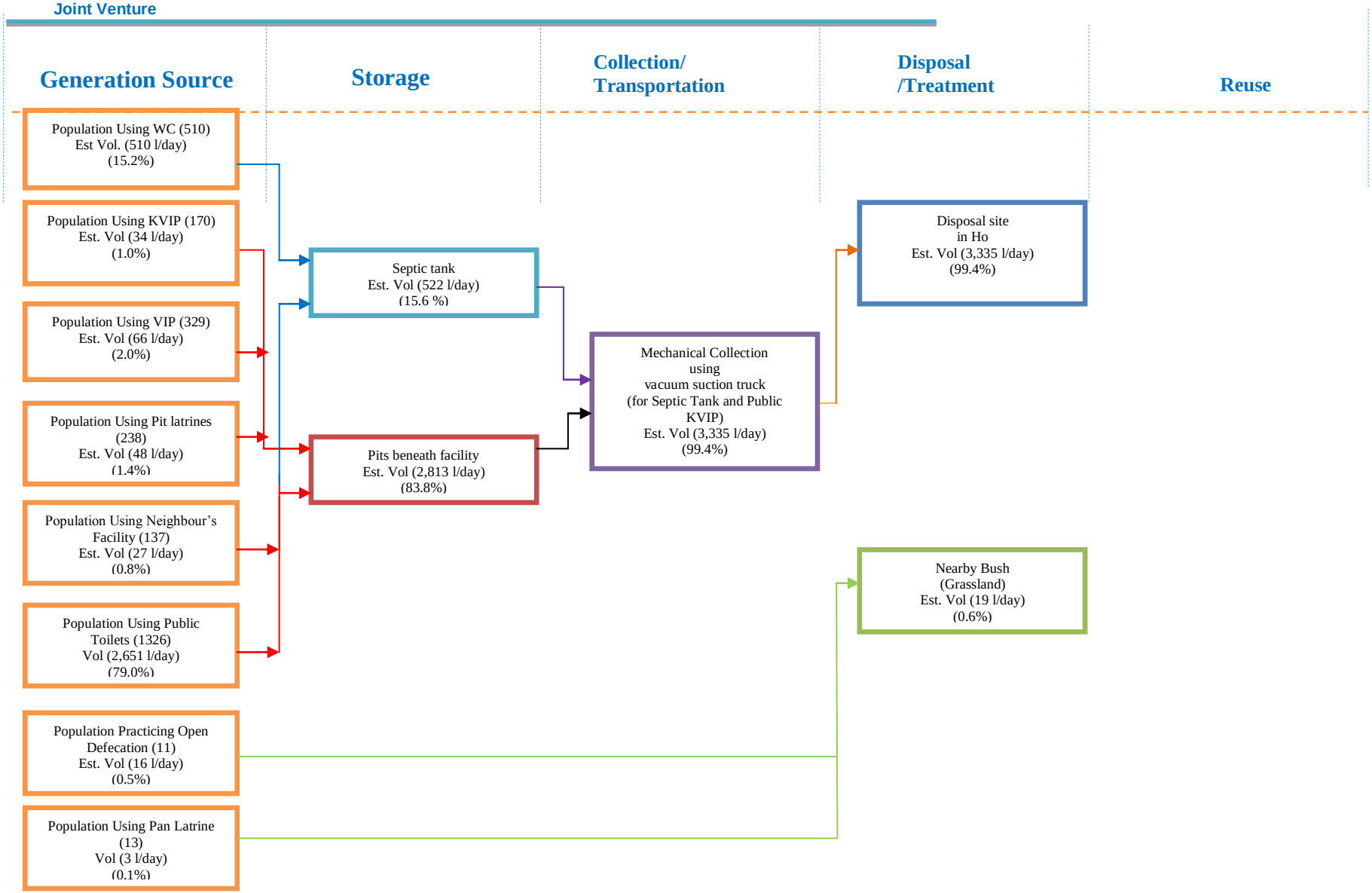


Figure 4.11: Shit- Flow Diagram for Kpedze

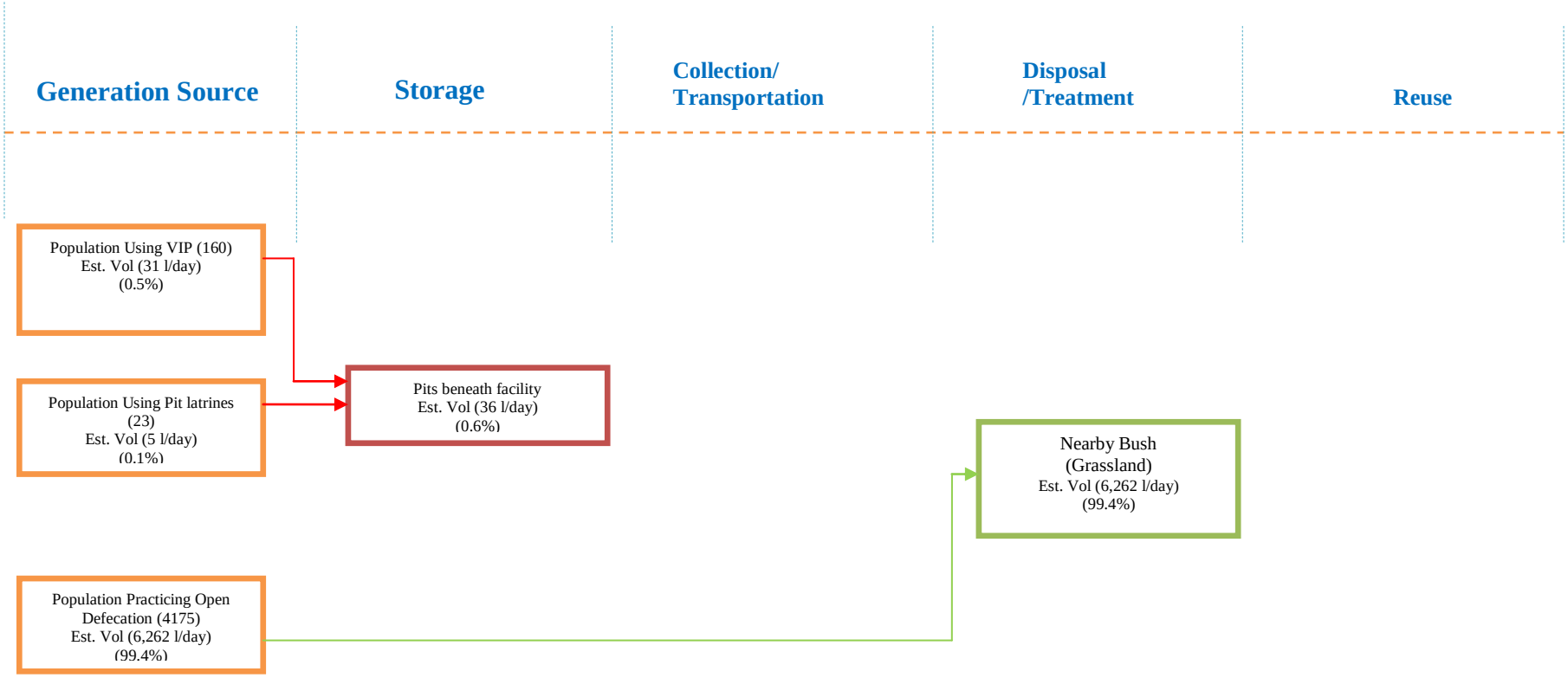


Figure 4.12: Shit-Flow Diagram for Sibi Hill Top

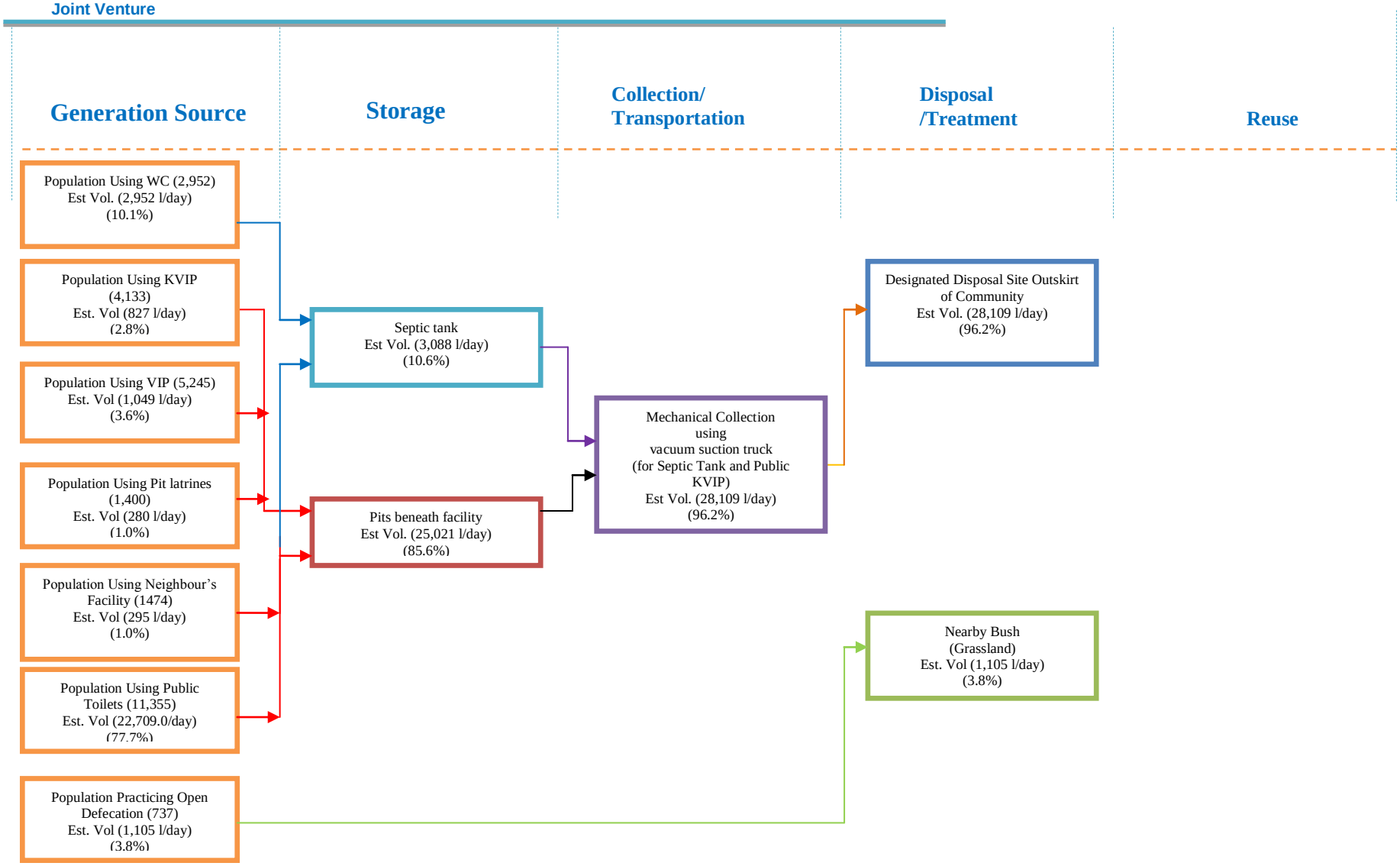


Figure 4.13: Shit- Flow Diagram Dzodze

4.1.8 Attitude, Knowledge, Practice and Environmental Sanitation Issues

Attitude towards Sanitation Service Providers

Attitude is often a direct function of a person's beliefs, norms and values and influences the individual's predisposition to certain opinions. Therefore depending on one's socio-cultural setting, knowledge and environment, one's attitude towards sanitation will vary. Generally, most people have a repulsive attitude towards human excreta and consider it as disgusting to be associated with it. Operators of cesspit emptiers and attendants of public toilets are sometimes looked down upon. There is however some evidence of a gradual shift from such attitudes and perception as people are becoming more conscious and aware of the health and economic benefits of proper human excreta/faecal disposal and treatment. With the exception of Dzodze and New Abirem who had some private desludging service providers within the community, the remaining communities rely on service providers from nearby larger towns.

Awareness on Proper Handling of Human Excreta

Based on the responses from the communities on their preference for household toilets and the reasons cited, it is evident that there is high level of awareness of the need for proper and hygienic disposal of human excreta. However, as a result of the high reliance on public facilities little attention is paid to how excreta are disposed-off as it is deemed as the responsibility of the operator. The few households which own toilets are responsible for the final disposal of excreta from their facilities.

4.2 Existing Solid Waste Management and Grey Water Disposal Situation

4.2.1 Solid Waste

Every household in the selected study communities has a refuse storage receptacle such as plastic bins, baskets, fertilizer sacks etc. for storing of solid waste on a daily basis. There is no separation of waste at the household level.

Communal waste containers have been provided by the District Assemblies in most of the peri-urban communities and small towns.

Mixed refuse from households are disposed of in communal waste containers which are then lifted by waste management companies (largely private sector operators, the District Assembly waste Management Department, etc.) for final disposal at designated refuse dump sites. Community members with the exception of Kpedze pay fees for disposal of refuse into the communal containers.

Generally, community members were not satisfied with the management of solid waste. Their concerns were mainly the inadequate quantities of communal containers, frequent delays in emptying of the containers when full and lack of environmental sanitation education in the communities.

In communities where communal containers have not been provided, most household members resort to dumping of refuse indiscriminately in their backyards or burial in pits. A handful of household members dispose of their refuse at designated refuse dump sites.

In many of the communities, refuse dump sites located within or close to built-up areas are periodically spread and compacted with earth moving machines hired by the District Assembly. In a few cases refuse dumps are evacuated using front-end loaders and tipper/skip trucks for disposal at the outskirts of the communities.

New Abirem in the Birim North District Assembly is the only community where it was reported that a new engineered landfill site is currently under construction at Old Abirem receive solid waste from its environs. This is being sponsored by Newmont Golden Ridge Limited as part of its corporate social responsibilities (CSR) to the communities within the enclave of its mining area.

4.2.2 Storm Water and Sullage (Grey) Water Conveyance

Most of the study communities had no effective drainage systems for stormwater and sullage conveyance. However, communities by main trunk roads have drains along the major roads.

Sullage and wastewater from kitchens and bathrooms respectively are disposed-off into the open lots/spaces, earth drains, soakage pits and septic tanks. Sullage and wastewater that are discharged into the open field runs along the lanes and in some cases stagnate as small ponds which serve are breeding grounds for mosquitoes and cause health risk to members of the communities. The profile of the storm water and sullage water conveyance is presented in Table 4.13 below.

Table 4.13: Profile of the storm water and sullage water conveyance

Storm Water and Sullage (Grey) Water Conveyance													
Parameter		Western Region			Central Region			Eastern Region			Volta Region		
		Adesu	Tikobo No.2	Sefwi Asawinso	Edina Essaman	Dago	Hemang	Akateng	New Abirem	Donkorkrom	Kpedze	Sibi Hill Top	Dzodze
Knowledge of Respondents on	*Incidence of flooding*	13.2%	0.3%	5.3%	62.5%	4.8%	4.8%	15.6%	13.9%	11.4%	9.1%	10.6%	20.8%
	Incidence of no flooding	86.8%	99.7%	94.7%	37.5%	95.2%	95.2%	84.4%	86.1%	88.6%	90.9%	89.4%	79.2%
Share Of Households who Dispose-Off Sullage from Kitchen & Bathhouse into	*Soakage pit*	3.5%	0.3%	21.6%	3.7%	8.1%	4.8%	23.7%	31.9%	20.1%	34.0%	33.9%	35.6%
	Open lots	89.4%	98.0%	49.7%	25.5%	74.5%	56.9%	66.3%	56.4%	72.4%	35.9%	58.3%	46.2%
	Drains	6.6%	1.7%	28.7%	69.9%	17.4%	38.3%	10.0%	11.4%	6.5%	29.7%	7.8%	15.5%
	Septic tank	0.5%	-	-	0.9%	-	-	-	0.3%	1.0%	0.4%	-	2.7%

4.3 Existing Water Supply Situation

Access to safe and reliable water coupled with sound environmental cleanliness contributes greatly to improving the health status of the people. The main sources of water in the selected communities include rivers/stream, borehole fitted with hand pumps, dug-out wells, mechanised borehole system, piped-borne (treated water from GWCL), sachet water, water vendors, rainwater harvesting, etc. for drinking and non-drinking purposes.

Mechanized boreholes and pipe-borne systems are available and operational in only a few communities. Some of the water supply systems were constructed ages ago with current population outstripping their capacities. These old systems break down frequently due to their age and the poor maintenance culture. Therefore users resort to the use of unsafe sources such as streams, rivers, hand-dug wells and dugouts.

In communities where new boreholes are installed it was reported that yields are low hence the reliance on unsafe water from streams, rivers, etc. with potential risks of water borne diseases. Tables 4.14 and 4.15 present a summary profile of the water supply facilities and other characteristics for the various communities.

Table 4.14: Water Supply Facilities in the Selected Study Communities

Region	District	Community	Water Supply Source/Facilities
Western	Wassa Amenfi East	Adesu	• Two (2) community boreholes. • One (1) stand pipe tapped from a polytank.
	Jomoro	Tikobo No.2	• Borehole with hand pump • Mechanized water system • Stream but unavailable during dry seasons
	Sefwi Wiawso	Sefwi Asawinso	• Pipe borne water supply from GWCL (Kwanyako Water Works) • Hand dug wells (39 No.) • 1 borehole with hand pump • River/stream
Central	Komenda Edina Eguafo Abirem	Edina Essaman	• Piped borne water supply from the Brimso Water Works. Most residents are connected to the water network system • Household hand dug wells • Household mechanized boreholes
	Gomoa West	Dago	• Pipe borne water supply from GWCL (Kwanyako Water Works) with three (3) standpipes. The water quality is inadequate (sometimes salty and turbid)
	Twifo Hemang Lower Denkyira	Hemang	• Small Town Water Supply System (Sekyere Hemang Water Works) • Boreholes with hand pump • Hand dug wells
Eastern	Upper Manya Krobo	Akateng	• Pipe borne water supply from Safe Water Network System with no household connection. The community has three (3) water vending points • 2No. Boreholes with handpump • Afram river
	Birim North	New Abirem	• Mechanised borehole system connected to houses, institutions and communal standpipes. Reliable water supply and is managed by a community water and sanitation management team (WSMT). Household survey results indicate the water is salty. • Alternative water sources include- River Afosu, household wells and boreholes with handpump.
	Afram Plains North	Donkorkrom	• Mechanised Water Supply System • Boreholes with hand pump • Water from river (Atakorah) mostly used for washing and sometimes cooking
Volta	Ho West	Kpedze	• Untreated pipe borne water with four (4) public standpipes • River Taale
	Nkwanta North	Sibi Hill Top	• Pipe borne water supply from Kpassa-Damanko Water Supply with six (6) public standpipes • Sibi Stream • No household water connection
	Ketu North	Dzodze	• Mechanised borehole system with about 865 houses connected to the pipe borne system and with 67 public standpipes • Rainwater harvesting • Boreholes with handpumps • Kplipka river

Table 4.15: Water Supply Coverage

Parameter	Western Region			Central Region			Eastern Region			Volta Region		
	Adesu	Tikobo No.2	Sefwi Asawinso	Edina Essaman	Dago	Hemang	Akateng	New Abirem	Donkorkrom	Kpedze	Sibi Hill Top	Dzodze
Water coverage												
Drinking Water Resources												
Stream/River	2.5%	16.7	0.6%	-	-	0.4%	23.7%	0.6%	0.9%	0.7%	15.9%	-
Piped-borne	30.3%	25.3	49.7%	94.9%	95.2%	66.5	70.2%	-	78.2%	62.0%	57.1%	-
Mechanised borehole	-	-	-	-	-	-	-	71.5%	-	-	-	41.6%
Borehole hand pump	62.1%	0.3%	4.4%	0.5%		23.3%	1.4%	1.9%	18.1%	0.8%	1.3%	0.3%
Hand-Dug Wells	2.5%		31.9%	2.3%	1.1%	5.8%	0.5%	8.2%	-	6.6%	-	0.3%
Rainwater	-	-	-	-	1.1%	0.5%	-	-	0.6%	0.8%	-	18.9%
Sachet water	2.5%	-	2.2%	2.3%	2.6%	3.5%	0.9%	10.7%	0.3%	10.9%	-	18.3%
Water Vendor	-	-	11.1%	-	-	-	-	-	0.6%	1.6%	-	0.3%
Multiple drinking water sources	-	57.7%	-	-	-	-	3.3%	7.1%	1.3%	16.6%	25.7%	20.3%
Non-Drinking Water Resources												
Stream/River	-	16.7%	0.6%	-	-	2.7%	79.6%	1.9%	0.3%	2.4%	59.6	-
Pipe borne	26.4%	17.7%	40.3%	80.1%	95.2%	46.3%	17.5%	-	56.8%	65.8%	-	-
Mechanised borehole	-	-	-	-	-	-	-	52.2%	-	-	-	43.2%
Borehole hand pump	48.7%	1.0%	6.4%		0.7%	16.5%	2.4%	3.5%	40.5%	-	14.7	0.5%
Wells	24.9%	0.3%	43.3%	17.6%	3.7%	34.5%	0.5%	36.2%	-	14.5%		0.3%
Sachet water	-	-	-	-	-	-	-	-	-	-	-	2.7%
Rainwater	-	-	-	-	0.4%	-	-	1.2%	0.6%	5.5%	-	40.8%
Water Vendor	-	-	9.4%	2.3%					0.9%	1.2%	-	1.4%
Multiple drinking water sources	-	64.3%	-	-	-	-	-	5.0%	0.9%	10.6%	25.7	11.1%

