

Living without Sanitary Sewers in Latin America

The Business of Collecting Fecal Sludge in
Four Latin American Cities

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Foreword

The first Latin American Conference on Sanitation LATINOSAN (Cali, November 2007), attended by participants from seventeen Latin American countries, concluded with the signing of the Cali Declaration. Under this compact, signatory countries made the commitment to give high priority to sanitation services, proper wastewater management, and the promotion of better hygiene practices, which together promote health and protect the environment and water resources.

The Cali Declaration calls for a series of strategies to promote the involvement of stakeholders at all levels. Chief among these is the implementation and financing of sustainable demand-based solutions.

In keeping with the Cali Declaration, the World Bank's Water and Sanitation Program (WSP) has conducted a number of studies to gain more thorough knowledge about the status of sanitation in peri-urban and rural areas.

The present report is part of this initiative. It synthesizes the findings from four case studies that examined the current and potential market for the removal, collection, and disposal of fecal sludge in peri-urban areas.

The case studies were conducted in four cities located in countries where coverage with sanitary sewerage services is below the regional average: Santa Cruz (Bolivia), Guatemala City (Guatemala), Tegucigalpa (Honduras), and Managua (Nicaragua).

In recent years, these cities have grown at such a rapid rate that on-site sanitation has become an increasingly popular solution in peri-urban areas. There is little understanding of basic sanitation in these areas. The fecal sludge market is going to continue to grow in the future.

Expanded coverage with sanitary sewage services, as well as the adoption of alternative on-site solutions in particular, will hinge on a number of factors. To begin with, it will be necessary to have the proper infrastructure and ensure that installations do not become foci of infection. In addition, there will need to be services to certify that the sewage is being properly managed.

In addition to covering these points, the present report has sought to contribute to the search for integrated, sustainable solutions that take into account the economic, social, political, and environmental dimensions of on-site sanitation.

With these goals in mind, a list of recommendations to government representatives, cooperation agencies, drinking water and sanitation providers, and operators responsible for the collection and disposal of fecal sludge is presented at the end of this report. The stakeholders mentioned above all play a role in the cycle that ensures the adequate formulation and execution of public policy, as well as the proper management of on-site sanitation in peri-urban areas.

Executive Summary

The present report spotlights the major challenges and the opportunities that lie ahead in fecal sludge management and summarizes the findings from four case studies that describe the current and potential market for sludge removal, collection, and disposal in peri-urban areas. These areas, inhabited by a variety of ethnic, religious, and cultural groups, typically struggle with high population density, insufficient land use planning, high citizen insecurity, and low coverage with basic services.

The report demonstrates how technical, financial, environmental, social, regulatory, political, and institutional

factors interact to create supply and demand in four markets where coverage with sanitary sewerage services is below the regional average, namely: Santa Cruz (Bolivia), Guatemala City (Guatemala), Tegucigalpa (Honduras), and Managua (Nicaragua).

Even though households in the four areas studied have on-site sanitation systems (latrines and toilets), fecal sludge and excreta often drain into the streets, and there is no control or treatment of the sludge, posing a risk for public health and the environment.

SUMMARY TABLE: KEY DATA

City	Population Size (millions)	Study participants			Market characteristics				
		End users	Sludge collection companies in peri-urban areas	Key stakeholders*	Peri-urban settlements	Population without sewerage connection	Cost of Latrine vs. Household income	Sludge collection: gap between high and low prices	Sludge collection: monthly household payment (US\$)
Santa Cruz, Bolivia	1.7	122	10 (out of 40)	3	N/A	60%	1.15	71%	US\$ 2.57
Guatemala City, Guatemala	2.7	79	5 (out of 27)	4	400	13%	1.05	55%	US\$ 8.10
Tegucigalpa, Honduras	1.3	69	3 (out of 4)	5	300	30%	0.86	11%	US\$ 13.57
Managua, Nicaragua	2.0	84	5 (out of 10)	5	350	61%	1.12	157%	US\$ 7.92

*Service providers and high-level government officials



Progress toward fulfillment of the MDGs indicates that the target of access to safe drinking water will be met. However, in many Latin American countries, even though access to improved sanitation is recognized as a key component in the integrated protection of health, this target is increasingly out of reach.

Conclusions

Legal norms and regulations – their absence...

- Makes it difficult to adopt mass solutions to improve sanitation.
- Restricts access to commercial credit.
- Hampers the exercise of rights.
- Places workers and the community, as well as the environment, at risk.

Institutional structure

- Governments do not take an active role in on-site (peri)urban sanitation.
- Coordination between key stakeholders is minimal or nonexistent.

Financing and tariffs

- None of the governments in question have participated in the promotion of on-site sanitation systems in peri-urban areas.
- In two of the four countries studied, tariffs for sewerage services were subsidized. On the other hand, households using sludge collection services were not receiving any government benefit.