Table 4.16: Water Supply Coverage Cont'd

Parameter	Western Region			Central Region			Eastern Region			Volta Region		
	Adesu	Tikobo No.2	Sefwi Asawinso	Edina Essaman	Dago	Hemang	Akateng	New Abirem	Donkorkrom	Kpedze	Sibi Hill Top	Dzodze
Time taken to access water source												
Within premises	44.4%	11.8%	49.0%	35.6%	14.5%	24.5%	7.4%	48.1%	20.2%	56.2%	1.6%	51.6%
30mins walk return	54.1%	87.9%	50.4%	64.4%	84.4%	73.9%	43.3%	48.1%	65.4%	41.1%	65.2%	45.4%
30mins- 1hr walk(return)	0.5%	-	-	-	1.1%		38.6%	3.2%	12.5%	1.9%	10.7%	3.0%
>1hr walk(return)	1.0%	0.3%	0.6%	-	-	1.6%	10.7%	0.6%	1.9%	0.8%	22.5%	-
Reliability of Water Source												
Yes	77.6%	99.3%	58.3%	89.6%	89.6%	78.5%	78.7%	70.9%	49.2%	50.4%	21%	77.8%
No	22.4%	0.7%	41.7%	10.4%	10.4%	21.5%	21.3%	29.1%	50.8%	49.6%	78.6%	22.2%
Water quality of the main drinking water source	BWH	Pipe Borne	Pipe Borne	Pipe Borne	Pipe Borne	Pipe Borne	Pipe Borne	Pipe Borne	Pipe Borne	Pipe Borne	Pipe Borne	Pipe Borne
Taste												
Neutral	74.2%	100%	91.5%	60.0%	29.8%	63.5%	81.3	69.1	21.1%	60.9%	84.3%	3.2%
Slightly salty	7.5%	0%	1.7%	12.5%	31.4%	18.9%	3.4	6.8	52.6%	23.2%	4.3%	24.2%
Salty	18.3%	0%	6.8%	27.5%	38.8%	17.6%	15.3	24.1	26.3%	15.9%	11.4%	72.6%
Hardness												
Soft	1.7%	100%	94.9%	40.0%	20.5%	77.3%	87.4	93.2	62.6%	84.6%	79.7%	13.7%
Slightly hard	0%	0%	1.7%	20.0%	0.5%	8.0%	2.7	3.9	32.5%	10.9%	1.4%	26.3%
Hard	98.3%	0%	3.4%	40.0%	79%	14.7%	9.9	2.9	4.9%	4.5%	18.8%	60%
Colour/turbidity												
Clear/no colour	95.9%	100%	96.1%	73.4%	47.4%	63.2%	63.3	93.7	89.2%	35.6%	15.0%	98.9%
Slighty coloured/turbid	0.8%	%	2.2%	1.8%	31.4%	18.4%	20.4	5.3	5.4%	51.3%	71.4%	1.1%
Colour/turbid	3.3%	%	1.7%	22.8%	44.3%	18.4%	16.3	1.0	5.4%	13.1%	13.6%	0%

4.4 Assessment of Sanitation Facility Types and Technologies

A number of the types of sanitation technologies identified in the selected communities and from the literature are assessed in this section. The objective of the assessment is to provide information on the options for adoption/adaptation where existing facilities are found to be unsuitable or do not exist at all.

The following segments in the excreta management service chain are discussed.

i. Household Toilet Types
ii. Desludging of Faecal Sludge
iii. Treatment and Re-use of faecal sludge

4.4.1 Household Toilet Types

Table 4.17 below presents an assessment of selected household latrine facilities and technologies identified in the selected communities and relevant literature. The sanitation ladder shown in Figure 4.14 is a modification of Figure 4.1 and gives the incremental improvement options for households latrines focusing on re-use of by-products

Table 4.17 Assessment of Toilet Facility Types and Technologies

Sanitation Facility Type/ Technology	Key Technical Features	Advantages	Disadvantages	Field Observation
Simple Pit Latrine	• Lined/unlined pit • Hygienic cover slab/floor • Super-structure • Seat/squat hole with foot rest • Lid to cover squat hole	• Affordable (least expensive toilet type), low capital and operating costs-appropriate for low-income households • Simple technology-easy to manage • Does not require a constant source of water • Can be built from local materials • Suitable for less densely populated area where space is available for relocating the latrine when it is full	• Odours are normally noticeable • The excreta pile in the pit is visible • Problem with fly control unless fly traps are used • Risk of groundwater and surface water contamination-not suitable for areas with high water table and flood-prone • Relatively short period for usage • Pit contents (output) not fully treated-requires further treatment before disposal	• Most of the pit latrines had super-structure • Privy rooms had foul smell • Few households had lid covering squat hole • Most squat slab had no foot rests • Pits contents are buried or disposed of at vacant lots when full. • Pits are sometimes covered with soil and abandoned
VIP	• An improved form of pit latrine • Vent pipe with a fly-screen fitted outside the superstructure to trap flies and reduce odour nuisance	• Little odour, improved fly control as compared with pit latrine • Privacy • Does not require regular water and suitable for water scarce area • Can be built with local material • Affordable • Construction and maintenance are easy • Suitable for less densely populated area where space is available for relocating the latrine when it is full • More sanitary compared to pit latrine	• Odours nuisance not fully controlled • Risk of groundwater and surface water contamination • Relatively short period for usage • Pit contents (output) not fully treated-requires further treatment before disposal • The excreta pile in the pit is visible	• Some households did not have their vent pipes extending from the pit hole-as designed • Pits contents are buried or disposed of at vacant lots when full
KVIP	• Same design as VIP but has two off-set pits. Use of pit is alternated to allow enough time (gestation period) for the decomposition/treatme	• Little odour, improved fly control • Privacy • Does not require regular water and suitable for water scarce area • Affordable but more expensive than the VIP • More hygienic compared to pit latrine • Pit contents can be used as organic manure/pit	• Construction and maintenance relatively complicated compared to VIP and traditional pit latrines • Requires more space-to construct	• Privy rooms of most public toilets visited had foul odour • Alternating pit usage mechanism not adhered to due to high attendance at the public toilets. In some cases alternating pits are being

Sanitation Facility Type/ Technology	Key Technical Features	Advantages	Disadvantages	Field Observation
	nt of the pit contents into environmentally and healthily safe pit humus.	humus-requires no further treatment		used concurrently • Pit contents desludged and disposed of at vacant lots when full
Pour Flush	• Pour flush toilets use a pit for excreta disposal and have a special pan which is cast in the floor slab and provides a water seal. • Sometimes a vent pipe with screen is fitted to the pit	• No odour-water seal eliminates entry of odour • No flies • More sanitary and convenient to use compared to KVIP, VIP and pit latrines • Privacy-can be in-built • Long life time and no need to move for many years • Suitable for all types of users (sitters, squatters, wipers and washers)	• Not appropriate where water is not available • More expensive to own and operate compared to KVIP, VIP, Pit latrine • Orientation for users needed for latrine maintenance, especially the bowl • Frequent desludging of toilet required every 3-5 years • Not appropriate in very cold areas where water seal may freeze • Further treatment of septage required • Risk of water pollution (sewer leakage, no treatment of discharged toilet wastewater) • Requires materials and skills for production that are not available everywhere • Coarse dry cleansing materials may clog the water seal	•
Water Closet/Cistern flush (connected to septic tank/sewer)	• Similar design feature as pour flush but water stored in the cistern above the toilet bowl and is released by pushing or pulling a lever	• Comfortable and hygienic to use • No odour • No flies • Privacy-can be in-built • Long life time and no need to move for many years • Suitable for all types of users (sitters, squatters, wipers and washers) • Easy to use and clean	• High capital and O&M costs; operating costs depend on the price of water • Technology is water dependent-requires a constant source of water • Cannot be built and/or repaired locally with available materials • Large volumes of sewage/septage to handle • Technical support required during installation • Septage/sewage (output) requires further treatment • Risk of water pollution (sewer leakage, no treatment of discharged toilet wastewater) • Orientation for users needed for latrine maintenance	• Only a few households use WC toilets • Septic tanks (both household and public) mechanically desludged using vacuum suction trucks). • Service providers (vacuum suction truck) dispose of the collected septage in open fields-designated or dispersed

Sanitation Facility Type/ Technology	Key Technical Features	Advantages	Disadvantages	Field Observation
Aqua Privy	• Similar design to a septic tank, the latrine is located directly over the tank, which means less water is needed for flushing. Shit hole directly extends into the pit	• Convenient and hygienic to use • Cheaper and less maintenance than septic tank systems	• Must be water tight to maintain a constant liquid level • Expensive • Difficult to construct within house-often public type • Large volumes of sewage/septage to handle • Requires a constant supply of water	• Only 1 (one) public toilet observed in New Abirem
Urine-Diverting Flush Toilet	• The urine-diverting flush toilet (UDFT) is similar in appearance to a Cistern Flush Toilet except for the diversion in the bowl. • The toilet bowl has two sections so that the urine can be separated from the faeces. • Both sitting and squatting models exist.	• Easy and convenient to use- like, and can be used almost like, a Cistern Flush Toilet (WC) • Requires less water than a traditional Cistern Flush Toilet • No odour • No flies • Privacy • Long life time and no need to move for many years	• Limited availability; cannot be built or repaired locally • High capital costs; operating costs depend on parts and maintenance • Labour-intensive maintenance • Requires training and acceptance to be used correctly • Is prone to misuse and clogging • Requires a constant source of water • Men usually require a separate urinal for optimum collection of urine	
Biofil	• The Biofil system combines the benefits of the WC flush toilet system and those of composting toilets • Flush water is channelled through a biofil digester and liquid waste separated from the solid waste • Liquid waste is purified by organic filtration system channelled into drain	• Easy and convenient to use- like a Cistern Flush Toilet (WC) • No odour • No flies • Privacy • Long life time if well-operated • Eliminates issue of desludging and treatment of faecal sludge common to the septic tank system • Output (decomposed faecal matter) safe to use as humus • Effluent is treated and can be reused for irrigation • Digester requires little space	• High capital investment required • Requires a constant source of water • Requires training and acceptance to be used correctly • Skilled personnel needed for maintenance • Requires a vast drain-field where water is not re-used for flushing	

Sanitation Facility Type/ Technology	Key Technical Features	Advantages	Disadvantages	Field Observation
	field, soak-away or reused • Separated solid/semi-solid waste (human excreta) is decomposed by natural macro and micro-organisms under aerobic conditions into humus			
Ecosan Technologies				
Arborloo	• This toilet is a simple shallow pit (less than 1 meter) toilet with a light weight superstructure placed over a hole. • The toilet itself can be either squatting or sitting and has a single hole with no separation of poop and urine. • Each time the toilet is used, cover material (either soil or carbon rich organic material) is added to the pit to reduce odours and flies and speed the decomposition of the wastes.	• Affordable, low capital and operating costs-appropriate for low-income households • Simple technology-easy to manage • Does not require a constant source of water • Can be built from local materials • Suitable for less densely populated area where space is available for relocating the latrine when it is full-super-structure is mobile • Odour and fly control • Rapid decomposition of pit content • Environmentally friendly-growing of trees on covered pit	• Risk of groundwater and surface water contamination-not suitable for areas with very high water table and flood-prone • Can only be used for a short period of time • Not suitable for densely populated areas-land/space is scarce	•

Sanitation Facility Type/ Technology	Key Technical Features	Advantages	Disadvantages	Field Observation
Enviro loo	• The Enviro Loo has a sealed unit that captures and treats waste through the natural processes of dehydration and evaporation	• No water is required for its operations • Odourless and fly control • Permanent installation, no relocation • Output (decomposed matter in sealed unit) environmentally safe • Privacy • Can be in-built (within house) • Simple technology-easy to manage	• Limited availability; cannot be built or repaired locally • Requires training and acceptance to be used correctly • Expensive (capital cost) compared to Arborloo • Associated maintenance and servicing cost	•

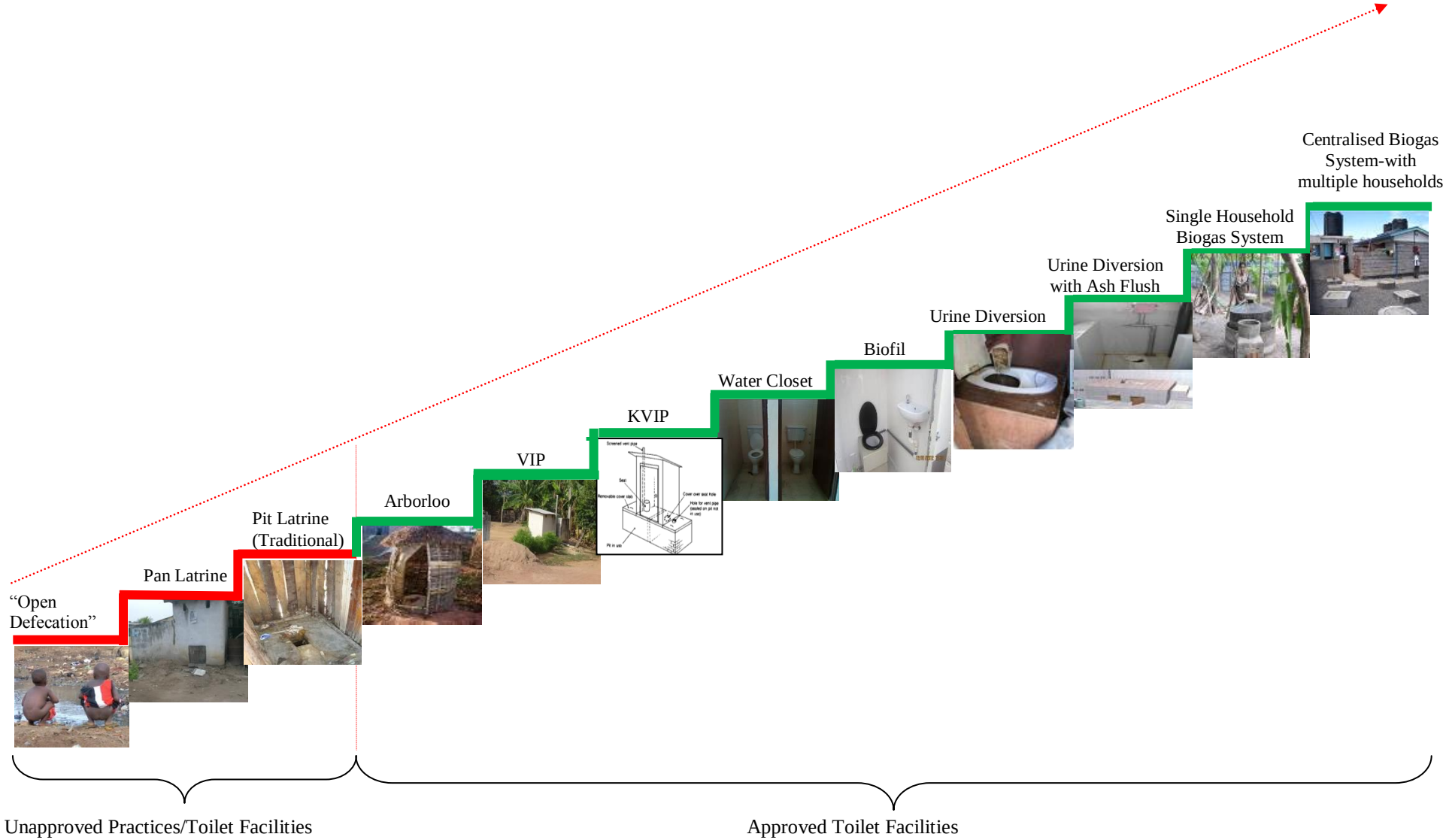


Figure 4.14 Sanitation Ladder for Household Latrine Options (Ecosan)

4.4.2 Faecal Sludge Emptying Services

The options for faecal sludge emptying services are discussed below.

Households Latrines other than Water Closets (WCs): The current practice of manual emptying and direct disposal of faecal sludge from household toilets into the environment with its attendant health and environmental hazards needs to be improved. The mechanized emptying systems, shown in Figure 4.15, have been used for small scale mechanized emptying as an alternative to manual means.

Microvac	Dung Beetle	Evac
		
The Micravac is a micro vacuum tanker for use on uneven roads and areas with poor access.	The Dung Beetle is a two wheeled tractor used for desludging small cesspits and septic tanks in congested low-income areas. This machine has been tried in Ghana.	The eVac is a portable power operated vacuum pump system suitable for inaccessible and low-income areas for emptying pit latrine sludge

Figure 4.15: Examples of small-scale mechanised emptying systems

Household WCs and Public Toilets: The collection, transportation and disposal of faecal sludge from household WCs and public toilets are carried out by the use of desludging trucks (vacuum trucks or cesspit emptier trucks). Figure 4.16 shows a cesspit emptier truck in action

Figure 4.16 Cesspit emptier trucks

4.4.3 Treatment and Re-use of Faecal Sludge

From the survey, only Edina Essaman in KEEA has a faecal sludge treatment facility with a capacity for treating $5m^3$ out of the estimated daily district output of $40m^3$ of faecal sludge. The widespread lack of treatment of faecal sludge is of grave public health concern as it leads to unsafe return of excreta into the environment.

In addressing the stated shortcomings, various treatment options are available. However, taking into consideration, the study objectives, the relatively small batches of faecal sludge volumes available for treatment in the communities, and the wide variation in the properties of faecal sludge the

following discussions focus on small-scale non-conventional treatment options that also afford re-use of by-products.

Figure 4.17 below show few relevant options for small-scale faecal sludge treatment (adapted from the Compendium of Sanitation Systems &Technologies EAWAG -2nd Revised Edition, September, 2014). Figure 4.18 shows a Janicki omni processor for treating faecal sludge and production of electricity and potable water. Table 4.18 highlights some advantages and disadvantages associated with the use of these options.

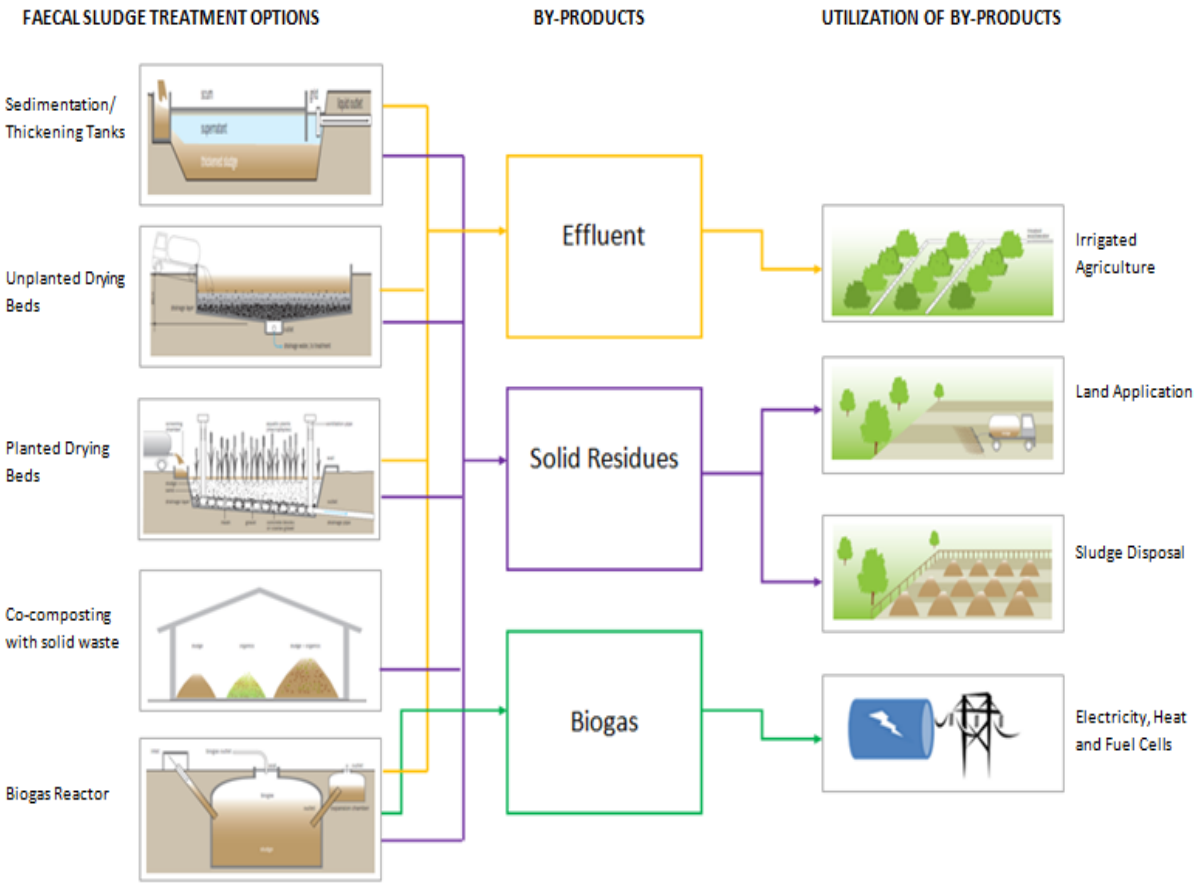


Figure 4.17: Options for Treatment of Feacal Sludge

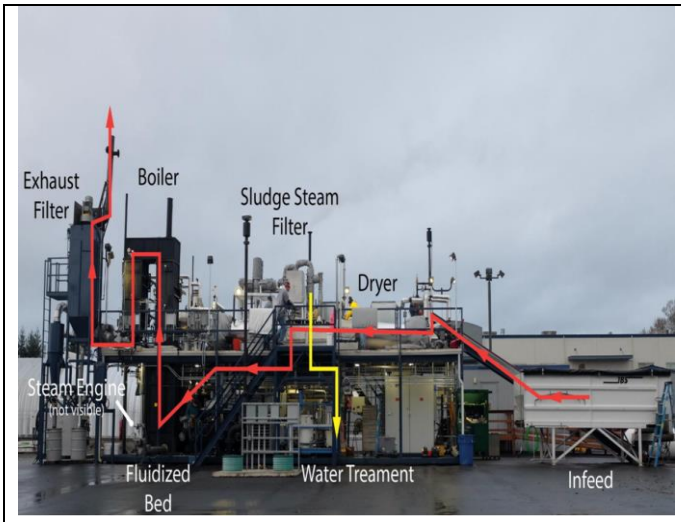
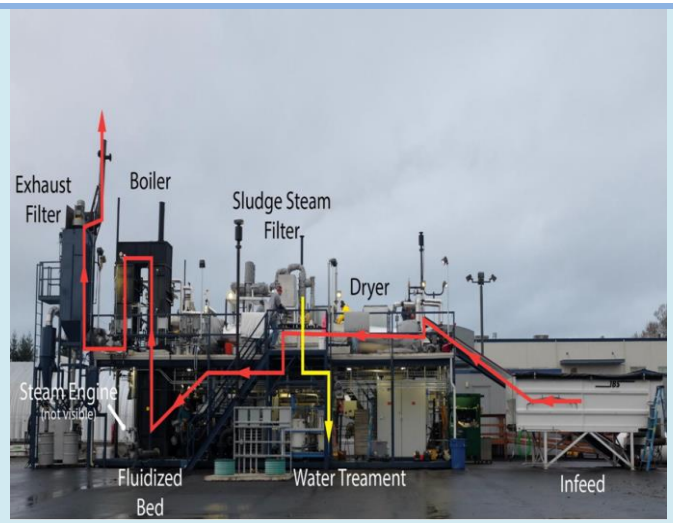
	The Janicki Omni Processor a faecal sludge treatment system which can also handle solid waste as part of the feedstock. This waste-to-energy (WtE) plant (Omni-processor) treats the faecal sludge in an environmentally friendly manner producing electricity and treated water as it end/by-products. A pilot plant commissioned in Dakar, Senegal has a capacity of 12.3 m^3 of sludge per day and produces a maximum power of 150 kW.

Figure 4.18: Janicki Omni Processor

Table 4.18: Assessment of Possible Faecal Sludge Treatment Options

Treatment Option	Key Features/Treatment Procedure	Advantage s	Disadvantages
Sedimentation/ Thickening Tanks	Sedimentation or thickening ponds are settling ponds that allow sludge to thicken and dewater. The effluent is removed and treated, while the thickened sludge can be further treated in a subsequent technology	• Is a low-cost option and can be installed in most hot and temperate climates • Operation and maintenance not intensive • Can be built and repaired with locally available materials • Relatively low capital costs; low operating costs • No electrical energy is required	• Requires large land space and difficult to site in built-up areas • Issues associated with smell- ponds may cause a nuisance for nearby residents due to bad odours and the presence of flies • Not a "complete" treatment system- thickened sludge and effluent still infectious and requires further treatment before disposal/re-use • Trained staff for operation and maintenance is required to ensure proper functioning • Excessive rain may hinder optimum performance of the system- prevents the sludge from properly settling and thickening • Requires expert design and construction • Long storage times required for thickening of sludge
Unplanted Drying Beds	Is a simple, permeable bed that, when loaded with sludge, collects percolated leachate and allows the sludge to dry by evaporation. Approximately 50% to 80% of the sludge volume drains off as liquid or evaporates.	• Good dewatering efficiency, especially in dry and hot climates • Can be built and repaired with locally available materials • Relatively low capital costs; low operating costs • Simple operation, only infrequent attention required • No electrical energy is required	• Requires a large land area • Odours and flies are normally noticeable • Labour intensive removal of dried sludge • Limited stabilization and pathogen reduction • Requires expert design and construction • Leachate requires further treatment
Planted Drying Beds	Similar to an Unplanted Drying Bed but has the added benefit of transpiration and enhanced sludge treatment due to the plants. The key improvement of the planted bed over the unplanted bed is that the filters do not need to be desludged after each feeding/drying cycle. Fresh sludge can be directly	• Can handle high loading of faecal sludge • Better sludge treatment than in Unplanted Drying Beds • Can be built and repaired with locally available materials • Relatively low capital costs; low operating costs • Fruit or forage growing in the beds can generate income • No electrical energy required	• Requires a large land area • Odours and flies may be noticeable • Trained staff required to ensure proper functioning • Long storage times • Labour intensive removal • Requires expert design and construction • Leachate requires further treatment- Faecal sludge is hazardous and anyone working

Treatment Option	Key Features/Treatment Procedure	Advantage s	Disadvantages
	applied onto the previous layer; the plants and their root systems maintain the porosity of the filter.		
Co-composting with Solid Waste	Co-composting is the controlled aerobic degradation of organics, using more than one feedstock (faecal sludge and organic solid waste). Faecal sludge has a high moisture and nitrogen content, while biodegradable solid waste is high in organic carbon and has good bulking properties (i.e., it allows air to flow and circulate). By combining the two, the benefits of each can be used to optimize the process and the product.	• Relatively straightforward to set up and maintain with appropriate training • Provides a valuable resource that can improve local, agriculture and food production • Serves as a solid waste treatment facility • A high removal of helminth eggs is possible (< 1 viable egg/g TS) • Can be built and repaired with locally available materials • Low capital and operating costs • No electrical energy required	• Appropriate when there is an available source of well-sorted biodegradable solid waste • Requires a large land area • The facility should be well located-close to the sources of organic waste and faecal sludge to minimize transport costs, but still at a distance away built-up area to minimize nuisances • Long storage times • Requires expert design and operation by skilled personnel • Labour intensive • Compost is too bulky to be economically transported over long distances • Proper ventilation and dust control are important • Facilities need to be covered especially in areas with high rainfall
Biogas Reactor	A biogas reactor or anaerobic digester is an anaerobic treatment technology that produces (a) a digested slurry (digestate) that can be used as a fertilizer and (b) biogas that can be used for energy. Biogas is a mix of methane, carbon dioxide and other trace gases which can be converted to heat, electricity or light. 	• Generation of renewable energy • Small land area required (most of the structure can be built underground) • Applicable at the household level, in small neighbourhoods or for the stabilization of sludge at large wastewater treatment plants • Similar level of treatment but with the added benefit of biogas generation • Long service life • No electrical energy required • Conservation of nutrients • Low operating costs The pilot 5m^3 biogas plan at Edina Essaman was constructed at an estimated cost of US$90,000.	• Requires expert design and skilled construction • The highest levels of biogas production are obtained with concentrated substrates, which are rich in organic material. e.g. as animal manure and organic market or household waste • Incomplete pathogen removal, the digestate might require further treatment • Limited gas production below 15 °C

Treatment Option	Key Features/Treatment Procedure	Advantage s	Disadvantages
Janicki Omni Processor	An alternative to the anaerobic digestion faecal sludge treatment system is the Janicki Omni-Processor. The waste-to-energy (WtE) plant (Omni-processor) treats the faecal sludge in an environmentally friendly manner producing electricity and treated water as it end/by-products. The processor is currently being piloted in a 12.3 $m^{3/}$day facility in Dakar, Senegal at an estimated cost of US $1.5 Million. To achieve optimum efficiency, household solid waste could be mixed the sludge from the hydro-segregation tank to enhance combustion and hence energy generation. This may potentially reduce the burden of solid waste management which has been a major challenge for most MMDAs in the country. For communities where the potential for re-use is high, the Janicki Omni-processor treatment plant can be assessed as an alternative to biomethanation (biogas). Further detailed feasibility study is required to establish the capacity of the plant as well as its viability in the local context. The initial investment cost of treatment using Janicki, US $125,000 per m^3, is comparatively higher.		

5. MARKETABILITY ANALYSIS

This chapter discusses the availability of faecal sludge for processing along the service chain. The analyses covers faecal sludge flows, collection, transport and treatment/reuse.

5.1 Faecal Sludge Flows

The details of toilet facilities usage and the volumes of sludge produced in each community are presented in Table 5.1 Faecal Sludge Generation (Base Year 2015).

In all the communities faecal sludge from public toilets and household water closet septic tanks are desludged and transported for disposal. Table 5.1 also shows the proportion of potential sludge flows from public toilets and household WCs desludged and transported for disposal.

Table 5.1: Portion of Sludge Desludged and Transported for Disposal Based - Share of Population Using Toilet Facilities (2015)

Region			Central			Western			Volta			Eastern			
District			Komenda Edina Eguafo Abirem	Gomoa West	Hemang Lower Denkyira	Wassa Amenfi East	Jomoro	Sefwi Wiawso	Ho West	Nkwanta North	Ketu North	Upper Manya Krobo		Birim North	Afram Plains North
Community			Edina Essaman	Dago	Twifo Hemang	Adesu	Tikobo No.2	Sefwi Asawinso	Kpedze	Sibi Hill Top	Dzodze	Akateng		New Abirem	Donkorkrom
Project Population (Base Year 2015)			2,006	6,972	13,356	1,445	5,805	20,793	2,733	4,358	27,295	1,787		7,495	10,175
Share of Household	Per Capita Faecal Sludge Generation														
	WC/flush	1.0 l/cap•day	61	171	677	61	43	713	510	-	2,952	-		474	451
Those Without Household Latrine	Population Using Neighbour's Household Toilet	0.2 l/cap•day	22	64	654	44	51	353	27	-	295	21		106	138
	Population Using Public Toilet	2.0 l/cap•day	2,897	1,492	107	905	1,231	5,198	2,651	-	22,709	1,737		1,889	7,082
Total Faecal Sludge Generated			**3,057**	**4,995**	**4,298**	**1,227**	**5,933**	**9,705**	**3,355**	**6,299**	**29,217**	**2,442**		**3,607**	**11,111**
Total Faecal Sludge Desludge and Transported			**2,980**	**1,727**	**1,438**	**1,009**	**1,325**	**6,264**	**3,189**	**-**	**25,956**	**1,759**		**2,469**	**7,672**
Percentage (%) of Faecal Sludge Desludge and Transported			**97%**	**35%**	**33%**	**82%**	**22%**	**65%**	**95%**	**0%**	**89%**	**72%**		**68%**	**69%**

From the table, there is a high desludging and transportation rate of up to 97% for Edina Essaman to 0% for Sibi Hill Top. These results reveal that over-reliance on public toilets contribute a large portion of sludge flows. The large proportion of sludge flows for Edina Essaman, mainly from public toilets also shows that communities that are Open-Defaecation-Free (ODF) potentially add to public sludge flows for disposal. This brings to the fore the need to research into the impact of non-point sources of pollution (open defaecation) to point sources of pollution (public toilet sludge) and how to effectively deal with unsafe return of excreta from each source of pollution.

As previously mentioned, Edina Essaman is the only study community which has a treatment facility while there are no treatment facilities in any of the selected communities, which show large sources of pollution due to direct discharge into the environment.

5.2 Potential Sludge Flows within Catchment of Selected Communities

Based on Table 5.1 communities with population above 20,000 and with high usage of public toilets were identified as potential locations for treatment/re-use facilities. These are Sefwi-Asawinso in the Western region and Dzodze in the Volta region. These towns can serve as faecal sludge treatment/reception centres for neighbouring communities.

Additionally, to ascertain other potential sources of sludge production a criterion was included in the baseline survey to identify large sources of generation of sludge within a distance of 25 kilometres radius of each community.

Potential large generators were identified within the specified radius for two (2) communities. These are Akateng in eastern region and Edina Essaman in the central region.

The following explain further the potential for increased inflows of sludge within the 25 km radius catchment for these towns:

Akateng (Eastern Region): is located 14 km from Asesewa the district capital of the Upper Manya Krobo District Assembly. Asesewa has a well patronised bi-weekly market with a huge transient population who rely mostly on public toilets. The night soil collected from the public toilets is currently discharged untreated into the environment. The combined sludge flows from Akateng and Asesewa and other close-by towns such as Sekesua another bi-weekly town (26 km from Akateng and 12 km from Asesewa) can be potentially treated by the appropriate siting of a faecal sludge treatment facility. This requires further investigations.

Edina Essaman (Central Region): is located within ten (10) kilometres from Elmina which is the capital of KEEA, and 19 (nineteen) kilometres from Cape Coast which is the capital town of the Central Region. Cape Coast with a population of 197,912 also has a large number of secondary schools as well as tertiary institutions. Currently faecal sludge from Elmina and surrounding communities is discharged directly into the environment around Edina Essaman without treatment.

5.3 Demand for Emptying Services from Different Customers (Private, Commercial, Industrial and Government)

The analysis of Table 3.2 shows that public toilets and households that use WCs, depend on cesspit emptying services. Demand for services by public toilets is about ninety percent (90%) while household generators make up for the remaining ten percent (10%). The sludge collected is not treated but discharged directly into the surrounding areas posing serious environmental degradation and health hazards.

5.4 Types of Emptying and Transportation Logistics and Equipment Available (Mechanical and Manual)

The cesspit emptier truck is the only mechanized means of sludge emptying and transportation to final disposal for all communities. From the study KVIP and VIP toilets are often emptied manually when filled up.

5.5 Regularity of Services

Cesspit emptier services are available and regular for the greater part of the year. During the rainy season in June and July demand for services increase because of poorly constructed septic tanks and cesspits which fill-up quickly due to ingress of rain water and groundwater from areas with high water tables.

According to a number of drivers who were interviewed, the rains also render a number of locations inaccessible due to poor conditions of roads. In such instances operators of cesspit emptier trucks are reluctant to offer services.

5.6 Average Household Incomes

Average household incomes for each community extracted from the baseline data is provided in Table 5.2. The table shows that on the average 44.7% of the population in the selected communities earn between GH₵ 100-200, 17.5 % earn between GH₵ 201-300,13 % earn between GH₵ 301-400, 12.9 %, earn GH₵ 400-500 while 11.9% earn above GH₵ 500.00 which is the upper limit.

Based on the survey results the earning capacity of the residents is indicative of their ability to afford and willingness to build a new facility or the upgrading of existing facilities.

Table 5.2: Average Incomes and Ability to Pay

Ability to Pay for Improved Sanitation System and Services											
District	Community	Dominant Economic Activity	Monthly Income Range (GH₵)						Ability to Pay for Improved Household Sanitation	Share of Population Requiring Loan Facility for Pre-Financing of Household Toilet	Preference of Government Subsidy
			<100	100-200	>200-300	>300-400	>400-500	>500		%	%
Wassa Amenfi East	Adesu	Farming (29.0%)	28.8	14.7	16.9	13.6	7.9	18.1	No	44.40%	86.20%
Jomoro	Tikobo No.2	Trading (31.2%)	12.4	22.1	44.1	15.2	5.9	0.3	No	66.80%	96.30%
Sefwi Wiawso	Sefwi Asawinso	Farming (34.0%)	10.9	19.3	11.5	28.1	25.2	5.0	No	55.70%	86.00%
Komenda Edina Eguafo Abirem	Edina Essaman	Farming (43.2%)	10.3	15.3	17.7	20.7	16.3	19.7	No	44.60%	86.30%
Gomoa West	Dego	Farming (77.7%)	8.9	18.9	29.5	11.6	12.2	18.9	No	97.40%	95.80%
Hemang Lower Denkyira	Twifo Hemang	Farming (62.3%)	39.2	26.9	8.5	12.7	8.5	4.2	No	89.40%	96.90%
Upper Manya Krobo	Akateng	Trading (33.0%)	18.9	16.5	16.0	17.0	12.3	19.3	No	79.90%	95.70%
Birim North	New Abirem	Farming (33.4%)	14.0	38.1	19.9	7.8	10.4	9.8	No	65.90%	81.10%
Afram Plains North	Donkorkrom	Farming (35.9%)	27.2	26.1	15.4	7.0	17.3	7.0	No	83.80%	82.60%
Ho West	Kpedze	Farming (29.2%)	36.3	29.1	10.5	5.9	5.9	12.3	No	57.70%	83.30%
Nkwanta North	Sibi Hill Top	Farming (93.5%)	34.0	20.2	10.8	7.7	20.6	6.7	No	61.90%	74.10%
Ketu North	Dzodze	Farming (33.2%)	29.1	18.9	9.0	9.0	13.1	20.9	No	49.10%	89.40%

5.7 Mix of Beneficiaries (Current and Potential) in Low, Medium and High Income Populations

The current beneficiaries in the faecal sludge desludging,-transport service chain consist of institutions and households that use WCs, and users of public toilets. Low and middle income populations in rural and peri-urban communities mainly rely on KVIPs, VIPs and traditional pit latrines which scarcely require cesspit emptying services. For all categories of households, institutions and public toilets emptying service-charges are fixed on volumetric and distance basis.

5.8 Financing of Services for Collection and Transportation

Institutions, households with water closets and franchise operators of public toilets pay for the services of collection and transportation. All categories of users of services pay for services from their incomes. For example public toilet operators pay from the user-fees they collect from users. In all cases services are rendered on cash basis.

5.9 Existing Contractual Arrangements for Collection

Private sector participation in construction of latrines and provision of emptying services is stipulated by the Environmental Sanitation Policy (Revised 2010). The sector oversight of faecal sludge collection, transport and disposal is by Metropolitan, Municipal and District Assemblies (MMDAs). Business operating permits for the operation of cesspit emptier service is by the MMDA including the selection of sites for discharge of untreated nightsoil.

The provision of cesspit emptier services is on open-market basis with no formal written contractual arrangements between the users and the service providers. The service is delivered on availability and a user is not bound to continuously use a particular service provider.

There are no formal contractual arrangements for the collection of faecal sludge. Individuals and institutions requiring the services of Service Providers make contacts with them, usually through telephone numbers advertised on the trucks.

5.10 Financing of Treatment Systems

Currently there are no treatment facilities in any of the selected communities. The faecal sludge desludged from septic tanks and the public toilets are discharged directly into the surrounding environment.

5.11 Regulation of Market For Faecal Sludge

Licensing of service providers is carried out by the MMDAs from whose jurisdiction they operate. The emptier operators do not register to operate outside the jurisdiction of their MMDAs. Service providers are charged annual business operating license fee as approved by the General Assembly of the MMDAs in their annual fee-fixing resolution.

An Association of Liquid Waste Service Providers has been formed as a branch of Environmental Service Providers Association (ESPA), a national umbrella organization of businesses providing all categories of environmental sanitation services.

5.12 Training Regimen

The major activity within the faecal sludge desludging activity is the driving and operating the truck during pit desludging. An important piece of equipment in the desludging operation is the sludge suction pump which requires proper handling. There is currently no formal training for truck attendants who learn on the job.

5.13 Sanctions and Penalties

MMDAs are responsible for enacting bye-laws to regulate the operators and fix fines in their annual fee-fixing resolutions for the approval of the General Assembly. When any operator infringes on any bye –law he is issued with summons to appear in court for the necessary fine to be imposed by the court. Most of the offences committed which attract sanctions are illegal discharge of faecal sludge in unapproved sites and from spillages and leakages of sludge on main and neigbourhood roads.

5.14 Mandatory Health Checks

Mandatory health checks although very essential for all faecal sludge workers are not enforced largely due to the fact that majority of the workers is private sector operators working without any written health regulations.


AMA running foul of the law?

The EPA went to court in February 2014 to stop the city authority from allowing for human excreta to be discharged into the sea.

The court gave the AMA seven days to shut down Lavender Hill, considering the unpleasant smell that emanated from the site as well as health hazards that the facility posed to the public.

The AMA at the time pleaded with the court to give it more time to provide an alternative solution.

The court, presided over by Justice K.A. Ofori Atta, agreed and gave the AMA until the end of last year to stop the practice,but four months on, the situation has not changed.

http://graphic.com.gh/news/general-news/42071-ama-running-foul-of-the-law.html

5.15 Capacity of Regulation Authorities (District Assemblies and EPA)

All MMDAs have enacted various bye-laws for the provision of services in line with the Environmental Sanitation Policy (Revised 2010). The Environmental Health and Sanitation Department (EHSD) of MMDAs is responsible for the inspection and enforcement of environmental sanitation bye-laws. The majority of staff of this department are environmental health officers (category) who have all received formal training from Schools of Hygiene. Currently enforcement

management is low due largely to constraint of resources for carrying out monitoring inspections and effective sanctioning. With respect to faecal sludge because the MMDAs themselves have not constructed acceptable treatment plants and so they are compelled to condone illegal discharge of faecal sludge into the environment.

The Environmental Protection Agency (EPA) also has qualified and well trained and resourced staff that carry out monitoring of environmental sanitation activities of the MMDAs. However in many cases, recommendations are not implemented due to lack of resources of the MMDAs.