Recommendations

Regulatory

- Define provisions, procedures, and regulations for overseeing fecal sludge removal services, including criteria applying to the vehicles and the drivers.
- Promote best practices for the collection, transportation, disposal, and reuse of sludge, as well as the maintenance of these services, in peri-urban areas.
- Develop a policy on tariffs, including ceilings.
- Evaluate subsidizing not only sewerage systems but also sludge collection and disposal.
- Promote the construction of condominium networks that discharge into multifamily septic tanks and are easy to access for maintenance, cleaning, and sludge collection.

(Inter)institutional

- Harmonize policies on sanitation, public health, the environment, and occupational safety.
- Encourage central Government, municipal governments, lending agencies, service providers, and users to work together.

Other

- Educate the population on the management of sewage and graywater.
- Train operators in environmental management, occupational safety, and fixed -and variable- cost analysis with a view to promoting the widespread use of improved on-site sanitation.

Abbreviations

ACSAACRUZ	Cooperative Association of Drinking Water and Sanitation Services of Santa Cruz (<i>Asociación de Cooperativas de Servicios de Agua y Alcantarillado de Santa Cruz – Bolivia</i>)
AAPS	Drinking Water and Sanitation Authority, OR: Authority for Oversight and Social Control of Drinking Water and Basic Sanitation (<i>Autoridad de Fiscalización y Control Social de Agua Potable y Saneamiento Básico – Bolivia</i>)
IDB	Inter-American Development Bank
EMPAGUA	Guatemala City Municipal Water Supply (<i>Empresa Municipal de Agua de Guatemala</i>)
ENACAL	Nicaraguan Water and Sewerage Service Supply (<i>Empresa Nicaragüense de Acueductos y Alcantarillados</i>)
EPSA	Drinking Water and Sewerage Services Provider (<i>Entidad Prestadora de Servicios de Agua Potable y Alcantarillado de Bolivia</i>)
HDI	Human Development Index
JMP	Joint Monitoring Program (WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation)
WSP	World Bank’s Water and Sanitation Program
GDP	Gross Domestic Product
OBA	Output-Based Aid
MDGs	Millennium Development Goals
SAGUAPAC	Santa Cruz Water Supply Cooperative (<i>Cooperativa de Servicios de Agua Potable y Alcantarillado Sanitario de Santa Cruz</i>)
SANAA	National Autonomous Water and Sewerage Service (<i>Servicio Autónomo Nacional de Acueductos y Alcantarillados – Honduras</i>)
SISAB	Superintendency of Basic Sanitation (<i>Superintendencia de Saneamiento Básico – Bolivia</i>)
SWAp	Sector Wide Approach

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I. Introduction

The present report addresses three essential aspects of on-site sanitation service management in periurban areas: fecal sludge removal, collection, and disposal.

1.1 Peri-urban Areas

There are a number of definitions of *peri-urban area*, but they share at least two characteristics in common: first, these areas are located on the periphery of cities, and second, they function as a transition between urban and rural areas. However, the concept is considerably more complex than that.

In the early 1990s, *peri-urban* was synonymous with informal or even illegal settlements, explosive growth, and population density, as seen in the following passage:

Third World cities are divided into two distinct sectors: formal and informal, or urban and peri-urban. Peri-urban and informal sector settlements are also commonly referred to as squatter settlements, marginal settlements, shantytowns, urban slums, or illegal settlements. [They] largely develop outside of government control and do not follow strictly formal and traditional urban planning and development processes. ... [They] are characterized by uncertain or illegal land tenure [and] minimal or no infrastructure ...¹

Today, however, peri-urban areas are not necessarily associated with illegal land ownership or high population density.

Latin America's peri-urban areas are currently experiencing economic and social processes not seen anywhere else in the world.

On one hand, they have been impacted by industrialization in the capital cities and its concentration of businesses

and industries which has attracted workers from the countryside in search of better remuneration. On the other hand, their character is being shaped by the interdependence between the people arriving from small cities and rural areas and those who already live in the large metropolises, giving rise to the creation of new identities.

These two processes have turned peri-urban areas into a heterogeneous environment that now has a mix of both formal and precarious housing and both middle- and low-income populations.

According to UN-Habitat (2005), 419 million people in Latin America and the Caribbean (79 percent of the region's total population) live in urban areas. Of these, 29 percent are considered poor or indigent. **Figure 1.1** shows that in Latin America nearly twice as many poor people live in urban areas as in the countryside (ECLAC 2010).

Given that a sizable portion of this population lives in peri-urban areas and that public resources are limited, the challenge of managing on-site sanitation solutions is considerable.

1.2 On-site Urban and Peri-urban Sanitation

Until not too long ago, the urban sanitation paradigm² was focused on the extension of mass wastewater collection and treatment services. Although conventional sewerage systems continue to be preferred by most, the last decade has seen efforts to find less expensive solutions to cover the cost of materials and supplies, earthworks, and installation through shared condominium sewers.