5.16 Roles and Responsibilities of Public Sector Institutions

The roles of the identifiable public sector institutions are as per Table 5.3 below:

Table 5.3 Roles and Responsibilities of Public Sector Institutions

MLGRD	MOFEP	Office of ADCF[3]
• Formulation policies and Guidelines on environmental sanitation. • Monitoring and Evaluation of the compliance environmental Sanitation policies. • Management of the Functional Organisation Assessment Tool (FOAT) for the evaluation of MMDAs. • Liaising with the Ministry of Finance and Economic Planning for the early release of funds due the MMDAs.	• The consolidation of MMDAs' Composite Annual Work Plans and Budgets (AWPBs) in the national AWPBs for approval by the Parliament for implementation. • Ensuring the availability and timely release of all funds to the MMDAs for the implementation of their development programmes.	• Computation of Annual DACF due each MMDA • Disbursement of funds as and when due.

5.17 Roles And Responsibilities of Private Enterprises

Private operators provide environmental sanitation services to complement the efforts of the various MMDAs. The major responsibility of the private sector is to provide desludging services, charge the approved user fees and comply with all the bye-laws of the MMDA and protect the environment from pollution from their operations. They are required to pay all local taxes levied by the MMDAs including business operating license fees, and also pay income tax on their profits to the Ghana Revenue Authority (GRA). Private operators are enjoined to provide health and safety clothing and equipment to all staff as part of licensing conditions.

[3] Administrator of District Assembly Common Fund

5.18 Financial Flows (Collection, Disposal Fees, Registration, Fines, Etc)

The following are the prevailing rates for services and fines within the faecal sludge service sector. The actual rate charged is presented in Table 5.4 and Figure 5.1.

Table 5.4: Fees and Fines

Item	Rate-GH¢	Rate-US $
Collection Fees	180-500	47-117
Disposal Fees	17-25	4-6
Business Operating License Fees	200-300	47- 70
Illegal Dumping & Spillage	350	82 per offence

Exchange Rate US$ 1=Ghc 4.2694-(average inter- bank rate 19/6/2015)

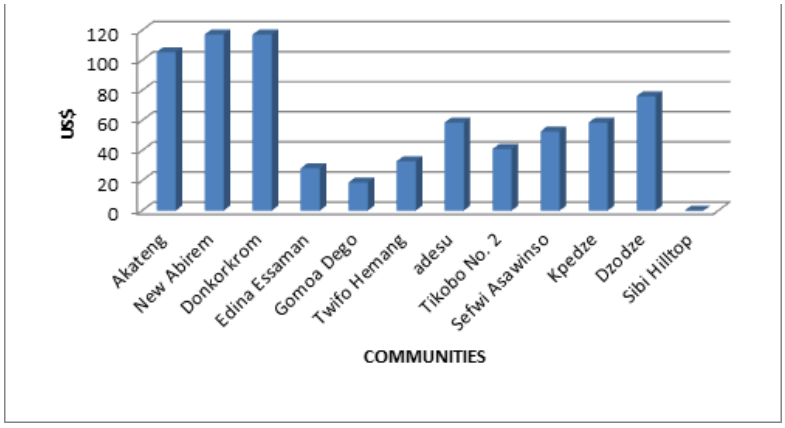


Figure 5.1: Cesspit Emptier Service Desludging Fees

5.19 Strength, Weaknesses, Opportunities and Threats for Public Sector Institutions Involved in Sludge \Management

Strengths	Weaknesses	Opportunities	Threats
• Well-trained staff and the necessary legal authority and appropriate bye-laws to enforce to ensure compliance by the private sector and the entire citizenry. • Access to the law courts for the prosecution and levying of fines on offenders to serve as a deterrent. • Annual Work Plans & Budgets by MMDAs and other public institutions to access resources for implementation of sanitation activities.	• Low staff levels and inadequate allocation of resources • Inadequate enforcement management of by-laws. • Poor monitoring and evaluation. • Lack of training of most officers in public private partnership (PPP) arrangements to enable them plan and promote more private sector involvement. • The non-Existence of continuous public education on business opportunities within the environmental sanitation value chain.	• Collaboration with ESPA and the general business community can fast track investments into the sector to diversify services.	• Loss of public confidence leading to failure of programmes etc. • Sanctions by local and international environmental sanitation agencies likely to affect operations

6. SERVICE DELIVERY MODELS

Service delivery models refer to the various linkages and interactions between service providers and beneficiaries in the faecal sludge management chain. Taking into consideration the overall outputs of the study, the focus of this section of the report is on the service delivery models for the following:

- Latrine promotion and construction
  - Household latrine promotion and construction; and
  - Public toilets management
- The collection and transportation of faecal sludge.
- Treatment, Disposal and Re-use

The segments are discussed in detail below.

6.1 Household Latrine Promotion and Construction

Household latrine promotion and construction involves key players including the household that makes the demand for a toilet, the service provider who constructs the toilet, and NGOs/CBOs/MMDAs who facilitate promotion as well as business support services providers that provide training and financial services.

6.1.1 Sustainability of Existing Service Providers

The awareness created by various institutions/organizations on the benefits of household toilets as part of Community Led Total Sanitation (CLTS) is gradually increasing the demand for improved household latrines in rural communities. However, the challenge of sustaining these efforts which are mainly tied to donor funded projects still remains. The inability of households to raise their own funds for latrine construction affects the sustainability of artisans engaged in construction of facilities. The fluctuating trend in funding for household latrine promotion and construction is a major bottle neck in sustainability of service delivery.

6.1.2 Drivers/Barriers for Growth and Market Consolidation

A number of the factors have been identified to have impact on sustaining the promotion of household latrines to yield the required benefits. Table 6.1 presents a number of criteria and related drivers and barriers. Figures 6.1 and 6.2 show the direct fund flow of financial institutions.

Table 6.1 Examples of Drivers/Barriers for growth and market consolidation

Criteria	Drivers	Barriers
Technical	The introduction of new technologically friendly household toilets has increased households' knowledge on different types of technologies and thereby giving them more choices.	The layout of compound houses of multiple rooms with enclosed central courtyard is a bottleneck for construction of additional toilets to satisfy one-household-one-toilet standard. The need for expertise in design and construction of types of sanitation facilities, eg biofill, anaerobic digestion system
Regulatory	The relaxation of restrictions on selection of technology types has increased household choice of toilets	Poor enforcement management and lack of prosecution of households without latrines.
Access to Finance	Facilitation of financing arrangements (eg credit) by MMDAs involving commercial banks and microfinance institutions is enhancing toilet acquisition by households.	Lack of access to credit facilities with repayment terms favorable (eg small daily repayment installment) to households.

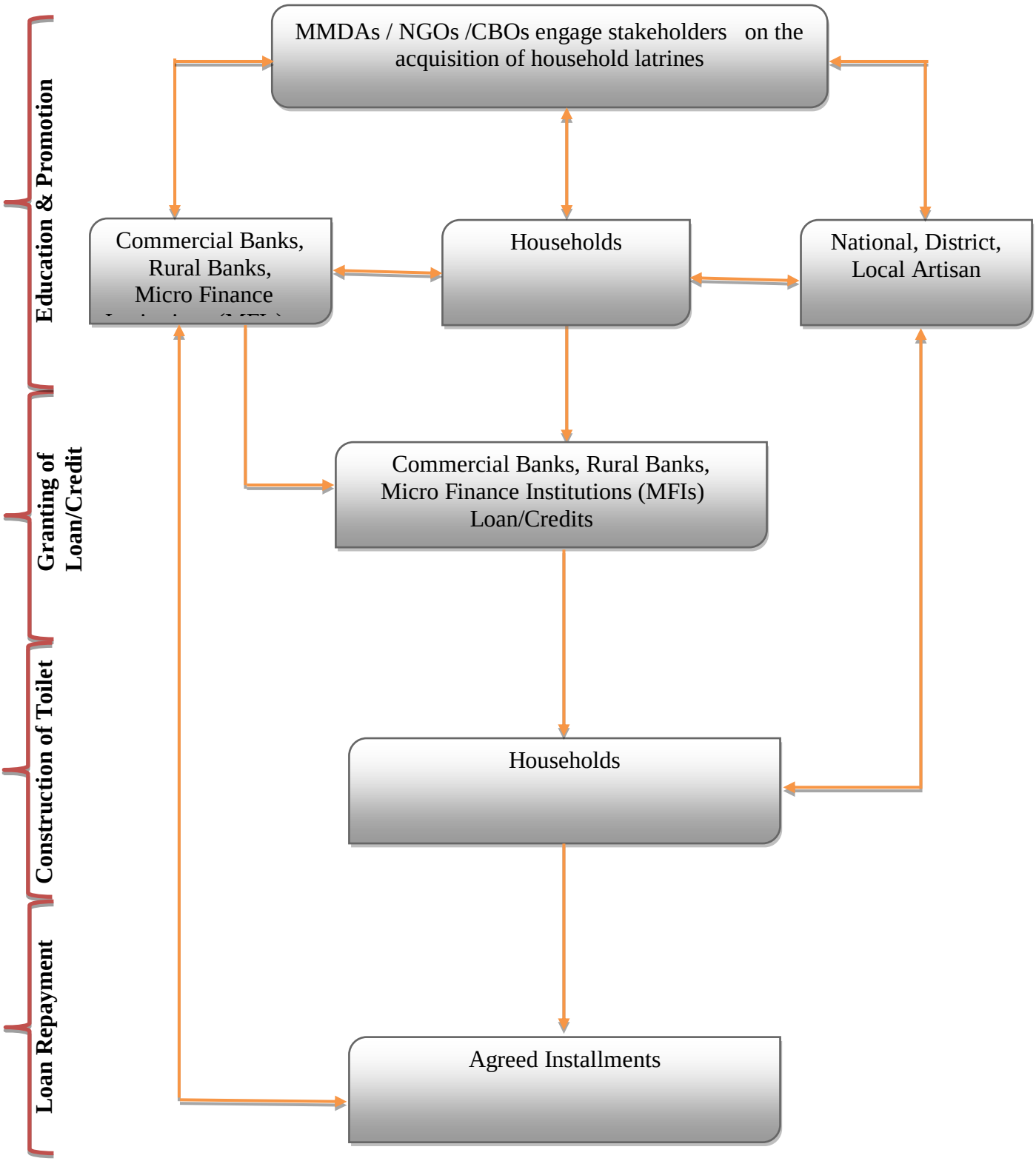


Figure 6.1 Direct funds flow from Commercial and Rural Banks and MFS

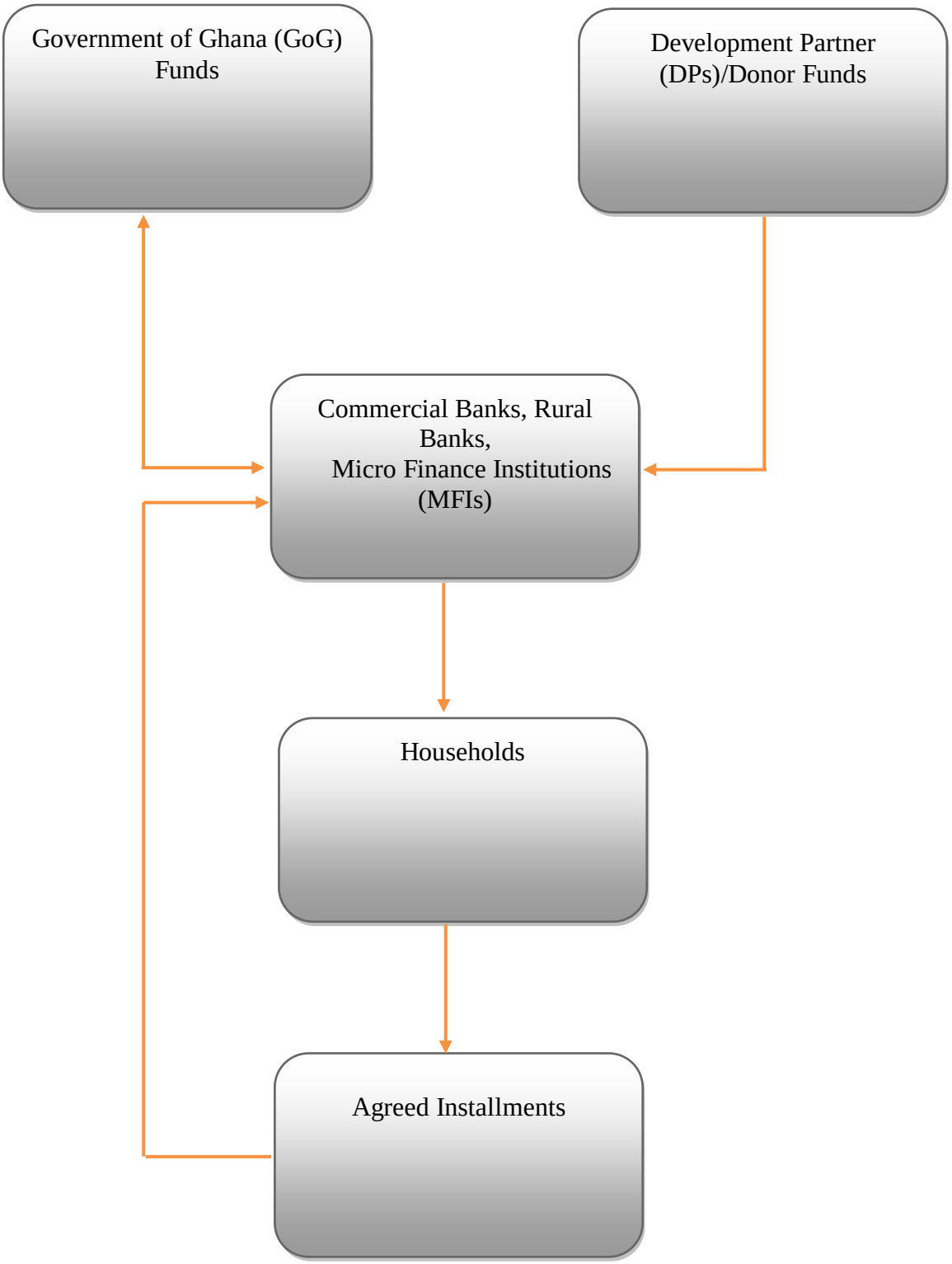


Figure 6.2 Direct Funds Flow from GoG/DPs

6.1.3 Existing Links between Sanitation Providers, Business Support and Financial Services

The effective service delivery management thrives on efficient service providers and business support/financial services. Currently there are no independent demand driven relationships between service providers and business support/financial services as business support services, example, for sanitation promotion are mainly project driven. However, the potential exist in improving the links between service providers and business support/financial services as shown in Figure 6.3.

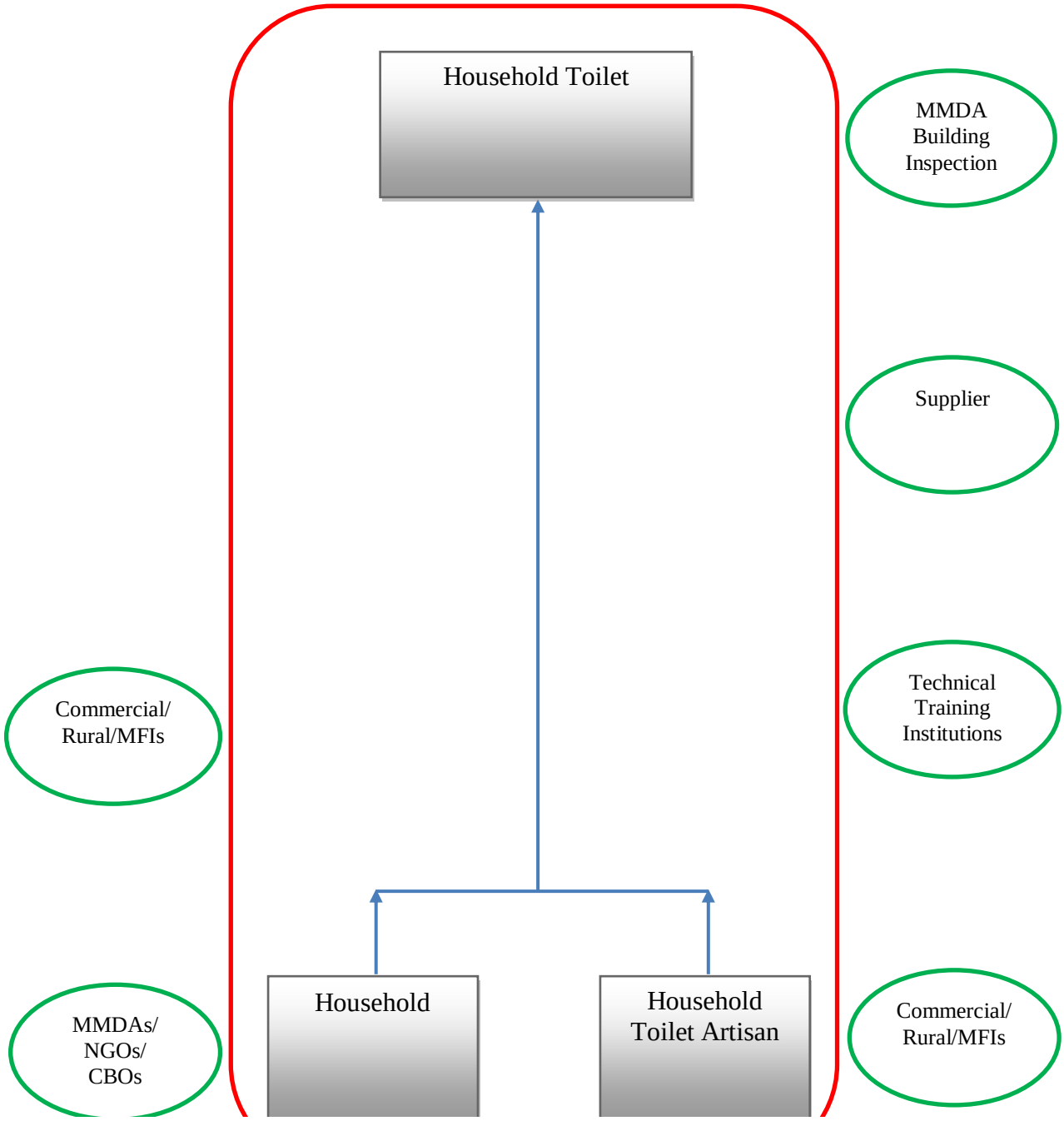


Figure 6.3 Links between service providers and business support financial/unit

6.1.4 Availability of Finance for Promotion and Construction of Household Latrines

Two (2) credit models for household toilet financing are described and itemized in Table 6.2 below. The direct commercial /rural/microfinance credit model has been adopted by many MMDAs for example Ga West Municipal Assembly (GWMA) in the Greater Accra Region. The external financial support model was applied in World Bank's Community Based Rural Development Project (CBRDP) which was implemented nation-wide.

Table 6.2: Credit models for household toilet financing

Direct Commercial/Rural/Microfinance Credit	Centrally Controlled Fund
1) MMDAs arrange with Commercial Banks(CBs) Rural Banks(RBs) and Microfinance Institutions (MFIs) to provide loans from their own resources to households to construct toilets. 2) The RBs and MIs collaborate with MMDAs to register small works contractors /artisans to construct household toilets. 3) The CBs RBs & MFIs collaborate with MMDAs to screen and approve prospective borrowers 4) Prospective borrowers put in applications for loans which are approved. 5) On approval of loan application accredited artisan construct toilet for household. 6) Artisan is paid by CBs/RBs/MFIs 7) Households pay loan installment and interest to CBs/RBs/MFIs .	1) Government/external and other financial institutions are made available to ARB Apex Bank for on lending for household improvement. 2) ARB Apex Bank lends the funds to interested Rural Banks (RBs) and Microfinance Institutions (MIs) for on lending to households. 3) The RBs and MIs collaborate with MMDAs to register small works contractors /artisans to construct household toilets. 4) The RBs & MFIs collaborate with MMDAs to screen and approve prospective borrowers 5) Prospective borrowers put in applications for loans which are approved. 6) On approval of loan application accredited artisan construct toilet for household. 7) Artisan is paid by RB/MFI 8) Household pays loan installment and interest to RB/MFI 9) RB/MFI pays installments to ARB Apex Bank 10) ARB Apex Bank pays installments to Government of Ghana.

Households raise funds from their own resources or from loan schemes as explained in Table 6.1 above before the commencement of construction works. By this approach the artisan contractor does not encounter any financial encumbrance in the delivery of individual units.

6.1.5 Feasibility of Service Provision for Low-Income Households

The provision of household latrines to low income households can be enhanced by targeted incentives including granting loans with very soft conditions such as long repayment period (three to five years) and non-commercial interest rates, re-payment scheme designed to meet their income earning patterns, by households making materials contributions towards the construction of toilets as well as making available manual labour. These schemes when implemented together can potentially create demand from low income households.

6.1.6 Strategies for Providing Sustainable Services for Low-Income Households

The Central Bank of Ghana should consider the inclusion of sanitation industry in the industrial lending quotas with special repayment and interest rates for compliance by all commercial and rural banks and microfinance organisations. The compliance with the industrial quotas will make cheaper credits available to low income households to access to provide toilets for their homes.

6.1.7 Assessment of Household Latrines Promotion in the Study Communities

Due to the continued incidence of open defecation in many communities in Ghana, the Ministry of Local Government and Rural Development (MLGRD) has requested all Metropolitan, Municipal and District Assemblies (MMDAs) to intensify their regulatory and governance roles to increase the acquisition of household latrines. Furthermore, MLGRD in collaboration with development partners especially UNICEF is implementing the Rural Sanitation Model with the focus on CLTS with the aim of achieving ODF status and 100% improved latrine coverage in rural communities.