¹ Hogrewe William, Joyce Steven & Perez Eduardo (1993). The Unique Challenges of Improving Peri-urban Sanitation. WASH, Washington D.C, p. 9.

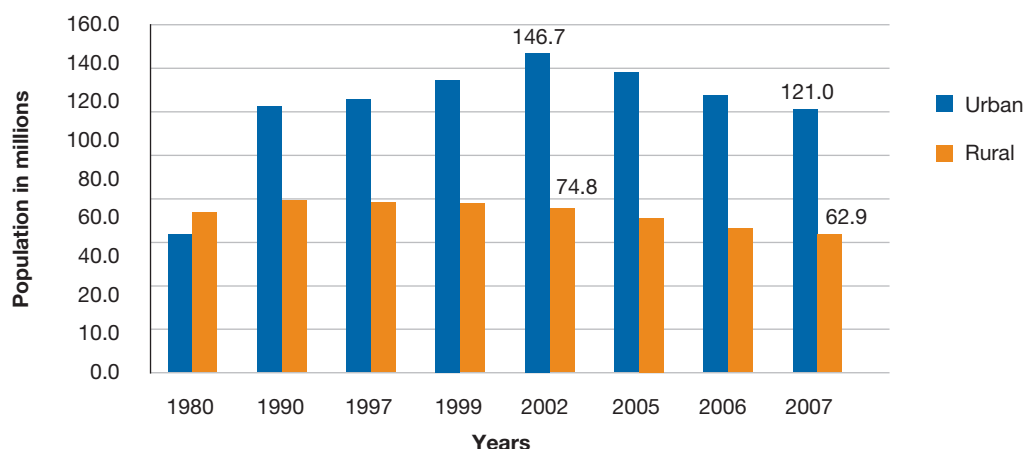
On-site sanitation is based on a different logic. In Latin America, governments are not usually involved; instead, households are empowered to assume responsibility for the construction of conventional systems (latrines, septic tanks or chambers, or absorption wells), or to a lesser extent, ecological systems (bathrooms that don't require water). The problem is that many of these projects fail to meet technical and environmental standards and therefore pose a threat to the environment and public health.

In other regions, it has been the governments that have promoted on-site sanitation programs. However, without the backing of sustainable policies several of these services have had to close down when their funding was diverted elsewhere (Trémolet 2010).

Nevertheless, these experiences have raised very valid questions about the future of urban sanitation in Latin America:

- Should governments support the construction of on-site sanitation solutions?
- Are these solutions really more economical than conventional sewerage systems?
- What additional measures are needed to ensure that these solutions are sustainable? Training to learn how to operate and maintain them? Education about sanitation and public health?
- What type of financing policy would be most appropriate? Full or partial subsidy? Promotion of microcredit?

FIGURE 1.1: POOR POPULATION IN LATIN AMERICA AND THE CARIBBEAN, 1980-2007



Source: Adapted from ECLAC 2010.

2 See Annex 1 for definitions of the concepts improved, unimproved, and on-site sanitation.

FIGURE 1.2: WASTEWATER RUNOFF IN CAMILO ORTEGA, MANAGUA

Hazards associated with improper disposal of fecal sludge

- Environmental contamination caused by
 - Overflowing of latrines into backyards and public walkways
 - Contamination of the subsoil and underground aquifers that supply the city's water.
- Infectious foci of pathogenic bacteria, helminth (parasite) eggs, and high concentrations of organic matter.
- Sale of untreated fecal sludge for agricultural purposes.



A number of experiences have demonstrated the feasibility of financing this kind of on-site sanitation project in urban areas. **Table 1.1** cites a few of them.

Another unresolved and equally crucial issue is the collection of domestic sludge. One of the main questions is whether the households themselves should take responsibility or whether economically sustainable services can be generated that will take responsibility for its collection and final disposal.

A septic chamber or septic tank is a technically feasible option for primary treatment of wastewater (removal of a percentage of the biochemical oxygen demand and total suspended solids). Effluent from the chamber or tank can be filtered through filtration ditches or absorption wells.

There are prefabricated tanks made of various materials that are easier to install, but they are usually more expensive than facilities built on site and are therefore less popular with low-income households.