Table 6.3 shows the activities of household latrine promotion and construction in the study communities and other communities in the district. For the purpose of this study, the MMDAs' on-going roles in the study communities were assessed against the incidence of open defecation as shown in Table 6.4 below. The criteria applied in the assessment were:

- Public Education of the communities
- Facilitating the access to loans and credits by community members from commercial banks, rural banks and microfinance institutions.
- Prosecuting both house owners of homes without latrines and persons who engage in open defecation respectively.

Table 6.3: Household Latrine Promotion and Construction Activities

Region	District	Role of MMDA in household latrine promotion and construction in district/specific community	Other stakeholders/ (Position)	Role of stakeholder in household latrine promotion and construction	Operational area/beneficiary community of other stakeholders		Provision of subsidy and type of subsidy
					Study Area	Others	
Central	Komenda Edina Eguafo Abirem	• Organisation/facilitation of stakeholder meetings with communities • Implementation and monitoring of CLTS • Enforcement of sanitation bye-laws	Netherlands Embassy and Government of Ghana (Donor)	• Programme financing (January 2014 – June 2015)	Nil	Bronyibima, British Komenda and Tekerkesem	No subsidy
			Simavi/Hope for the Future Generation (NGO)	• Implementation of CLTS and BCC • Advocacy for the enforcement of sanitation byelaws through active partnership with the assembly			
	Gomoa West	• Assist in the facilitation of community meetings, consultations and communications • Environmental health officers sometimes assist the artisans in marketing of sanitation facility products to households • Approval of facility types and location within the premises of the beneficiary household.	USAID-Relief International/ Winrock/Adventist Development Relief Agency (ADRA) (Donors/Project Partners)	• Programme financing • Project Design and implementation management (2009-2013)	Nil	Ankam, Adaa, Kyiren	Yes, provision of construction materials
			New Life Foundation (Local NGO)	• Recruitment and training of local artisans on household sanitation facility construction and promotion/marketing			
			Artisans	• Construction household latrines sanitation facilities			
	Hemang Lower Denkyira	• Implementation and monitoring of CLTS • Assist in the facilitation of community meetings, consultations and communications • Linking up interested households with trained artisans	Royal Netherland Embassy/VNG International (Donor/Project Partners)	• Currently funding and providing monitoring support the implementation of CLTS under a 3 year project (Local Government Capacity Programme) - 2012-2016	Hemang		No subsidy
			Artisans	• Construction and marketing of sanitation facilities to interested households			
			Global Communities	• Currently implementation of CLTS			
			CWSA	• Trained local artisans in construction sanitation facilities to meet technical specification (was undertaken as part of the Small Town Water Supply and Sanitation Project)			
Eastern	Afram Plains North	• Recommending appropriate toilet facility types to households • Linking up artisans with beneficiary households	Afram Plains Development Organisation (APDO) -a district-based NGO	• Assist households in acquiring household toilets by providing construction materials as a form of subsidy. Interested households are required to apply for the subsidy and	Donkorkrom		Yes, provision of construction materials (applies to

Region	District	Role of MMDA in household latrine promotion and construction in district/specific community	Other stakeholders/ (Position)	Role of stakeholder in household latrine promotion and construction	Operational area/beneficiary community of other stakeholders		Provision of subsidy and type of subsidy
					Study Area	Others	
				granted after assessment. • Support in linking up beneficiary households with artisans			only APDO)
			WaterAid (International Development Partner/Donor)	• Provide capacity development training to NGOs (e.g. Links, APDO) in WASH in the district			
			Links (local NGO)	• Marketing (advocacy in household latrine ownership) and construction of household toilet facilities			
			Artisans	• Construction of household toilet facilities			
	New Abirem	• Organisation/facilitation of stakeholder meetings with communities • WatSan Committee members of the district assembly assist artisans in marketing of sanitation products/facilities • Implementation of CLTS in communities	WaterAid (International Development Partner/Donor)	• Financing and organisation of latrine construction and marketing workshops for artisans	Nil	Adedekrom	No subsidy
			Artisans	• House latrine construction and marketing			
	Upper Manya Krobo	• Public education/awareness on the importance of owning household toilet facilities	Nil	• NA[4]	Nil	Nil	NA
Volta	Ho West	• Facilitate implementation of CLTS in communities	DANIDA (International Development Partner/Donor)	• Training of artisans in latrine construction and marketing	Nil	Dodonu Teleafenu	No subsidy
			UNICEF (International Development Partner/Donor)	• Financing and management support in the implementation of CLTS			
	Nkwanta South	• Enforcement of local by laws on households owning their own toilet facilities. • Public education/awareness on the importance of owning household toilet facilities	Nil	• NA	Nil	Nil	NA

[4] NA- Not Applicable

Region	District	Role of MMDA in household latrine promotion and construction in district/specific community	Other stakeholders/ (Position)	Role of stakeholder in household latrine promotion and construction	Operational area/beneficiary community of other stakeholders		Provision of subsidy and type of subsidy
					Study Area	Others	
	Ketu North	• Facilitate implementation of CLTS in communities • Enforcement of sanitation bye-laws	UNICEF (International Development Partner/Donor)	• Financing and management support in the implementation of CLTS	Nil	Kpotadzi, Agortonugbedze, Netsikope	No Subsidy
Western	Wassa Amenfi East	• Public education/awareness on the importance of owning household toilet facilities	Nil	• NA	Nil	Nil	NA
	Jomoro	• Public education/awareness on the importance of owning household toilet facilities	Nil	• NA	Nil	Nil	NA
	Sefwi Wiawso	• Public education/awareness on the importance of owning household toilet facilities • Provision of permits for household latrine construction	Nil	• NA	Nil	Nil	NA

Source: Personal communication with District Environmental Health Officers (DEHOs) of MMDAs of selected communities

Table 6.4: Results of Assessment of Selected MMDAs in Household Latrine Promotion

Region	District	Community	Estimated No. of Households engaged in open defecation	Estimated Proportions (%) of Households engaged in open defecation	Evaluation Criteria		
					Public Education in Community	Facilitation of Household Latrine Financing Arrangements by MMDAs	Prosecution of Offenders
Central	Komenda Edina Eguafo Abirem	Edina Essaman	0	0%	Yes	NIL	Rarely
	Gomoa West	Dago	388	23.4%	Yes	NIL	Rarely
	Hemang Lower Denkyira	Twifo Hemang	120	5.7%	Yes	NIL	NIL
Western	Wassa Amenfi East	Adesu	13	4%	Yes	NIL	NIL
	Jomoro	Tikobo No.2	644	48.1%	Yes	NIL	Rarely
	Sefwi Wiawso	Sefwi Asawinso	50	1.1%	Yes	NIL	NIL
Volta	Ho West	Kpedze	3	0.4%	Yes	NIL	Rarely
	Nkwanta North	Sibi Hill Top	636	95.8%	Yes	NIL	Rarely
	Ketu North	Dzodze	195	2.7%	Yes	NIL	Rarely
Eastern	Upper Manya Krobo	Akateng	97	25.5%	Yes	NIL	Rarely
	Birim North	New Abirem	5	0.3%	Yes	Yes	5-6/ month
	Afram Plains North	Donkorkrom	370	17.7%	Yes	Yes	2-3/month

Source: Personal communication with District Environmental Health Officers (DEHOs) of MMDAs of selected communities

From the table above, Edina Essaman is the only study community which is open defecation free. All the communities have varying levels of open defecation. However, Edina Essaman's status was achieved not through the acquisition of household latrines but rather through the reliance on public latrines. The table shows that the performance of MMDAs in terms of public education and prosecution of offenders is inadequate.

6.2 Public Latrine Management

Public toilets are mostly constructed by MMDAs and are usually sited in markets, lorry parks and other public areas within communities mainly for use by transient persons. However, due to the lack of household toilets many households resort to the use of public toilets.

Private sector operators are also permitted to construct, own and operate public toilets. The Ministry of Local Government & Rural Development (MLGRD)'s Guidelines for the Provision, Operations & Maintenance of Public Toilets (2003) stipulates the arrangements for private sector participation in the provision of public toilets (see Table 6.5).

Table 6.5: Options for Construction/Rehabilitation/Management of Public Toilets

Options	Ownership	Operations &Maintenance	Capital Investment	Commercial Risk	Period
MMDA Toilet	MMDA	Private	Private	Private	5-10 years
BOT(build-operate-transfer)	Public/Private	Private	Private	Private	5-10 years
ROT(rehabilitate-operate –transfer)	Public/Private	Private	Private	Private	3-5 years
BOO (build-own-operate)	Private	Private	Private	Private	Indefinite

An example of private ownership of public-toilet constructed on a BOO basis is a 10 (ten) seater water closet public facility located in Abeka, a community in Donkorkrom in Eastern region.

The management of public toilets owned by MMDAs under franchise arrangements is a national policy to ensure full cost recovery of service costs. The operators of public toilets are responsible for the operations and maintenance (O & M) of public toilets and recover costs from user fees. The distribution of the common types of facilities in the communities is presented in Table 6.6 below.

Table 6.6: Types of public toilet facilities in selected communities

No.	Community	Vault Chamber	Aqua-privy	KVIP	WC
1.	Akateng			√	
2.	New Abirem	√	√		
3.	Donkorkrom			√	√
4.	Edina Essaman			√	
5.	Gomoa Dego			√	
6.	Twifo Hemang			√	
7.	Adesu			√	
8.	Tikobo No. 2			√	

No.	Community	Vault Chamber	Aqua-privy	KVIP	WC
9.	Sefwi Asawinso			√	
10.	Kpedze			√	√
11.	Sibi Hilltop				
12.	Dzodze			√	√

MMDAs are responsible for fixing user fees for all public toilets. User fees are determined by toilet type and in accordance with the annual fee fixing resolution of the assemblies. Fee rates are presented to the General Assembly for approval after consultations with stakeholders.

The approved user fees only becomes effective after it is published in the National Gazzette by each MMDA. The current public toilet fees applicable in the selected communities are presented in Table 6.7 below.

Table 6.7: Public Toilet user fees in selected communities

District	Komenda Edina Eguafo Abirem	Gomoa West	Hemang Lower Denkyira	Wassa Amenfi East	Jomoro	Sefwi Wiawso	Upper Manya Krobo	Birim North	Afram Plains North	Ho West	Nkwanta North	Ketu North
Community	Edina Essaman	Dego	Twifo Hemang	Adesu	Tikobo No.2	Sefwi Asawinso	Akateng	New Abirem	Donkorkrom	Kpedze	Sibi Hill Top	Dzodze
Present Public Toilet User Fee (GHp)	20	20	30 and 50	20 to 50	20 to 50	30	20 to 50	20 to 50	30	20 to 50	-	10 to 20

Faecal sludge collected by cesspit emptier trucks is disposed of at locations usually at outskirts of communities designated by the MMDAs. This is referred to as controlled or authorized dumping as against un-authorised or clandestine dumping which occurs without MMDAs' approval. The cost of desludging ranges between GH¢ 180 – GH¢ 500 depending on the distance covered by each cesspit emptier from its normal (base) operational area.

6.3 Existing Business Arrangements for Desludging Services

A combined emptying-and-transport of sludge carried out by mostly privately owned cesspit emptier trucks is the only service available to the selected communities. Currently a few MMDAs (KEEA and THLDDA) provide emptying services. A description of the predominant services is provided below.

The service delivery involves:

a. Ownership of Cesspit Emptier

The private sector operator procures a cesspit emptier, pays all vehicle operating costs including insurances and road worthiness. The owner registers the business with an MMDA and pays all registration fees to enable it operate within the district.

The owner engages a cesspit emptier driver and agrees on a weekly amount according to the prevailing market rates to be rendered by the driver at the end of each week. The owner is responsible for carrying out repairs and maintenance of the vehicle and renewing all licenses for the operation. The owner also pays a monthly salary to the driver and his two (2) assistants.

b. Operation of Cesspit Emptier

The cesspit emptier driver is responsible for engaging the services of a minimum of two (2) assistants whose duties are to empty cesspits, clean the surrounding of the desludged tanks and any spillages. The driver is responsible for fueling the vehicle, looking for business and paying tipping fees at the disposal point. The driver also pays a per diem allowance to the assistants. He also pays daily dues to the Drivers' Union.

6.3.1 Sustainability of Existing Service Providers

The weekly sales return rendered by the driver to the vehicle owner is calculated so that the vehicle owner can recover capital investments, recoup operating costs and make some returns. The desludging fees are fixed by the MMDAs upon negotiation with stakeholders such as the umbrella organization, Environmental Service Providers Association (ESPA).

The sustainability of the operations is largely dependent on the prudent cash management of the vehicle owner. In most cases existing vehicles are operated till their end of life and are hardly replaced by their owners, therefore there are always new entrants in the market.

6.3.2 Drivers/Barriers for Growth and Market Consolidation

A number of drivers/barriers have been identified in the provision of desludging services. Table 6.8 presents a number of criteria and related drivers and barriers.

Table 6.8 Examples of Drivers/Barriers for growth and market consolidation

Criteria	Drivers	Barriers
Technical	The availability of household WCs and public toilets which produce large volumes of faecal sludge for offsite treatment. Availability of cesspit emptier trucks within the reach of communities for desludging services.	Common latrines e.g VIP and the KVIP, produce small volumes of faecal sludge which do not require desludging.
Regulatory	Desludging services has been liberalized and privatized.	Poor enforcement management leading to unauthorized disposal of faecal sludge.
Access to Finance	The availability of funds from private sector is an incentive for both capital acquisition and working capital requirement.	High interest and the requirement for loan approval demotivate service providers.

6.3.3 Existing Links between Sanitation Service Providers, Business Support and Financial Services

The successful operations of the desludging services are largely dependent not only on availability of market but also effective business support and financial services. The regulation of services by MMDAs is limited to granting of operating licenses and designating of sites for disposal and charging appropriate fees. The private operators largely operate from their resources and therefore have non-formal links with business support and financial services providers.

The Service Providers' operations are critically supported by operators in the motor vehicle and transport industry as well as fuel and lubricants dispensing outlets.

Motor vehicle spare parts and accessories sellers import and retail essential spare parts which ensure the availability of parts for maintenance of trucks. Motor mechanics and vulcanisers also play important roles in operation and maintenance of the vehicles.

Commercial banks and microfinance institutions also support the operations of operators by providing banking services, loans and overdrafts that enable the operators to purchase new trucks and rehabilitate existing old and new trucks.

6.3.4 Availability of Finance for Expansion of Businesses in Desludging Services

As mentioned earlier, there are no dedicated funds or financial institutions designated for providing funds for the expansion of businesses for desludging services.

6.3.5 Feasibility of Service Provision for Low-Income Households

From the survey results many low-income households rely on public toilets which are serviced by emptier trucks, as well as on KVIPs and VIPs which do not require desludging. This is shown in the various SFDs for the selected communities.

6.3.6 Strategies for Providing Sustainable Services for Low-Income Households

From the survey results, most households rely on VIPs, KVIPs which are emptied mostly by manual means. The unsafe return of excreta into the environment disposed of from household pit latrines and over-used KVIP toilets account for a substantial portion of the total faecal sludge generated in each of the study communities. The small volumes of the faecal sludge disposed of, and in many cases, the inaccessibility of the toilets do not make it technically feasible and economically viable to use cesspit emptier trucks for desludging. To improve the handling and disposal of faecal sludge, alternative means of emptying especially the use of small scale emptying equipment will enhance services.

Haulage of solid waste in Ghana up to the year 2005 had been carried out mainly by various types of refuse collection vehicles (RCVs) and manual push trucks. In 2006, a three wheel mechanized collection truck was introduced and targeted at pre-collection services for small generators and congested areas. The 3-wheeler trucks (and also tricycles) have become popular (commonly called "Borla Taxi"). The Borla Taxi which was previously non-existent is now widely patronized by the private sector and small waste generators and it is currently hauling about 30% of the total solid waste delivered at landfill sites.

The widespread use of the "borla taxi" is indicative of the profitability of the small scale equipment in the waste management cycle. With the necessary education and advocacy, private sector entrepreneurs can be encouraged to invest in the small motorised emptying equipment. Households which had hitherto paid for unsafe manual emptying will have a safer and hygienic option and the burden of pollution due to unsafe return of excreta to the environment reduced.

6.4 Treatment, Disposal and Re-Use of Faecal Sludge

From field visits during the survey it was observed that only Edina Essaman had a biomethanation plant for the treatment, disposal and re-use of faecal sludge. In the remaining communities, direct discharge of excreta into the immediate environment is what prevails.

6.4.1 Edina Essaman Biomethanation Plant

The widespread lack of treatment of faecal sludge is of grave public health concern as it leads to unsafe return of excreta into the environment. From the survey, only Edina Essaman in KEEA has a faecal sludge treatment facility with a capacity for treating $5m^3$ out of the estimated daily district output of $40m^3$ of faecal sludge5.

The Edina Essaman biometanation (biogas) plant (Figure 6.4) was constructed as a stand- alone plant to receive and treat faecal sludge desludged from public toilets, institutional toilets and household water closets within the community. It has a capacity of $5m^3$ and faecal sludge is the only substrate. The technical and financial details of the operations of the plant are provided in Table 6.9 below.

Figure 6.4: Edina Essaman Biomethanation Plant

[5] At the time of the survey, this biomethanation (biodigester) plant was not operational due to litigation over the payment for the land on which plant is sited

Table 6.9: Technical and Financial Operations of the Plant

Parameter	Value
Year of Construction	2013
Type of Facility	Brick dome (fixed dome)
Capacity of Bio-digester	250m^3
Daily input (feed)	5 m^3 of faecal sludge
Daily output	4 m^3 (biogas) and 2 tonnes (slurry- sawdust compost)
Cost of Facility	GHc 270,000, (US$ 63,240.74)

Exchange Rate US$ 1=GHC 4.2694-(average inter- bank rate 19/6/2015)

The unit process flow diagram of the plant is shown in Figure 6.5

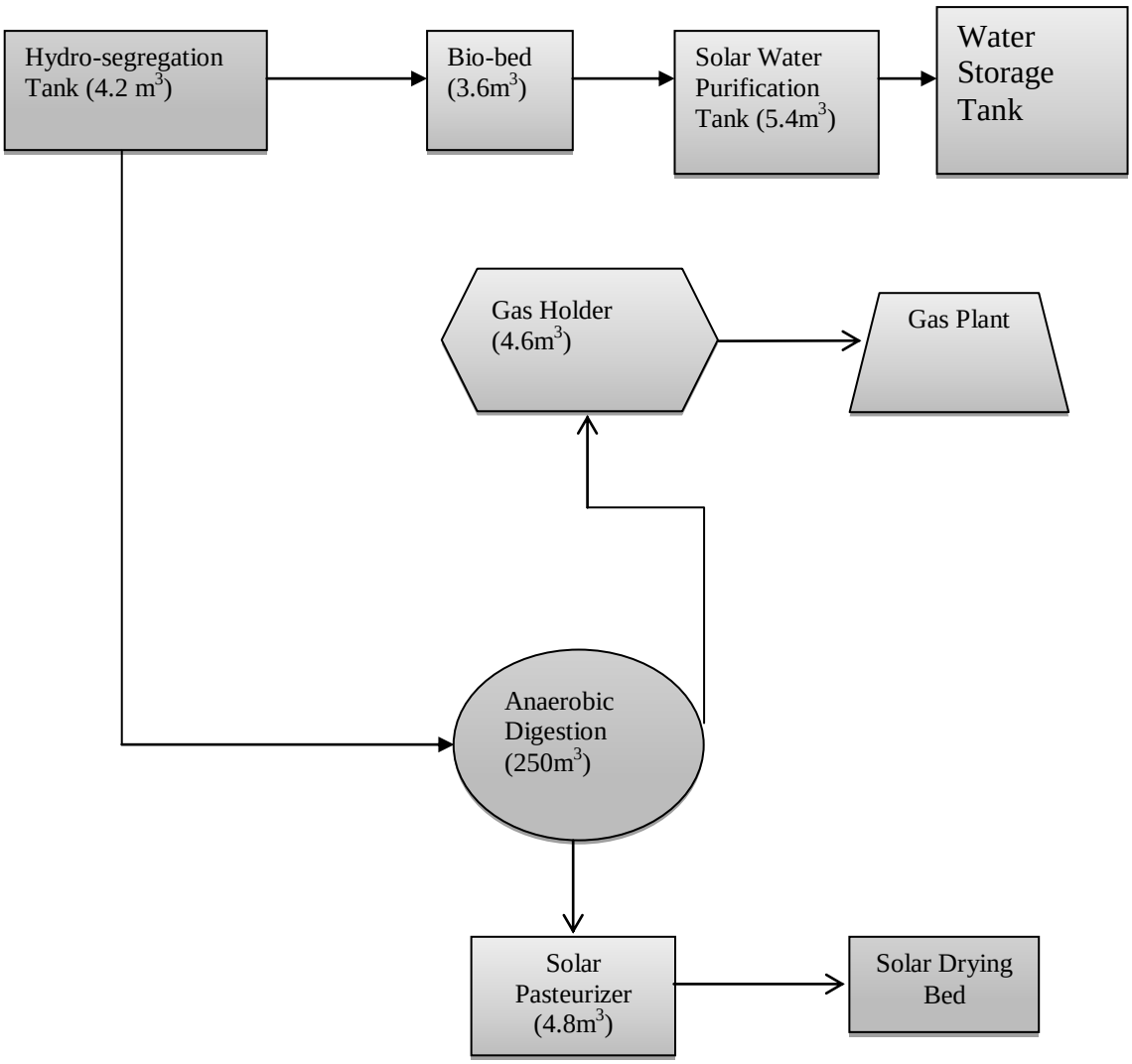


Figure 6.5 Unit Process Flow of Edina Essaman Anaerobic Digestion Plant (ADT)

Ownership and Management: the plant was financed by a grant from the Royal Kingdom of Netherlands (RKN) to the Edina Essaman community and the KEAA respectively. The plant is located on a 16.32 acre of land the community had allocated to the KEEA and has been used for the dumping of both solid waste and faecal sludge without treatment.

The management arrangement for the plant is in the process of being implemented (due to delays caused by litigation between the community and KEEA for non- payment of rent for the entire land).

An independent private operator is in the process of being appointed to manage the plant on behalf of the joint owners (the community and KEEA).

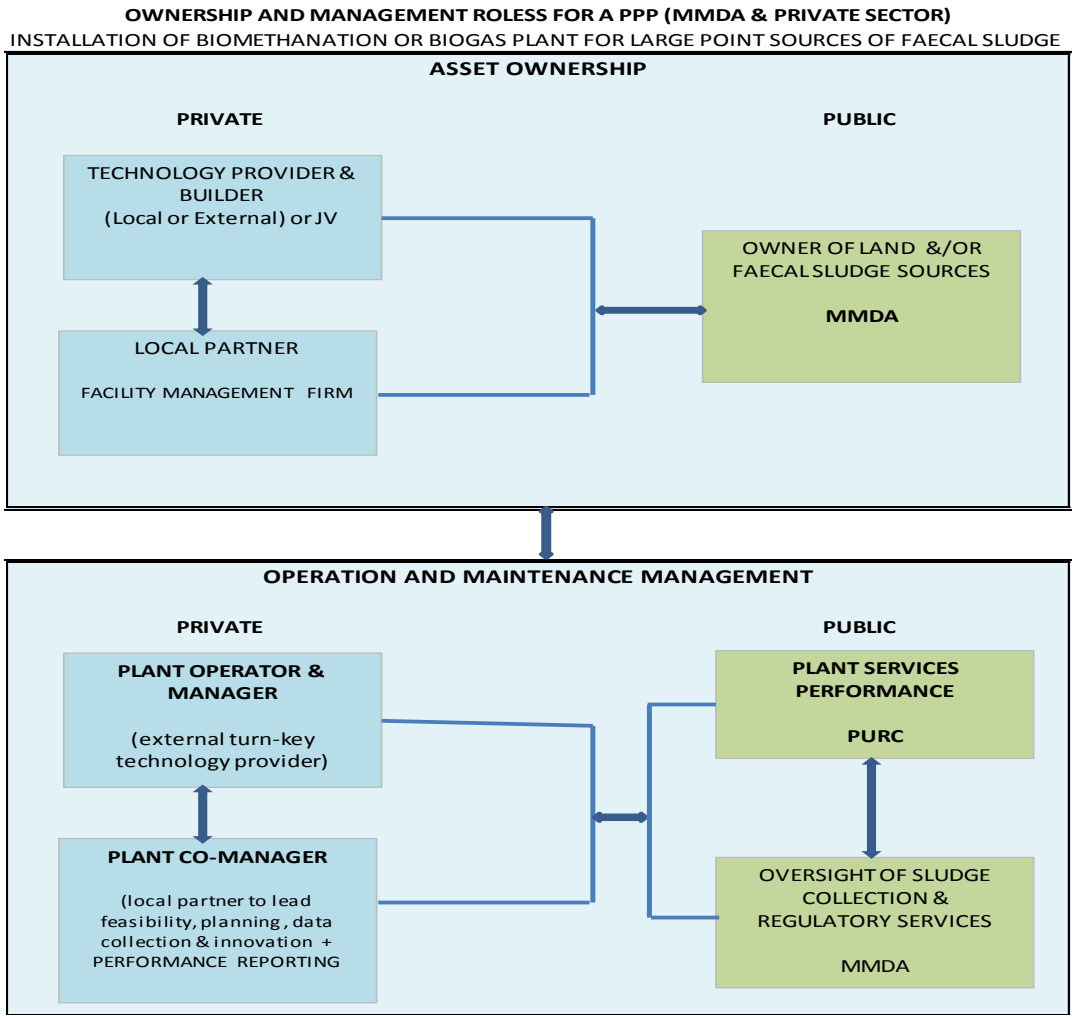


Figure 6.6: Ownership and Management Roles in MMDA and Private Sector Partnership

6.4.2 Sustainability of Existing Service Providers

The discussions under the following sections concern the Edina Essaman pilot plant.

Drivers/Barriers for Growth and Market Consolidation: the drivers/barriers specific to the Edina Essaman plant are presented in Table 6.10.

Table 6.10 Examples of Drivers/Barriers for growth and market consolidation

Criteria	Drivers	Barriers
Technical	There is a potential flow of faecal sludge up to 40 m^3 within the entire district and also the very large generation points within 25km radius.	Low intake capacity of plant of 5m^3 daily. The plant does not have a dedicated cesspit emptier assigned to its operation.
Regulatory	Public Private Partnership arrangement for the implementation and management of the plant.	Non-adherence of government directive to MAs to purchase and own land for treatment and disposal of waste. Poor advisory support for drafting of Memorandum of Understanding (MoU) and implementation of management administration.
Access to Finance	Start-up capital by Development Partner (DP) (Royal Kingdom of Netherlands); expansion to be borne through sales of by-products and tipping fees.	Low volumes of by-products affect profitability.

Existing Links between Sanitation Service Providers: Business Support and Financial Services: the basic links is between operators of the plant, KEEA and has minimal operating and maintenance costs beside staff costs.

Availability of Finance for Expansion of the Business: as shown in Table 6.9 it is expected that expansion will be borne through of biogas and compost. For the current capacity of the plant an additional business line could be the drilling and mechanisation of borehole for sale to the community to increase profitability.

Strategies for Providing Sustainable Services for Low-Income Households: from the survey, many low income households rely on public toilets. The sustenance of affordable tipping fees will ensure affordable services to the low-income households.

7. BUSINESS MODEL ASSESSMENT

The results of the assessment of the business models for faecal sludge management including household latrine collection and transport, disposal/treatment and reuse are presented in the sections below.

7.1 Household Latrine Promotion and Construction

The various models for household latrine promotion and construction are as follows.

7.1.1 Rural Sanitation Model and Strategy

The Ministry of Local Government and Rural Development (MLGRD) has prepared a manual- Rural Sanitation Model and Strategy (2012) to guide the implementation of rural sanitation delivery. The rural sanitation model and strategy relies on MMDAs as district facilitating agents, local private sector as producers and suppliers and where feasible micro-finance institutions and rural banks as credit sources for the delivery of household sanitation facilities. The model comprises of two elements, (i) the building of capacities of entire communities in behavioral change for hygienic living through Community Led Total Sanitation (CLTS) towards achieving an Open Defecation Free (ODF) status; and (ii) the promotion of owning of household toilets.

7.1.2 Description of Various Models for Household Sanitation Promotion

Household sanitation facility promotion and construction has always been a priority for many MMDAs and relevant central government agencies. Various models have been proposed, adopted/adapted and applied for the delivery of household toilets in communities with varying successes.

In a recent study of fifty (50) selected communities from ten (10) Districts in five regions (Central, Volta, Upper West, Upper East, Northern) of Ghana by UNICEF-Ghana a number of business models were identified. The commonly applied models identified are described in the report on "Business solutions and micro-finance for sanitation in Ghana" and include the artisan driven model, district- driven model and national manufacturer model.

The results of the findings of the survey, largely conforms to those of UNICEF's recent study. The main models identified are described below.

Artisan Driven Model: this model aims at creating a sustainable artisanal delivery of household toilets with the artisan carrying out both marketing and construction of toilets for households. In this model the artisan procures the materials and carries out all the construction works. Previous experiences show that if the artisans' businesses are project-driven then the demand from households for artisans' services decline accordingly. This model can be sustained if the artisan is self-motivated and engaged in a sanitation business.

The artisan driven model is enhanced by the extension of credits to households by rural banks and microfinance institutions for home improvement including acquisition of household toilets. This has the potential of increasing the construction of toilets by households.

District Driven Model: in this model, standardized latrine components are manufactured by a district based manufacturer who markets and distributes the parts in communities. The artisan's role is to install the components for the household for a fee. The emphasis here is that the marketing and promotion is carried out by the districts. Any lax on the part of the district based manufacturer affects the delivery of the household programme.

National Manufacturer Driven Model: in this model, a national manufacturer produces components for distribution and installation nationwide. The marketing and installation are in most cases carried out by the national manufacturer. The community artisan's role in this model is very minimal. The level of delivery of toilets under this system is largely dependent on the marketing capabilities and resources of the manufacturer. Any operational challenges encountered by the national manufacture affect household toilet delivery nationwide. Figure 7.1 gives a summary of the different business solution models described.

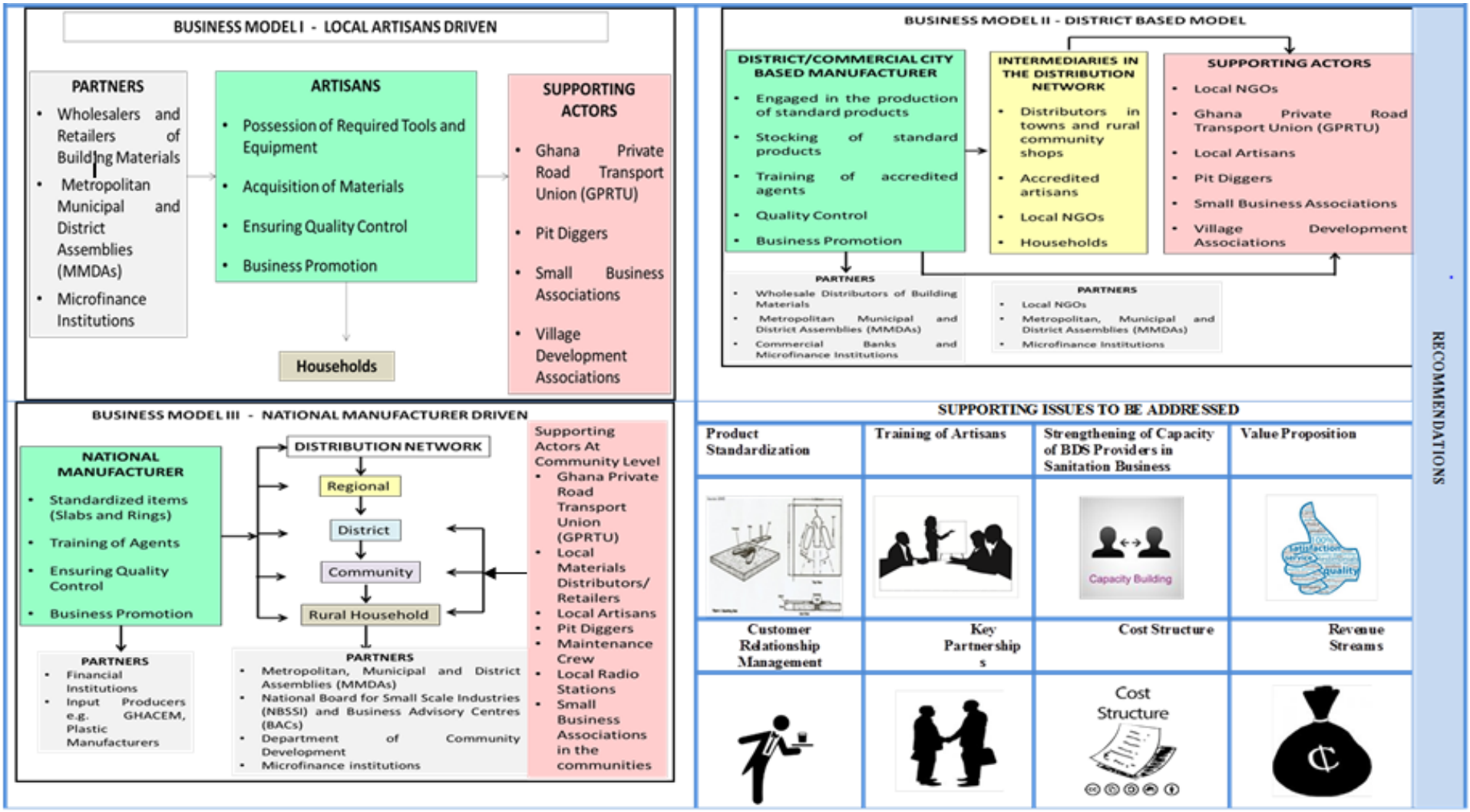


Figure 7.1 Existing Business Models

Source: UNICEF-GOG WASH Programme, Vol. 1 Assessment Report on Applying Business Solution and Micro-finance to Rural Sanitation Delivery in Ghana, 2014 by CDC Consult Limited, Accra, Ghana

Another model which has been applied mainly in urban and peri-urban areas is the small works contractor model. This model was applied in Ghana's five largest cities of Accra, Kumasi, Takoradi, Tema and Tamale under the Urban Environmental Sanitation Project series (UESP I&II). The model is described below.

Small Works Contractor (SWC) Model: This is a modified version of the artisan driven model that has been successfully applied to deliver household toilets in the larger cities of Ghana. In this model, local small works contractors (who can also be entrepreneurs who act as management intermediaries) engage trained toilet artisans to market and construct approved household toilets in houses for a percentage of the total workmanship cost. The inclusion of various financial institutions (commercial banks, rural banks and microfinance institutions) which advance credits to households to finance home improvements, including household toilets, has the potential for sustaining latrine promotion. The key features of the model are detailed in Table 7.1 below.

Table 7.1: SWC Business Model for household Toilets

<table>
<tr><th>Key Partners</th><th>Key Activities</th><th>Value Propositions</th><th>Customer Relationships</th><th>Customer Segments</th></tr>
<tr><td rowspan="2"> 
1.MMDAs
2.NGOs
3. Hardware Suppliers
4. Transport sector operators
5.Commercial Banks
6. Rural Banks.
7.Microfinance Institutions</td><td> 
1 Marketing of Household Latrines
2. Households secure funds to construct household toilets
3. Artisans/households procure materials for construction
4.Artisans construct household toilets
5. Household/MFI settles balance of facility cost.
6. Small works contractor pays artisans labour costs
KEY RESOURCES
Well trained household artisans.
Efficient Hand tools
Toilet construction materials</td><td rowspan="2"> 
1. Promoting a clean environment.
2.Reducing environmental pollution and degradation
3.Sustaining the health and well-being of communities
3. Increasing socio-economic activities and gains in the environmental sanitation value chain.
4.Increasing agricultural output
5. Constructing household KVIP toilets.
6. Utilising humus from decomposed feaces for backyard gardening to supplement home domestic budget.</td><td> 

1. Small works contractor and artisans move from house to house to market toilets
2. Artisans maintain contact within the community for future engagements
CHANNELS OF DISTRIBUTION
 

House-to-house canvassing</td><td rowspan="2">Households</td></tr>
<tr><td colspan="2">COST STRUCTURE
 
Toilet construction materials
Small work contractor's fees
Artisan commission</td><td colspan="2"> 

REVENUE STREAMS
Household savings
Micro finance loans and advances
Small works contractor's profit
Household Artisan's commission</td></tr>
</table>

7.2 Faecal Sludge Emptying Services

Desludging is an important element in the excreta collection, haulage and final disposal business. The collection and transportation of the bulk of faecal sludge is carried out by cesspit emptier truck operators. The analysis of costs, revenues and barriers to profitability of desludging services are described under the following sections.

Tariff Structure: service fees charged are based on the capacity of the truck and a minimum haulage-distance from the discharge point (site). Extra charge is incurred for distances beyond the minimum radius of coverage. This accounts for the high fees paid by rural households with water closets and operators of public toilets as cesspit emptier trucks do not operate from rural communities but from larger towns. (See Figure 7.1 above)

Disposal/Dumping Fees: Dumping fees are charged according to the capacity of the truck. Table 7.2 presents current disposal fees.

Table 7.2: Current Disposal Fees

Capacity	Fees/ Trip GHC¢	Fees/trip-US$
$18m^3$	25.00	6.00
$15m^3$ and below	15.00	3.50

Equipment Costs: the main equipment used in the collection and transportation of faecal sludge is the cesspit emptier truck. Cesspit emptier trucks with capacities ranging between 8 m^3 to $18m^3$ are used in emptying, collecting and transporting faecal sludge from household/institutional septic tanks and public toilets. These are mostly fairly used 2^{nd}-hand trucks imported from Europe and elsewhere. The average cost of a $15m^3$ truck is GH¢ 85,400 (US$ 20,000) and an$18m^3$ truck is GH¢ 107, 000 (US$ 25,000). The estimated lifespan of the trucks in Ghana is at a minimum of 20 (twenty) years.

Operation and Maintenance Costs: the truck owner and the truck driver incur separate operation and maintenance costs. The average monthly operation and maintenance costs based on an assumption of two trips per day are presented in Table 7.3. The average monthly operations and maintenance costs of the truck owner is GH¢ 2,561 (US$ 600) while the truck driver's cost amounts to GH¢ 5,337 (US$ 1,250).

Table 7.3: Average Monthly Operations & Maintenance Truck Owning and Operation Costs

No	Expenditure Item	Truck Owner		Truck Driver	
		GH¢	US$	GH¢	US$
1.	Vehicle Insurance & Roadworthy	51	12		0
2.	Business Operating Fees	38	9		0
3.	Vehicle Repairs & Maintenance	1,000	234		0
4.	Salaries	700	164		
5.	Amortisation of Equipment Cost	444	104		

No	Expenditure Item	Truck Owner		Truck Driver	
		GH¢	US$	GH¢	US$
6.	Fuel & Lubricants			2,698	632
7.	Dumping Fees			1,349	316
8.	Assistants Per Diem			538	126
9.	Union Dues			269	63
10.	Protective Clothing			269	63
11.	Other Incidental Expenses	328	77	214	50
	TOTAL	**2,561**	**600**	**5337**	**1,250**

Exchange Rate US$ 1=GHC 4.2694-(average inter- bank rate 19/6/2015)

Profit Margin: The estimated annual profit of the truck owner and the truck driver respectively based on an average operation level of 2 (two) trips a day are detailed in Table 7.4. From the analysis the truck owner earns annual cash profit of GH¢ 64,260 (US$ 15,048). From this earning the payback period for recovering the initial capital outlay for the purchase of the truck is estimated at 20 (twenty) months. With an average truck lifespan of twenty years, it can be concluded that the desludging service is potentially lucrative business.

The truck driver earns an average annual fixed income of GH¢ 13,164 (US$ 3,084) paid by the truck owner. In addition, the driver earns GH¢ 175 (US$ 41) for any additional trip in excess of the daily minimum of 2 (two) trips.

Table 7.4: Estimated Annual Profit of Truck Owning & Operation

No.	Items	Truck Owner		Truck Driver	
		GH¢	US$	GH¢	US$
1.	Revenue-Truck Driver	0	0	13,500	3,162
2.	Revenue-Truck Owner	7,472	1,750	(7,472)	(1,750)
3.	**Net Revenue**	**7,472**	**1,750**	**6,028**	**1,412**
4.	Operating Costs (see Table 6.8)	(2,561)	(600)	(5,337)	(1,250)
5.	Gross Monthly Profit	4,911	1,150	691	162
6.	Driver's Salary	0	0	406	95
7.	Monthly Profit	4,911	1,150	1,097	257
8.	Add Monthly Amortisation of Equipment	444	104	0	0
9.	Monthly Cash Profit	5,355	1, 254	1,097	257
10.	Annual Cash Profit	64, 260	15,048	13,164	3,084
11.	Cost of Truck	106,735	25,000		
12.	Payback Period (item 11 /item 10)	1(one) year, 8 months (20 months)			

Exchange Rate US$ 1=GHC 4.2694-(average inter- bank rate 19/6/2015)

Approaches to Cost Effectiveness: the continuous engagement of the truck driver is dependent on the delivery of the agreed weekly sales, taking proper care of the truck to minimise repairs, accidents etc. In event of the truck owner incurring a material financial loss which can be attributed to the truck driver, the driver is dismissed without any compensation.

This undocumented contractual condition between the truck owner and the driver serves as a moral check on the performance of the driver which impacts on costs. The driver also incurs cost from the vehicle operations. Control of these costs increases the earnings of the driver.

Financing Mechanism: trucks are acquired from owners' resources. Operations and maintenance costs are financed from the daily service fee charged by the driver which is paid for in cash with no credit options.

Cost of Capital: the current interest rates of commercial banks range between 30% and 35% per annum on reducing balance basis. Micro-finance institutions however charge far higher rates of between 4% - 6% per month bringing their total annual interest rates to 48% -72% per annum.

Frequency of Emptying: Public toilets because of the high level of usage by both households and transient public are desludged more often than household and institutional toilets. From interviews conducted, public toilets are desludged averagely once every two months while large institutional toilets are desludged twice a year on average and water closet toilets for an average household size of 7-10 persons are desludged once every two years.

Market Size: demand for emptying services for public toilets constitute about 90% of the market share per community.

Barriers to Access: there are no major barriers to access except for new developing areas with very poor access roads. During the annual rainy season of June and July, most residential areas are difficult to access and this affects service delivery. There is also great demand for tanker services during the rainy season due to the ingress of rain water into poorly constructed holding-tanks and areas with high water table. The seasonal rise in demand of emptying services often creates long waiting times.

Need for Transfer Stations: the volumes of faecal sludge collected and transported are small such that there is no need for the provision of transfer stations. Direct collection of faecal sludge by cesspit emptier trucks is the prevalent mode of service.