TABLE 1.1: ON-SITE URBAN SANITATION PROJECTS

Project	Funding mechanisms
Mozambique Improved Latrines Program Urban areas <ul style="list-style-type: none"> • Improved latrines • 1'887,900 persons • 1980 to 2007 	<ul style="list-style-type: none"> • Technical assistance for sanitation promotion and the establishment of local workshops to build slabs and latrines • Output-based subsidies to local sanitation providers for each slab or latrine sold (intended to cover 40% to 60% of hardware costs) • Public funds = 58% of total cost of adopting the sanitation improvement
Senegal PAQPUD Project Urban areas <ul style="list-style-type: none"> • Improved latrines and septic tanks • 410,500 persons • 2002 to 2005 (using an output-based scheme) 	<ul style="list-style-type: none"> • Technical assistance for sanitation promotion, including hygiene promotion and education, community organization, and technical support • Output-based hardware subsidies to local sanitation providers for each sanitation solution built (to cover about 75% of hardware costs) • Limited plans for facilitating access to credit • Public funds = 89% of total cost of adopting the sanitation improvement
Vietnam Sanitation Revolving Fund Urban areas <ul style="list-style-type: none"> • Mainly bathrooms and septic tanks • 193,000 persons • 2001 to 2008 	<ul style="list-style-type: none"> • Technical assistance sanitation promotion and hygiene education • Easy access to credit through sanitation revolving funds • Subsidy through credit concessions (subsidized interest rates) on loans for construction materials • Private/public investment ratio = 19.92

Source: Trémolet et al. 2010.

Despite the availability of technically and eco-friendly options,³ two major drawbacks stand in the way of their mass adoption: **their price**, and the fact that **the people building them are not qualified to install them**. The latter situation can lead to a number of problems, including the following:

- The septic tanks can end up storing water and fecal solids together. If the septic tank does not have at least two chambers, one larger than the other, the fecal sludge is not separated out, and therefore it cannot be extracted later (Tilley et al. 2008).
- The residual water can remain in the septic tank instead of being discharged to absorption wells and/or filtration beds.
- The holes in the well filter can become clogged with grease, preventing filtration of the residual water. As a result, the wells overflow and households are faced with the unanticipated cost of cleaning out both the chamber and the absorption well.
- The size of septic tanks tends correlate with the financial capacity of households. Small tanks fill up more frequently and require a greater investment in maintenance. Large tanks, on the other hand, can collapse if their structure is weak.

³ Namely, septic chambers or tanks (which allow the effluent to be absorbed through filtration wells) and, although they are more expensive, prefabricated tanks.

II. Methodology

2.1 Objective

To summarize the findings from four case studies⁴ that undertook to describe the current and potential market for fecal sludge removal, collection, and disposal services in peri-urban areas. These studies were conducted in four cities located in countries where coverage with sanitary sewerage service is below the regional average.

2.2 Study Areas

The present investigation has undertaken to analyze and compare case studies conducted by the World Bank's Water and Sanitation Program in Santa Cruz (Bolivia), Guatemala City (Guatemala), Managua (Nicaragua), and Tegucigalpa (Honduras), selected because of both their sanitation profile and the availability of data.

For their field work, these case studies used the following inclusion criteria: (a) lack of sanitary sewerage services, (b) use of on-site sanitation, and (c) communities with households representative of the local peri-urban profile.

The study focused on peri-urban areas because they have the largest volume of fecal sludge that needs to be collected

and disposed of at appropriate sites, but the on-site solution can be applied in other parts of a city in a less concentrated manner.

2.3 Research Tools

This investigation used both qualitative and quantitative methods. The researchers emphasized the following elements in the study design and its application:

The strengths and limitations of on-site sanitation in the peri-urban environment;

- Broadening of the “on-site” concept to extend beyond the construction and installation of infrastructure (including the collection and final disposal of the sludge);
- Evaluation of the costs and the amount and frequency of the household payment for sludge removal compared with the average bill for connection to a sanitary sewerage system;
- Potential reuses for the fecal sludge.

2.4 Participants

Table 2.1 summarizes the number of participants in each city,⁵ broken down by their profile and the instrument used to collect their contributions.

⁴ Three three studies in Central American were conducted in two complementary phases: the first, in August and September 2008, and the second, in March and June 2010. The study in Santa Cruz was carried out in 2009.

⁵ See Annex 4 for further details.

TABLE 2.1: PARTICIPANTS IN THE STUDY, BY CITY AND PROFILE

	Surveys and focus groups: end users	Surveys and interviews: operators	Interviews: strategic stakeholders
Santa Cruz (Bolivia)	122	10 (out of 40)	3 ⁶
Guatemala City (Guatemala)	79	5 (out of 27)	4 ⁷
Tegucigalpa (Honduras)	69	3 (out of 4)	5 ⁸
Managua (Nicaragua)	84	5 (out of 10)	5 ⁹

See Annex 2 for further information about the participants and the research methods used.

2.5 Limitations

The present report covers case studies that were conducted independently. An effort has been made to present and, wherever possible, compare the main findings from these studies.

6 Representatives of sanitation providers and the government, including the Vice Minister for Drinking Water and Basic Sanitation, the Ministry of the Environment and Water, and the Santa Cruz Departmental Government.

7 Guatemala City Municipal Water Supply (EMPAGUA), Ministry of Environment and Natural Resources, Ministry of Public Health and Social Assistance, and Presidential Secretariat for Planning and Programming (SEGEPLAN).