Use of Equipment for Other Services beside Faecal Sludge Collection/Haulage: The cesspit emptier trucks are not used for other services beside excreta collection/haulage.

SWOT Analysis of Existing Collection and Transportation Systems: the SWOT analysis of existing collection and transportation system is presented in Table 7.5 below.

Table 7.5: SWOT Analysis of Existing System

Strengths	Weaknesses	Opportunities	Threats
Quality equipment for service delivery. The extensive participation of the private sector ensure availability and reliability of service The acceptance of MMDAs fixing minimum fees.	Lack of sites for treatment and disposal compelling the unhygienic discharge of sludge into the environment instead of processing it for further economic gains. Lack of knowledge of the economic benefits of the treatment and use of by-products of faecal sludge Lack of continuous public education by MMDAs, NGOs and the Central Government. Lack of commercial enterprises engaged in the treatment and re-use of faecal sludge.	Extensive agricultural activities nationwide provide a huge market for the re-use of faecal sludge in all communities. The grouping of environmental service providers under ESPA provides a platform for attracting prospective investors into the faecal sludge business.	The lack of treatment plants for excreta can eventually lead to ceasure of unauthorised discharge. Increasing O&M costs is likely to reduce patronage by households.

The existing business model for the collection and transport system is described in Table 7.6 below.

Table 7.6: Business Model Faecal Sludge Collection and Transport

<table>
<tr><th>KEY PARTNERS</th><th>KEY ACTIVITIES</th><th>VALUE PROPOSITIONS</th><th>CUSTOMER RELATIONSHIPS</th><th>CUSTOMER SEGMENTS</th></tr>
<tr><td rowspan="2">1. MMDAs
2. Spare Parts Suppliers
3. Mechanical Workshop Owners.
4. Fuel Station Operators</td><td> 

1. Cesspit Emptier Truck owner procures truck for the operation of faecal sludge desludging services.
2. Truck owner engages Truck driver to render service to the public and account for operations.
3. Truck driver engages assistants and delivers service to customers..
4. Truck drive charges service fees and desludges faecal sludge and disposes of sludge at designated locations.
5. Truck driver pays truck owner weekly sales.
6.Truck owner pays driver pays driver monthly salary
7. Truck driver pays assistants daily allowance and monthly salary.</td><td rowspan="2"> 
1. Providing reliable and affordable cesspit emptier services for customers.
3. Clean environment.
2. Reducing environmental pollution and degradation by disposing of faecal sludge at designated locations.</td><td>1. Cesspit Emptier Truck drivers maintain phone contacts with regular customers for service delivery.

2. Telephone contact numbers are inscribed on the trucks for the public to contact for service

3. Trucks are packed at designated locations for personal contact by the public.</td><td rowspan="2">1. Households
2. Public Latrines
3. Commercial and Institutional Latrines</td></tr>
<tr><td>KEY RESOURCES
1. Cesspit Emptier Truck.
2. Well trained driver s and assistants</td><td>CHANNELS OF DISTRIBUTION
Telephone and personal contacts.</td></tr>
<tr><td colspan="2">COST STRUCTURE
Capital cost of Truck
Spare parts, fuel and lubricants
Business registration fees
Truck Owner’s Weekly fees
Truck Driver’s Salary
Driver’s Assistant’s daily allowances and salaries.</td><td colspan="3">REVENUE STREAMS
Desludging service fees
Truck Owner’s Weekly fees
Truck Driver’s Salary</td></tr>
</table>

7.3 Treatment, Disposal and Re-Use of Faecal Sludge

Anaerobic digestion facilities are becoming the preferred treatment option especially for private institutions (hotels, hospitals and schools). The main driver for this choice is the convenience of operations and maintenance and ready usage of by-products (e.g. biogas). Table 7.7 provides details of a number of Anaerobic Digestion Treatment (ADT) facilities.

Table 7.7: Snapshot of Existing ADT Facilities

No.	Ownership	Location	Current Situation
1.	Flagstaff House-Seat of Ghana Government	Accra, Greater Accra Region	Functional
2.	Fiesta Royal Hotel	Accra, Greater Accra Region	Functional
3.	African Regency Hotel,	Accra, Greater Accra Region	Functional
4.	Psychiatric Hospital; all in Accra;	Accra, Greater Accra Region	Functional
5.	Ghana International School	Tema Greater Accra Region	Functional
6.	Edina Essaman Community	Edina Essaman, Central Region	Non -operational
7.	All Nations University	Koforidua, Eastern Region	Functional
8.	Safisana Pilot,	Ashaiman	Functional
9.	Soya Milk Factory	Tema, Greater Accra Region	Functional
10.	Kumasi Institute of Tropical Agriculture	Domeabra, Kumasi, -Ashanti Region	Functional
11.	Ghana Permaculture Institute,	Tano-boasi,Techiman, Brong Ahafo Region	Functional

7.3.1 Selection of Preferred Treatment and Re-Use Option

As stated in previous sections, the selection of a preferred treatment and re-use option is based on consideration of the study objectives, the type and volume of material (faecal sludge), and the physical and chemical properties of the material. The following provide additional criteria for selecting small-scale, non-conventional treatment options that also afford re-use of by-products:

- **Performance of existing treatment plants**: the current state of the sewerage systems in communities within the three (3) major cities in Ghana as shown in Table 3.2 above gives an indication of the difficulties in the operation and maintenance (o&m) management of sewerage systems. The long term functionality and ease of O&M management are therefore important criteria for the choice of treatment option. The continuous functionality of installed ADT systems makes them attractive alternatives.

- **National Policy on treatment and re-use**: the Environmental Sanitation Policy (ESP Revised, 2010) which provides national policy guidelines on environmental sanitation and the National Environmental Sanitation Strategic Action Plan (NESSAP 2010-2025) recommend the adoption of decentralised-excreta-treatment-resource-recovery and re-use (DETERRR) systems and further identify bio-digesters/reactors as a favourable option which can lead to cost-reduction in developing treatment facilities, especially for handling faecal sludge from public toilets and domestic on-plot systems.

- **The quantities and availability of faecal sludge**: the faecal sludge available for treatment in the study communities as shown in Table 5.1 (total volume of sludge desludged and transported) above are not in adequate quantities for the application of large scale treatment facilities. The use of ADT systems for small batch flows is an appropriate option - example the $5m^3$ capacity plant for KEEA.

- **Operation and maintenance management of facilities**: compared to other decentralized systems used in Ghana for handling batch flows of faecal sludge such as faecal sludge treatment ponds, ADT systems provide environmentally friendly treatment and are not dependent on additional equipment and machinery.

As a result of the low levels of faecal sludge flows in the various communities, the reliability of the of biogas technology, the low cost of the facilities and operations and maintenance costs, the construction of biogas reactors in the study communities is recommended. This is to ensure the safe treatment of faecal sludge to address the unsafe return of excreta into the environment.

Additional benefits as well as some disadvantages of Anaerobic Digestion Treatment are provided in the Table 7.8 below.

Table 7.8 Benefits and Disadvantages of ADT Plants

Other Advantages		Disadvantages
• Less energy required		• Long Start-up time
• Less sludge production		• May require alkalinity control
• Fewer nutrients required		• Effluent requires further treatment
• Methane(Biogas) production		• Nutrient Removal not possible
• Smaller Reactor Volume required		• Susceptible to toxic substances
• Robust		• Potential for producing odorous gases

7.3.2 Options for Locating Anaerobic Digestion Treatment Plants in Communities

The technical feasibility and economic viability of Anaerobic Digestion Treatment (ADT) plant is largely influenced by its location within the community. Table 7.10 provides possible options for locating bio-digesters.

Table 7.9 Options for Locating ADT Plants

Option	Toilet/Facility Type	Advantage	Disadvantage	Remarks
Bio-digester (ADT Plants)	Single Household System	•No desludging of faecal sludge and therefore related cost is eliminated •Underground construction minimises land use	•Cost per household is high •Requires expert design and skilled construction	•Effluent still to be treated before final discharge /e-use
	Centralised System with Multiple Households	•Low Operating Cost •No desludging of faecal sludge and therefore related cost is eliminated •Generation of renewable valuable energy source	•Cost for gas transmission and utilisation can increase cost •Requires expert design and skilled construction	•Effluent still to be treated before final discharge /e-use
Coupling Bio-digesters to Existing Public Toilets	KVIP	•Not Applicable		•Modification of pits required to overcome difficulty of desludging of multiple pits.
	Aqua Privy	•Generation of renewable valuable energy source •No desludging of faecal sludge and therefore related cost is eliminated	•Central vent pipe allows escape of methane gas •Existing water seal to prevent effective trapping of biogas	•Coupling biogas plants to existing public toilets has limiting factor
	WC/Flush Toilet	•Septic tank can easily be reticulation into the proposed bio-digester	•The plant will require large space which is limited	
Stand-Alone facility at outskirt of community	Bio-digester (ADT plant)	•Low Operating Cost •Generation of renewable valuable energy source •Availability of land •Environmental health threats are reduced. •Haulage distance, time and cost of faecal sludge is reduced.	•Low faecal sludge volumes from the rural communities and small towns may not sustain economic operations of the bio-digesters. •Low cost recovery and so requires other complementary investment such as water	•This is a feasible option for peri-urban communities and other communities with high transient population.
Stand-Alone facility located within 25km radius catchment area	Bio-digester (ADT plant)	•Availability of land •Generation of renewable valuable energy source •Availability of large volumes of faecal sludge creates opportunity for financially viable operations. •Environmental health threats are reduced. •Communities in addition to the study communities will also benefit from the facility.	•Requires expert design and skilled construction •Requires higher investment cost. •Haulage distance, time and cost of faecal sludge may increase. •Low cost recovery and so requires other complementary investment such as water	•This option is feasible but will require further studies to determine the quantities of sludge and the location of facility

Example of sitting for Edina Essaman plant (KEEA): from the above table the Edina Essaman plant satisfy two criteria, (i) Stand-Alone facility at outskirt of community and (ii) Stand-Alone facility located within 25km radius catchment area of larger towns.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

8.1.1 Household Latrine Promotion and Construction

From the study, there are on-going efforts by MMDAs for improving access to household latrines in communities. However, these efforts are not achieving the desired results. The incidence of open defecation is high in the study communities and reliance on public toilets is prevalent (see Table 8.1). Even for the unique case of Edina Essaman where open defecation is reported to be absent, the dependence on public toilets is as high as 72%.

In a number of communities MMDAs, NGOs and CBOs are implementing various schemes for supporting household latrine construction including subsidies and micro-finance credit schemes. The persisting low uptake of construction of latrines by households is indicative of the need for appropriate financing arrangements for constructing household latrines that take into account households earning capacities and patterns.

Table 8.1: Incidence of open defecation and dependence on public and neighbour's household toilets for households without toilet facilities

Community	Households with Toilet Facility	Households using Neighbour's Household Toilet	Households using Public Toilet	Households Practicing Open Defecation	ODF Ranking
Edina Essaman	22.20%	5.60%	72.20%	0%	1st
New Abirem	80.00%	7.10%	12.60%	0.30%	2nd
Kpedze	46.10%	5.00%	48.50%	0.40%	3rd
Sefwi Asawinso	77.90%	8.50%	12.50%	1.10%	4th
Dzodze	50.30%	5.40%	41.60%	2.70%	5th
Adesu	49.50%	15.2%	31.30%	4%	6th
Twifo Hemang	69.40%	24.50%	0.40%	5.70%	7th
Donkorkrom	40.70%	6.80%	34.80%	17.70%	8th
Dago	61.30%	4.60%	10.70%	23.40%	9th
Akateng	19.70%	6.00%	47.30%	25.5%	10th
Tikobo No.2	36.90%	4.40%	10.60%	48.10%	11th
Sibi Hill Top	4.20%	0%	0%	95.80%	12th

The modest gains towards achieving ODF status in some of the communities can be attributed to the implementation of Rural Sanitation Model (RSM) and the roll out of CLTS. It suggests the need for introducing stricter bye-laws and effective enforcement management to sustain and add on to the gains made.

The study also showed the linkages among household toilets service providers, business support, financial services providers and MMDAs are currently not effective. This can be attributed to the fact that many of the intervention are project driven which come with specific project management arrangements that are not sustained after the project life span. There is need for policy initiative that engenders demand driven collaboration amongst households, service providers, financial institutions and MMDAs.

8.1.2 Faecal Sludge Emptying Services

From the study, the collection and transportation of faecal sludge by emptier trucks was found to be efficiently run by the private sector. However, the direct discharge of faecal sludge into the environment poses serious pollution impact which needs to be addressed by the provision of downstream treatment facilities.

The practice of manual emptying of latrines also poses health hazards. The introduction of robust small scale emptying machinery will improve the situation especially in inaccessible areas.

8.1.3 Public Toilet Management

The over dependence of households on public toilets has been a major setback to improving hygienic standards of the facilities. The non-provision of disability- and old-age friendly accessories in the toilet cubicles also impede their use by the elderly and people with special needs which need to be addressed. Enforcing bye-laws for maintenance of hygienic standards should be intensified.

8.1.4 Treatment, Disposal and Re-use of Faecal Sludge

From the study, there is lack of adequate treatment of faecal sludge and very minimal practice of re-use in spite of the potential environmental and socio-economic benefits. There is urgent need for appropriate final treatment facilities to reduce the impact of unsafe return of excreta to the environment. The selected treatment technologies should be suitable for handling small batch flows of faecal sludge as found in the study communities (see Figures 4.2 to 4.13). From the previous sections Anaerobic Digestion Treatment (ADT) technology is an appropriate option for the batch flows and low volumes as shown in the SFDs.

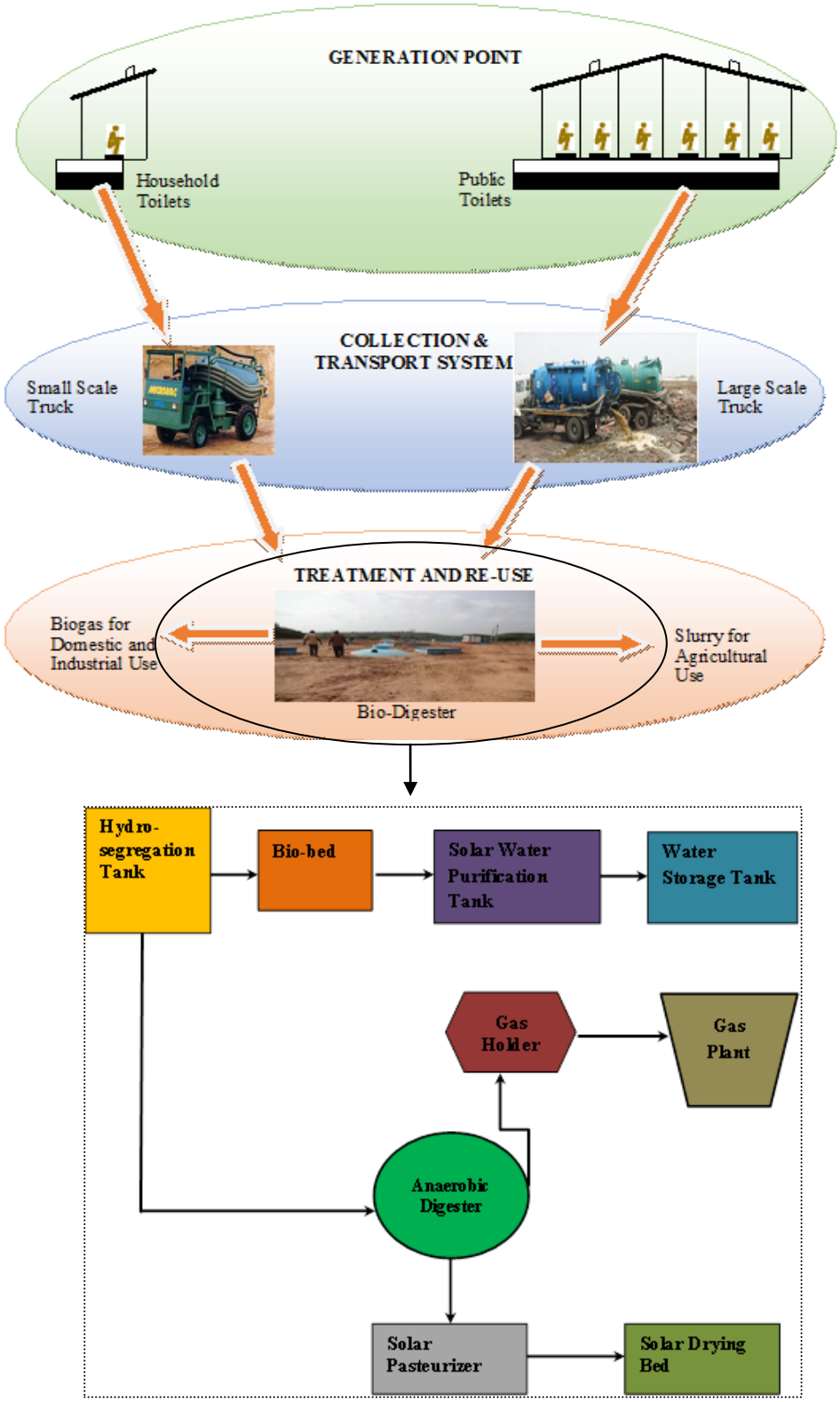


Figure 8.1: Flow Diagram for Faecal Sludge Collection, Treatment and Re-use (ADT scheme)

8.2 Recommendations

After a careful review of the existing faecal sludge management situations in all the selected communities and other management options, the following recommendations are made for implementation for improving the management faecal sludge in the study area and other similar communities.

8.2.1 Household Toilet Promotion and Construction

The up-scaling of improved sanitation facilities for households using the models identified in the UNICEF study of 50 communities and the Small Works Contractor (SWC) model can be adopted to achieve the following:

- provide households with improved sanitation facilities to meet objectives of healthy living;
- reduce households' reliance on public toilets
- eliminate open defecation
- provide sustainable business solutions in household excreta management and hence employment generation by engaging households, artisans, small works contractors, entrepreneurs, micro-finance institutions and rural banks.

In order to develop and sustain effective linkages among households, service providers, business support, financial services providers and MMDAs for promotion and construction of latrines, government policy should facilitate the establishment of mechanisms for promotion and construction of household latrines which are driven by the identified stakeholders in the linkages. The emphasis should be on the identified stakeholders' PPP arrangements that promote and sustain demand driven approaches.

In lieu of project driven financing which has proven unsustainable, financing mechanisms that depend on households paying for and owning their own toilets have the potential of sustaining the acquisition of household toilets. However, the important ingredient for households to pay for their latrines is to make available financing mechanisms with favorable credit terms which include the matching of repayment installments with the income earning patterns of the households.

Effective enforcement management is also required to ensure compliance with the provision of adequate latrines in all homes. The discussions below (see Table 8.3) give the relevant institutional arrangements for addressing enforcement.

Strategies for Improving Household Latrine Promotion for Specific Communities: whilst the above discussion is general for all communities, the peculiarities of each community should also be taken into consideration. To improve on the overall faecal sludge management in each community, the options in the sanitation ladder (refer to Figure 4.14) serve as a guide to the current situation which can inform strategies for promotion.

For example taking Sibi Hill Top (with population of 4,252) which was ranked the outlying highest in open defecation (95.80%), a specific proposal can be made for the adoption of ecological sanitation (ecosan toilets) for addressing the overwhelming prevalence of open defecation. For this community, the CLTS goal for ODF with the exclusive emphasis on the ecosan option which includes an intensive promotion of excreta reuse for back-yard farming because of the availability of space around homes.

Business Model for Promotion and Construction of Household Latrines: a generic business model recommended for the up-scaling of household promotion and construction are as shown Table 8.2. An important addition in the stakeholder linkages is the business support service providers whose roles include technical and entrepreneurial training focusing on household latrine promotion and construction. In this revised model (which covers the National, District, Artisan and Small Works Contractors (SWC)) has the potential to create a sustainable private sector led demand driven industry.

Table 8.2: Modified Business Model for Household Latrine Promotion and Construction

<table>
<tr><th>Key Partners</th><th>Key Activities</th><th>Value Propositions</th><th>Customer Relationships</th><th>Customer Segments</th></tr>
<tr><td rowspan="2"> 
1.MMDAs
2.NGOs
3. Hardware Suppliers
4. Transport sector operators
5.Commercial Banks
6. Rural Banks.
7.Microfinance Institutions
8. Business support service providers (e.g. Technical training institutions, Entrepreneurial Training Institutes etc)</td><td> 
1 Marketing of Household Latrines
2. Households secure funds to construct household toilets
3. Artisans/households procure materials for construction
4.Artisans construct household toilets
5. Household/MFI settles balance of facility cost.
6. Small works contractor pays artisans labour costs
KEY RESOURCES
Well trained household artisans.
Efficient Hand tools
Toilet construction materials</td><td rowspan="2"> 
1. Promoting a clean environment.
2.Reducing environmental pollution and degradation
3.Sustaining the health and well-being of communities
3. Increasing socio-economic activities and gains in the environmental sanitation value chain.
4.Increasing agricultural output
5. Constructing household KVIP toilets.
6. Utilising humus from decomposed feaces for backyard gardening to supplement home domestic budget.</td><td> 

1. National, District, Artisans and Small works contractor move from house to house to market toilets
2. Artisans maintain contact within the community for future engagements
CHANNELS OF DISTRIBUTION
 

House-to-house canvassing</td><td rowspan="2">Households</td></tr>
<tr><td colspan="2">COST STRUCTURE
 
Toilet construction materials
Small work contractor’s fees
Artisan commission</td><td colspan="2"> 

REVENUE STREAMS
Household savings
Micro finance loans and advances
Small works contractor’s profit
Household Artisan’s commission</td></tr>
</table>

Institutional Governance for Delivery of Household Toilets: the MMDAs' roles with respect to enforcement management are critical to the achievement of the objectives of faecal sludge management. Table 8.3 below shows the various roles and responsibilities of key stakeholder institutions in household latrine promotion.