8 National Autonomous Water and Sewerage Service (SANAA), Ministry of the Environment and Natural Resources, Ministry of Health, the Tegucigalpa City Government, and Pollution Research and Control Center (CESCO).

9 Nicaraguan Water and Sewerage Service Supply (ENACAL), Ministry of Environment and Natural Resources (MARENA), Nicaraguan Water and Sewerage Institute (INAA), Ministry of Health (MINSAL); and the Managua City Government.

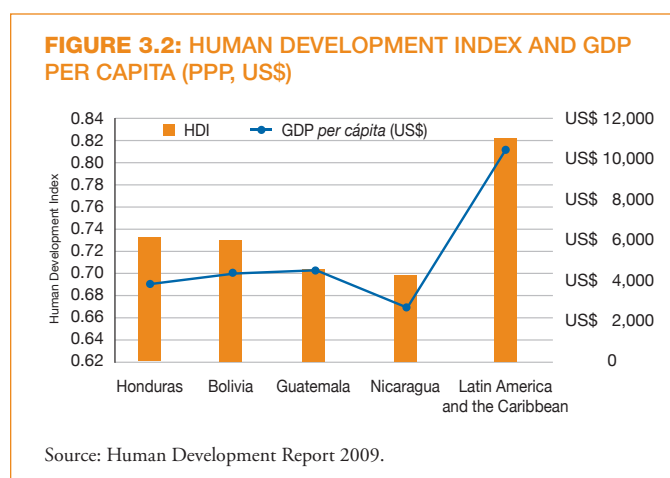
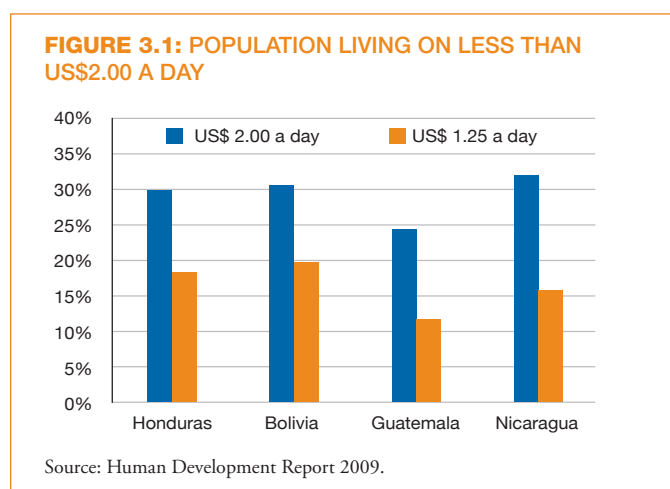
III. Profiles of the Study City Countries

City Countries

3.1 Social Characteristics

The research was conducted in four Latin American countries in which the economic and social dynamic is faced with similar challenges: Bolivia, Guatemala, Honduras and Nicaragua.

Together, the four countries have a total of more than 36 million inhabitants (WHO/UNICEF JMP 2010). **Figure 3.1** shows that a large percentage of them live on less than two dollars a day.



These four countries all have a Human Development Index¹⁰ within the range of 0.70 to 0.73, compared with an average of 0.82 for Latin America and the Caribbean (LAC) as a whole (**Figure 3.2**). In turn, the per capita GDP in the counties studied ranges between US\$2,570 and US\$4,500, compared with an average of US\$10,000 for all of Latin America and the Caribbean.

Another important indicator is mortality in children under 5 years old. While the average child mortality rate for Latin America is 24 per 1,000 live births, in Bolivia it is 57 per 1,000; in Guatemala, 39; in Honduras, 24; and in Nicaragua, 35 (PAHO 2010).

3.2 Sanitation

In recent decades, demand in the water and sanitation sector in Latin America has focused on access to safe drinking water. Consequently, urban coverage in Latin America and the Caribbean now reaches 97 percent for drinking water¹¹ and 86 percent for improved sanitation. By contrast, these indexes for rural areas have only reached 80 percent and 55 percent, respectively (WHO/UNICEF JMP 2010).

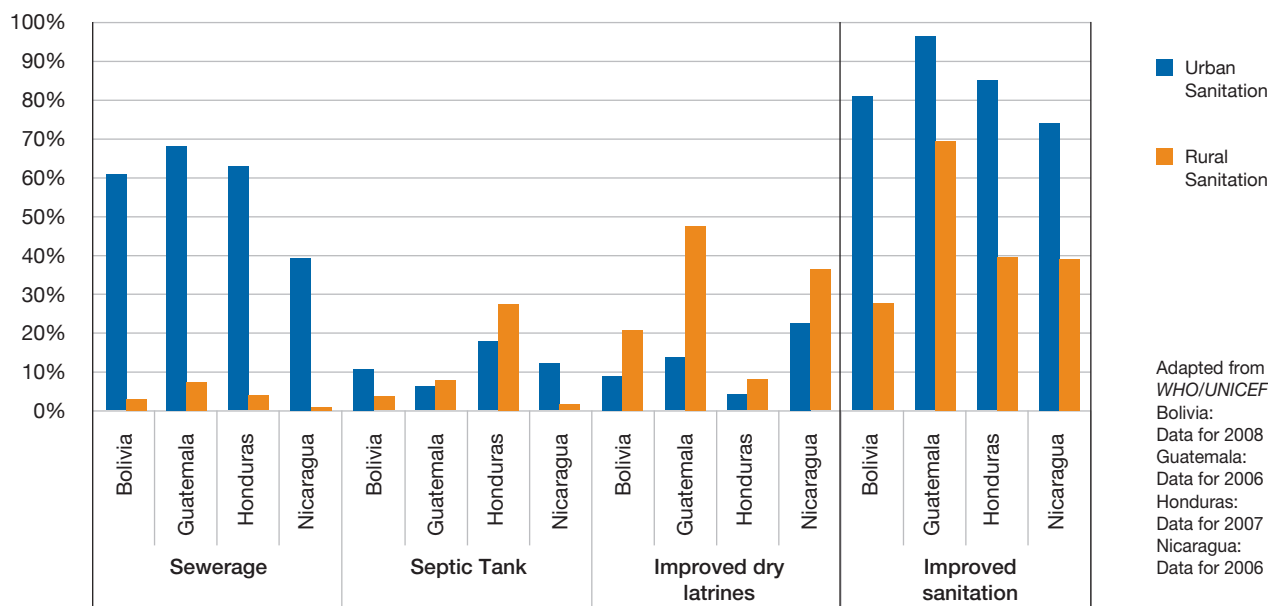
In the countries where the study cities are located, coverage with sanitary sewerage systems is between 25 percent and 40 percent for the country as a whole. It is higher for improved latrines and septic tanks: the average for the four countries is 65 percent in urban areas and 52 percent in the countryside. Even so, this coverage is considerably below the average for Latin America as a whole.

The **Figure 3.2** shows a breakdown by country and, further, by urban versus rural residence. It shows that the largest deficits are in Bolivia and Nicaragua, where 40 percent of the national population lacks improved sanitation services. Nevertheless, the challenge for these two countries is not very different from the situation in the other two. In total, there are more than 12 million people who could benefit from a significant improvement in sector policies.

10 A combined measurement that reflects level of schooling, life expectancy, and household income.

11 This figure represents improved access to safe drinking water. Coverage at the network level is 92 percent.

FIGURE 3.3: POPULATION WITH IMPROVED SANITATION



3.3 Legal Norms Governing Fecal Sludge Collection

None of the four countries corresponding to the cities studied has legal norms regulating services for the cleaning of septic tanks or the collection and final disposal of fecal sludge. However, major changes are foreseen in the near future for Bolivia and Guatemala.

3.3.1 Bolivia

Bolivia has had a regulatory framework for the management of drinking water and sanitation since 1997. However, only in the last two years have the key steps been taken to implement it properly.

The new water and sanitation authority, Authority for Oversight and Social Control of Drinking Water and Basic Sanitation (*Autoridad de Fiscalización y Control Social de Agua Potable y Saneamiento Básico – AAPS*) was created in 2009. In addition to replacing the previous regulatory agency (SISAB), it has assumed functions in keeping with the country’s new regulatory model based on social participation.

Administrative Regulatory Resolution 227/2010,¹² issued at the end of 2010, includes the following provisions:

- Natural or legal persons who provide fecal sludge removal services using tanker trucks must obtain authorization from AAPS to conduct this activity once they have met the relevant requirements and followed the corresponding procedures.
- Tariffs for treating fecal sludge collected with tanker trucks must be approved by the AAPS, which shall give special attention to the needs of consumers.
- The drinking water and sanitation provider must present a plan for fecal sludge removal that can be implemented by the service operator.

In addition to regulating the supply of collection services, the resolution also seeks to prevent a monopoly on drinking water and sanitation services. However, it still leaves gaps with respect to important aspects of sludge management and final disposal, including protection of the environment and industrial safety.

At the departmental level, the governments have the authority to issue and grant an environmental license, but once it has been granted, there is no mechanism for monitoring fulfillment of the commitments assumed by providers of this type of service.

In the specific case of Santa Cruz, the municipal government

¹² Consulted in April 2011. Available at http://www.aaps.gob.bo/wp-content/uploads/2011/05/RAR-227_2010.pdf (verified on 05/09/11).

maintains a registry of providers of fecal sludge collection and disposal services. However, the category is not listed separately; these companies are subsumed under a more general heading.

It is hoped that the gaps in Administrative Regulatory Resolution 227/2010 that have been mentioned here will be corrected.

3.3.2 Guatemala

Executive Order 236 issued in 2006 sets allowable limits on the discharge of wastewater into both receiving water bodies and sanitary sewerage systems.