Table 8.3: Institutional Governance for Household Facilities Promotion

Institution	Arrangements
MMDAs	i. Selection of an agency institutions to draw up a curriculum for the training and also undertake the training of household toilet masons/artisans ii. Involvement of all the decentralised sub-structures in the promotion of household toilets
Judicial Service	Establishment of Sanitation courts in the communities for the trial of sanitation offences.

Regulatory Support: The regulatory support activities indicated in Table 8.4 will be required to support the implementation of household latrine promotion.

Table 8.4: Regulatory support for household latrine construction

Organisation	Regulatory Support
MMDA	• Update of Assembly's Bye-Laws to increase current fines for non- provision of toilets in homes. • Drawing time lines for the compliance of provision of households • Undertaking public education on the bye-laws. • Facilitation of the establishment of Special Sanitation Courts (SSCs) in the Districts by the Judicial Service for trying sanitation offenses. • Provision of the necessary logistics to the Environmental Health and Sanitation Department (EHSD) to carry out house to house inspections and issue homes without toilets and issue preliminary Warning Notices. • Appointment of Sanitation Monitoring Teams (SMT) to monitor the performance of the EHSD by visiting homes to cross –check the issue of Warning Notices. • Intensification of the arrest and prosecution of individuals who engage in open defecation. • Issue of summons and prosecution of Landlords who fail to provide household toilets after the grace period.
Sanitation Courts	Trial of sanitation offences committed in communities.

Analysis of Organisations (Public and Private) to Partner Future Investment Programs: public and private organisations identified as key partners in supporting investment management of household latrine promotion and construction is discussed below;

- **Public Institutions**
  - Community Water and Sanitation Agency (CWSA)

CWSA has successfully supported MMDAs in the delivery of household and institutional latrines in rural areas. By its Establishment Act (Act 564, 1998), CWSA is mandated to facilitate the provision of safe water and water related sanitation services to rural communities and small towns.

A key role played by CWSA is the provision of technical assistance and facilitation to MMDAs in the implementation of water and sanitation projects. CWSA can be a key player in the delivery of business support services in the private sector-led demand driven approach. An assessment of CWSA's strength in playing such a role will be useful in this direction.

- Metropolitan, Municipal and District Assemblies (MMDAs)

MMDAs are in charge of the decentralized government structures and the primary agents for local development including provision of environmental sanitation services. MMDAs facilitate the implementation of community programs. The private sector and Non-Governmental Organisations (NGOs), Community-Based Organization (CBOs) are required to register with MMDAs before commencing programmes in communities.

- ARB Apex Bank

The ARB Apex Bank is the body controlling all rural banks in the country and can be a very reliable partner in programmes that rely on the participation of rural banks and micro-finance institutions.

- **Private Organisations**
  - Rural Banks/Microfinance Organisations

One of the potential sources of financing for the construction of household toilets is by obtaining soft loans from banks and micro finance institutions. The rural banks which operate mainly in rural and peri-urban communities are known for the advancement of credits to households and small businesses. An emerging area of involvement is the granting loans for home improvement including household sanitation facilities.

8.2.2 Public Toilets Management

The following strategies for making public toilets more user-friendly are proposed:

- Extending the working hours and/or operating within hours suitable to users to reduce inconveniences and compulsion to engage in open defecation.
- Making the facility disability- and old-age -friendly by providing special compartments, accessibility ramps, seats and other special fixtures to aid the use of the facility.
- Continuous inspection of the facility to ensure all hygienic and environmental standards are maintained and sustained.
- Compliance with all the terms and provisions of the Ministry of Local Government & Rural Development (MLGRD) Guidelines for the Provision, Operations & Maintenance of Public Toilets (2003).

8.2.3 Collection, Desludging, Transportation and Disposal

Small Scale Pit Emptying, Collection, Transportation from Households: To improve on the handling of faecal sludge through manual evacuation of filled pits it is recommended that small motorized equipment is introduced. This approach is designed along the bola–taxi model used in refuse collection. This will however require extensive public education and legislative support to ensure its successful implementation.

The business model for this system is designed along the model for the cesspit emptier truck described earlier. The canvas of the business model is shown in Table 8.5 below.

Table 8.5: Proposed business model for small scale desludging services

<table>
<tr><th>KEY PARTNERS</th><th>KEY ACTIVITIES</th><th>VALUE PROPOSITIONS</th><th>CUSTOMER RELATIONSHIPS</th><th>CUSTOMER SEGMENTS</th></tr>
<tr><td rowspan="2">1. MMDAs
2. Spare Parts Suppliers
3. Mechanical Workshop Owners.
4. Fuel Station Operators

5. Equipment Owner

4. Equipment Operator</td><td> 

1. Small Mechanised Emptying Machinery owner procures equipment.
2. Equipment owner engages equipment operator to render service.
3. Operator engages assistants and delivers service to customers.
4. Operator charges service fees and collects faecal sludge to designated locations.
5. Operator pays owner weekly sales.
6.Owner pays operator monthly salary
7. Operator pays assistants daily allowance and monthly salary.</td><td rowspan="2">1. Providing reliable and affordable cesspit emptier services for households over relying on pit latrines and KVIPs.
2. Reducing environmental pollution and degradation by disposing of faecal sludge at designated locations.</td><td>1. Operators maintain phone contacts with regular customers for service delivery.
2. Telephone contact numbers are inscribed on the trucks for the public to contact for service
3. Small Mechanised Emptying Machinery move in the community for personal contacts.</td><td rowspan="2">1. Households

2. Bio-digester Operators</td></tr>
<tr><td>KEY RESOURCES
1. Small Mechanised Emptying Machinery.
2. Well trained operators and assistants</td><td>CHANNELS OF DISTRIBUTION
Telephone and personal contacts.</td></tr>
<tr><td colspan="3">COST STRUCTURE
Capital cost of Small Mechanised Emptying Machinery
Spare parts, fuel and lubricants
Business registration fees
Owner’s Weekly fees
Operator’s Salary
Operator’s Assistant’s daily allowances and salaries.</td><td colspan="2">REVENUE STREAMS
Desludging service fees
Owner’s Weekly fees
Operator’s Salary</td></tr>
</table>

Government together with MMDAs should carry out public education on the impact of unsafe return of excreta to the environment via manual emptying and the potential solutions including the use of small mechanised emptying equipment. This has the potential of triggering private sector investment in appropriate machinery and equipment. Subsequently, stricter enforcement of proper disposal of faecal sludge can also spur investment in final treatment facilities.

Institutional Governance: the role of MMDAs in promoting and ensuring the successful operation of the above arrangements is very critical. The institutional arrangements required to support this model is detailed in Table 8.6 below.

Table 8.6 - Institutional Governance arrangements for small scale desludging services

Institution	Arrangements
MMDAs	i. Drawing up a public education program to educate the private sector, community of opportunities in the model. ii. Involvement and resourcing of all the decentralised sub-structures in the promotion of the model.
Judicial Service	Establishment of Sanitation courts in the communities for the trial of sanitation offences.

Regulatory Support: the regulatory support activities required for the successful implementation of the model is explained in Table 8.7 below.

Table 8.7 Regulatory support for small scale desludging services

Organisation	Regulatory Support
MMDA	• Update of MMDA's Bye-Laws to increase current fines for illegal discharge of sludge into the environment. • Drawing time lines for compliance by households for provision of improved toilets • Undertaking public education on the bye-laws. • Facilitation of the establishment of Special Sanitation Courts (SSCs) in the Districts by the Judicial Service.
Sanitation Courts	Trial of sanitation offences committed in communities.

Financing Approach: This approach is designed to be a wholly private sector activity in which the investment, operations and maintenance and labour costs are provided by the service provider. The private operator recovers costs from user-fees approved by the MMDAs.

All the public and private sector organization analysis enumerated under household toilets in Section *8.2.1* also applies in this case.

Cesspit Emptier Trucks (Desludging Trucks

Business Model for Collection and Transport Systems: the business model for the collection and transport of faecal sludge as described in Section 7 of the report was found to be effective for the delivery of services and it is therefore recommended for retention.

8.2.4 Treatment, Disposal and Re-Use of Faecal Sludge

Preferred Treatment Option: ADT is the preferred treatment option for adoption. The following ADT systems with their relevant capacities are proposed.

Table 8.8: Details of Size and Costs of ADT plants for the Study Communities

Region	District	Community	Est. Daily FS Collected and Transported for disposal flow/ (m^3) (a)	Estimated Design Vol. for Digester (b)	Estimated Cost of Digester @ US$ 20,000/(m^3) (c)
Central	Komenda Edina Eguafo Abirem	Edina Essaman	3.0[6]	150	60,000.00
	Gomoa West	Dago	2.0	100	40,000.00
	Hemang Lower Denkyira	Twifo Hemang	1.0	50	20,000.00
Western	Wassa Amenfi East	Adesu	1.0	50	20,000.00
	Jomoro	Tikobo No.2	1.5	75	30,000.00
	Sefwi Wiawso	Sefwi Asawinso	6.0	300	120,000.00
Volta	Ho West	Kpedze	3.5	175	70,000.00
	Nkwanta North	Sibi Hill Top	0.0	0	-
	Ketu North	Dzodze	30.0	1500	600,000.00
Eastern	Upper Manya Krobo	Akateng	2.0	100	40,000.00
	Birim North	New Abirem	2.5	125	50,000.00
	Afram Plains North	Donkorkrom	8.0	400	160,000.00
Total					**1,150,000.00**

Notes:
Cost Analysis based on similar bio-digester schemes.
Estimated daily of faecal sludge to be treated per community.
Volume of digester dome based on retention period of 25 – 35 days
Estimated cost of bio-digester based on US$15,0000 – US$20,000 per m^{3Re}

Options for Siting Faecal Sludge Treatment Plant (FSTPs): the following options are recommended for the installation of FSTPs in the selected communities:

Providing Individual Communities with Stand-Alone Bio-Digesters

For individual communities, a stand-alone bio-digester can be installed at a suitable location, preferably on the outskirts. In order to achieve recovery of capital cost of the plant, as well as the operations and maintenance costs, complementary investments will have to be made e.g. water supply, direct use of gas for artisanal enterprises and farming activities based on use of effluent for the production of compost. Investments in larger bio-digesters can lead to potentially higher yields of gas and hence better cost recovery-e.g. the generation of electricity for sale to the national grid.

a. Bio-Digesters Sited for Handling Excreta Flows from 25km Catchment Radius

The strategic location and siting of ADT (biogas) plants within 25km catchment areas to serve two or more additional towns with potentially large sources of faecal sludge is proposed for further consideration as this can improve the technical and financial viability of the options. The strategic location of facilities and the determination of actual faecal sludge loads for plant sizing need further detail study and assessment.

b. Areas Identified for the Strategic Siting within Catchment Area (Centralized) Bio-Digesters

The siting of ADT plants to serve other larger catchment radius within the 25m radius is provided by two examples - Akateng, in the Eastern Region and Edina Essaman, in the Central Region. Details of the possible locations of the bio-digesters in the study communities have been provided under the section on Desludging, Collection and disposal Faecal Sludge-(Section 5.2) in this report.

It is recommended that further studies should be carried out to determine the potential flow of faecal sludge from the other commercial and larger towns/communities within the catchment areas of these towns to improve the economic viability by installing bio-digesters with larger capacities. In respect to Edina Essaman there is a bio-digester with an installed capacity of $5m^3$ which is inadequate to handle the estimated $40m^3$ of faecal sludge from the district (Komenda Edina Eguafo Abirem, KEEA); additionally there is a potential of large flows of excreta from the regional capital Cape Coast within the 25 km catchment area.

c. Siting of Bio-Digesters in large towns to serve surrounding peri-urban and smaller communities

Dzodze in the Volta Region and Sefwi Asawinso in the Western Region with populations of 27,295 and 20,793 respectively can each serve as a location for bio-digesters serving the town as well as surrounding smaller communities.

The determination of the locations, volumes of faecal sludge from targeted communities and the sizes of the bio-digesters will require further study beyond the scope of the current study.

Recommendations Based on Levels of Pollution: based on the levels of unsafe return of excreta to the environment, based on SFDs the levels of pollution of faecal sludge have been ranked and recommendations made for the implementation of projects for consideration. Table 8.9 below presents the ranking and recommendation for each community.

Table 8.9 Recommendations for Each Community

No.	District	Community	Treatment and Re-use					Manual Disposal into Environment from Households		Open Defecation		Recommendation
			Total Population	Est. Daily FS Collected and Transported for disposal flow/ (m^3)	Cost of ADT Plant	Per capita cost	Ranking	Population	Ranking	Population	Ranking	Community Specific Recommendation
1	Ketu North	Dzodze	26,786	30	600,000.00	22.40	1	13,157	2	2,675	2	Construct a biogas plant, pilot small scale household desludging services and promote the construction of household latrines.
2	Afram Plains North	Donkorkrom	9,821	8	160,000.00	16.29	2	3,578	5	1,738	4	Construct a biogas plant,, pilot small scale household desludging services and promote the construction of household latrines
	Sefwi Wiawso	Sefwi Asawinso	20,355	6	120,000.00	5.90	3	17,068	1	1,008	6	Construct a biogas plant,, pilot small scale household desludging services and promote the construction of household latrines
4	Ho West	Kpedze	2,666	3.5	70,000.00	26.26	4	695	10	40	11	Construct biogas plant and enforce law to eliminate open defecation

No.	District	Community	Treatment and Re-use					Manual Disposal into Environment from Households		Open Defecation		Recommendation
			Total Population	Est. Daily FS Collected and Transported for disposal flow/ (m^3)	Cost of ADT Plant	Per capita cost	Ranking	Population	Ranking	Population	Ranking	Community Specific Recommendation
5	Komenda Edina Eguafo Abirem	Edina Essaman	1,946	3.0	60,000.00	30.83	5	386	11	0	12	Construct biogas plant, pilot small scale household desludging.
6	Birim North	New Abirem	7,341	2.5	50,000.00	6.81	6	5,229	3	92	10	Construct biogas plant, pilot small scale household desludging, Enforce law to eliminate open defecation.
7	Gomoa West	Dago	6,802	2	40,000.00	5.88	7	3,332	6	1,592	3	Construct biogas plant, pilot small scale household desludging and promote household latrine construction to eliminate open defecation.
8	Upper Manya Krobo	Akateng	1,750	2	40,000.00	22.86	8	3242	7	2051	3	Construct biogas plant, pilot small scale household desludging and promote household latrine construction to eliminate open defecation.

No.	District	Community	Treatment and Re-use					Manual Disposal into Environment from Households		Open Defecation		Recommendation
			Total Population	Est. Daily FS Collected and Transported for disposal flow/ (m^3)	Cost of ADT Plant	Per capita cost	Ranking	Population	Ranking	Population	Ranking	Community Specific Recommendation
9	Jomoro	Tikobo No.2	5,625	1.5	30,000.00	5.33	9	4,659	4	966	7	Construct biogas plant, pilot small scale household desludging and promote household latrine construction to eliminate open defecation.
10	Hemang Lower Denkyira	Twifo Hemang	9472	1	20,000.00	2.11	10	3,515	6	540	8	Construct biogas plant, pilot small scale household desludging and promote household latrine construction to eliminate open defecation.
11	Wassa Amenfi East	Adesu	1,403	1	20,000.00	14.26	11	1,102	9	230	9	Construct biogas plant, enforce law to eliminate open defecation
12	Nkwanta North	Sibi Hill Top	4252	0	0	0.00	12	0	12	4,073	12	Launch CLTS, promote household latrine construction (ecosan) and enforce law to eliminate open defecation.rs

Proposed Business Model for Treatment Plants: the proposed arrangements for the operations and management of ADT plant is the Public Private Partnership (PPP) model as presented in Table 8.10 below

Table 8.10: PPP Business Model



KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITIONS	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
1. MMDAs-to prepare proposals and/ or raise funds and invite private sector to form company under PPP arrangement. 2. Private sector investors-to provide funds to partner MMDA to form company under PPP arrangement. 3. Cesspit Emptier Service Providers-to supply faecal sludge desludged from generators. 4. Middle Level Works Contractors to construct the biogas plant and install accessories.	1. Reception of faecal sludge and control feed to digester. 2.producing biogas and slurry for sale. 3. Selling gas to customers. 4. Banking daily sales in bank 5. Paying for o & m expenses. **KEY RESOURCES** 1. Biogas plant and accessories 2. Faecal sludge	1 .Promoting a clean environment. 2.Reducing environmental pollution and degradation 3.Sustaining the health and well-being of communities 3. Increasing socio-economic activities and gains in the environmental sanitation value chain. 4.Increasing agricultural output 5. Construction of a biogas plant to process faecal sludge, produce biogas and slurry. 6.Selling biogas and slurry for profit and the recoupment of capital	1. Companies to advertise products- gas and slurry availability on radio and personal contacts 2. MMDAs to sensitise communities and promote use of gas and slurry usage 3. MMDAs to pass bye-laws to compel service providers to discharge waste collected at the biogas plant. **CHANNELS of Distribution** 1.Sales point for gas and slurry at Biogas plant premises	1. Household kitchens 2.Restaurants 3. Small scale farmers 4. Cesspit emptier truck drivers.
 **COST STRUCTURE** Company formation costs Lease of Land Biogas Digester Temporary structures for operations Operations & Maintenance (O&M)		 **REVENUE STREAMS** Stated Capital Sale of biogas Tipping Fees Sale of slurry		

Institutional Arrangements

Institutional Governance**:** institutional roles for the operations of treatment plants are listed in Table 8.11. As indicated three institutions namely MMDAs, the Judicial Service and financial institutions play important roles for the successful operations of the plant.

Table 8.11: Institutional Governance roles/arrangements for management treatment plants

Institutions	Actions
MMDAs	➢ Performing Lead Agency role in the formation of PPP Company. ➢ Paying in cash or in kind its share of agreed stated capital. ➢ Facilitating private sector access to matching funds for PPP company. ➢ Providing logistic support to EHSD to perform its daily functions. ➢ Providing logistic support to District Agriculture Department to undertake intensive public education on the safety and benefits of products of the plant to promote patronage.
Judicial Service	➢ The establishment of Sanitation Courts (SC)
Financial Institutions	➢ Provision of financial support to interested private operators to either partner MMDAs to/or establish and operate a biogas plant.

Regulatory Support: the essential regulatory support to ensure the successful operations of treatment plants is shown in Table 8.12. The MMDAs and the Sanitation Courts play enabling regulatory roles.

Table 8.12: Regulatory Support for operations of biogas plant

Institution	Actions
MMDAs	➢ Update of sanitation bye laws ➢ Fixing of dumping fees for emptier trucks arresting and prosecuting persons for sanitation offences.
Sanitation Courts	➢ Expeditious trial and disposition of sanitation offences including trying illegal dumping (cowboy tipping) of faecal sludge

Analysis of Organisations (Public and Private) to Partner Future Investment Programs:

Public Organisations

- CWSA

The CWSA play key roles in supporting and facilitating the provision of water and water-related sanitation facilities by MMDAs. As mentioned earlier, CWSA with vast experience in the sector can be a major player in the management of business support services for private sector-led demand driven approach for improving faecal sludge management.

- MMDAs

The MMDAs as the primary agencies responsible for the provision, control and monitoring of environmental sanitation services play important roles in the promotion of private sector initiatives, including investments in faecal sludge management. MMDAs should establish business support services desk to facilitate the activities of all the identified stakeholders.

Private Organisations

- Environmental Sanitation Providers Association (ESPA)

Under the auspices of the Environmental Service Providers Association (ESPA) many private companies provide environmental services under registration and permitting by MMDAs. ESPA engages the Government and MMDAs on national issues on sanitation and also negotiates user fees and tariffs for environmental services. ESPA can be encouraged to carry out advocacy for private sector investment for treatment schemes. This activity will be enhanced by providing enabling business environment whereby there is assurance of associated services such as emptying, collection and transport of faecal sludge to treatment plants.

- ARB Apex Bank, Commercial, Rural Banks and Micro-Finance Institutions.

As mentioned earlier under the Section *8.2.1* the ARP Apex, commercial, and rural banks, as well as micro-finance institutions play important roles in the promotion of household toilets. The Central Bank of Ghana should consider the inclusion of water and sanitation sector in the industrial lending quotas with special repayment and interest rates for compliance by all commercial and rural banks and microfinance organisations. The compliance with the industrial quotas will make cheaper funds available for investment in FSTPs.

- Public and Private Technical and Vocational Training Institutions

Regional technical training institutes, vocational training institutes, polytechnics and universities have key roles in the capacity and skill of all stakeholders in the faecal sludge management. In order to create the needed platform for learning and sharing of relevant knowledge and skills on emerging technologies (ecological sanitation) and treatment systems (ADT), it is recommended that these institutions work together with CWSA, ESHD (MLGRD), ESPA and MMDAs to develop and implement specific training programmes for all stakeholders.

The above recommendations are particularly necessary to contribute to achieving universal coverage in improved access to household sanitation and reduction of unsafe return of excreta to the environment in line with Sustainable Development Goals (SDGs) target 6.2 and 6.3.