Chapter VIII of this document¹³ contains the provisions affecting fecal sludge. One of its clauses emphasizes that these services shall be delivered on a free market basis as long as the following stipulations are met: (a) limits on heavy metals are observed; (b) sludge is collected in containers and vehicles that have been outfitted to prevent leaks and spills; and (c) authorization has been granted by the Ministry of Environment and Natural Resources. It also emphasizes that the collection companies should take samples and have them analyzed.

The order prohibits final disposal of sludge in the sanitary sewerage network and in surface and subterranean water bodies. In addition, it prohibits the use of fecal sludge as fertilizer for edible produce that is consumed raw or precooked, unless it has been demonstrated that the sludge contains no heavy metals and fecal coliforms do not exceed a maximum of 2,000 CFU/kg.

Perhaps because compliance with the levels specified is not required until 2011, the order is still not well known. It should be fully promoted.

For further information on the regulatory norms in Guatemala, see Annex 3.

3.3.3 Honduras

Since the promulgation of Decrees 118-2003 and 180-2003, the sector has been engaged in the process of decentralizing its services, which recently gained impetus with the new

Framework Law on Water. The law regulates the discharge of wastewater to receiving water bodies, but it does not cover the collection and disposal of fecal sludge.

The National Autonomous Water Supply and Sewerage Service (SANAA) has been transferring its responsibilities to municipalities. Since this process began, the main challenge has been to get the new municipal enterprises to deliver their services efficiently, effectively, and sustainably.

For further information on the regulatory norms in Honduras, see Annex 3.

3.3.4 Nicaragua

The legal framework covering the water and sanitation sector is mainly focused on drinking water supply. Instruments governing sanitation have been issued by several different institutions. In the case of fecal sludge, the Ministry of the Environment and Natural Resources has been drafting a proposed law on proper sludge management within the context of environmental management of residential wastewater.

The text of the proposed legislation focuses on regulating and promoting the management and reuse of sludge under a set of sanitary requirements.

It is important to emphasize the difference between the instrument in Guatemala, which is intended to encourage business initiative at the municipal level, and the proposed law in Nicaragua, which is concerned with the transformation and utilization of nonhazardous sludge (domestic wastewater).

The proposal is supplemented by another draft law proposed by ENACAL on the use of sanitary sewerage by the plumbing industry.

In Nicaragua there is considerable optimism regarding the potential benefits of these two laws for the on-site sanitation service market.

For further information on the regulatory norms in Nicaragua, see Annex 3.

13 Consulted in May 2011. Available at <http://www.ccad.ws/documentos/legislacion/GT/R-236-2006.pdf> (verified on 05/09/11).

IV. Profiles of the Cities Studied

The four selected cities share in common the fact that they are each key to the development of their countries. Nevertheless, as it can be seen in **Table 4.1**, there are significant differences in their drinking water and sanitation coverage.

TABLE 4.1: DRINKING WATER AND SANITARY SANITATION COVERAGE IN SELECTED CITIES

City and environs	Population of metropolitan area (thousands)	Drinking water coverage	Sanitary sewerage coverage	Comments
Santa Cruz, BOLIVIA	1,700	95.0%	39.6%	13 cooperatives provide drinking water services. SAGUAPAC is the only provider of sewerage services, although 3 cooperatives are in the process of building sewerage systems.
Guatemala City, GUATEMALA	2,700	90.0%	87.0%	EMPAGUA covers 85% of the metropolitan area; other private operators (including Agua Mariscal) cover the rest.
Tegucigalpa, HONDURAS	1,300	80.0%	70.0%	SANAA is the national enterprise that covers the city of Tegucigalpa, among others.
Managua, NICARAGUA	2,000	84.0%	39.0%	ENACAL is the national enterprise that covers the country's cities.

Sources: Own preparation, based on consultation with AAPS for Bolivia; Guatemala City local government and EMPAGUA for Guatemala; SANAA and ERSAPS for Tegucigalpa, Honduras; and ENACAL and World Bank - WSP publications in the case of Nicaragua.

In the peri-urban areas of the selected cities, it is quite common to see on-site sanitation systems such as latrines and toilets with no drainage. It is even more common to find septic chambers, both with and without absorption wells.

In general, in the peri-urban areas that have on-site sanitation systems there has been no systematic effort to develop services to maintain them or remove excreta and fecal sludge.

As a result, fecal sludge and excreta from sanitation systems tend to exceed the capacity of on-site sanitary facilities and spill into roads, ditches, gulleys, and ravines near the collection point.

4.1 Santa Cruz

Located in eastern Bolivia at an average altitude of 416 m above sea level, Santa Cruz is one of the country's earliest urban settlements. In 1950 it had only 41,500 inhabitants, but by 2001 it had passed the one million mark.¹⁴

The city of Santa Cruz extends over an area measuring 386km². A report by the Inter-American Development Bank (2009) described it as follows:

Urban sprawl that has outstripped the capacity of basic services, large areas of vacant land, productive

¹⁴ According to the 2001 National Population and Housing Census, Santa Cruz had 1'113,582 inhabitants.

activity performed without standards or oversight in almost all parts of the city, precarious living conditions for the low-income population, and the warm, humid climate, combined with the population's lack of awareness and education, are the main factors behind the marked and growing degradation of the Santa Cruz environment, which poses a constant threat to its population (p.15).

In Santa Cruz, the area's drinking water and sanitary sewerage services are provided by 13 cooperatives. As it can be seen in the following table, most of them provide drinking water services.

The SAGUAPAC cooperative covers 64 percent of the 386 km² that constitute the metropolitan area of Santa Cruz. In its coverage area, as of 2008, SAGUAPAC provided drinking water to 99 percent of the population and sanitary sewerage connections to 58 percent (World Bank - WSP, 2008). It is estimated that the latter figure has now risen to 65 percent.

TABLE 4.2: WATER AND SANITATION COVERAGE, SANTA CRUZ METROPOLITAN AREA

N°	Area	Municipality in the Metropolitan Area	Company	Population of service area (2007)	Coverage (%)	
					Drinking Water	Sanitary sewerage system
1	El Bajío	Municipio Santa Cruz	COSPAIL	67,472	92.3%	0.0%
2	Los Chacos	Municipio Santa Cruz	COSCHAL	17,064	79.0%	0.0%
3	Pampa de la Isla	Municipio Santa Cruz	COOPAPPI	54,587	89.0%	0.0%
4	Limoncito	Municipio Santa Cruz	COOPLIM	7,638	88.1%	0.0%
5	Plan 3,000	Municipio Santa Cruz	COOPLAN	147,423	78.2%	0.0%
6	Villa 1° de Mayo	Municipio Santa Cruz	COOPAGUAS	114,898	90.3%	0.0%
7	Km 4 al norte	Municipio Santa Cruz	COSPHUL	15,465	96.9%	0.0%
8	Santa Cruz	Municipio Santa Cruz	SAGUAPAC	999,582	100.0%	58.0%
SUBTOTAL				1'424,129	95.8%	40.7%
9	Yapacaní	Municipio Yapacaní	Coop. Yapacani	87,956	76.0%	0.0%
10	Cotoca	Municipio Cotoca	COSAP	20,862	71.0%	5.0%
11	El Torno	Municipio El Torno	SEAPAS	23,305	97.7%	51.6%
12	La Guardia	Municipio La Guardia	Coop. La Guardia	34,798	88.0%	7.0%
13	Mineros	Municipio Mineros	COSMIN	66,582	97.5%	0.0%
TOTAL				1'657,632	94.39%	35.91%

Source: AAPS 2009.

Because of the sewerage network's low level of coverage, the unserved population has been adopting alternative technologies for the disposal of excreta. In most cases they have opted for on-site sanitation units (**Figure 4.1**)—in other words, individual household or multifamily latrines or septic tanks—with the latter typically connected to absorption wells or filtration beds.

FIGURE 4.1: LATRINE ON THE OUTSKIRTS OF SANTA CRUZ



With regard to the maintenance of on-site sanitation, the work of cleaning septic chambers and collecting fecal sludge began 50 years ago. At that time, the city was starting to shift from cesspits to pour-flush latrines or septic tanks with or without absorption wells.

At around the same time, small services appeared on the scene and began to offer septic tank cleaning services and collection and final disposal of fecal sludge. In the beginning there were only five such enterprises, but in the 1980's the number of competitors began to grow. There are now 40 companies doing this work, although not all of them are formally established.

4.2 Guatemala City

Located 1,600m above sea level in a valley in south-central Guatemala, the capital city has grown to the point that it is

now the urban center with the largest population in Central America.

In 1981, the population density in Guatemala City was 41 persons per hectare. By the year 2000 it was already 55 per hectare, and it is estimated to reach 59 per hectare by 2020. However, proper urban planning has not kept pace with this population growth.

Unlike other Central American countries that have at least two major cities, the only development pole in Guatemala is its capital. Its high concentration of institutions, service industry activities, telecommunications, and transportation facilities, among other key sectors of the national economy, continues to make it a magnet for migrants.

Shantytowns began to emerge after the challenge of earthquakes in 1917, 1918, and 1976, in the wake of which the city was unable to fully recover and rebuild.

According to data from the Guatemala City municipal government, in 2003 there were a total of 175 shantytowns that were home to 47,650 families, or an estimated population of 200,000.

EMPAGUA provides drinking water and sanitation services to the Guatemala City metropolitan area and its coverage is high; even on the outskirts, sewerage services reach 87 percent of the population.

4.3 Tegucigalpa

Founded in colonial times, the capital of Honduras is located in the center of the country at an altitude of 990 m above sea level.

The most important economic activities in the country's political and economic hub are in the tertiary sector (commerce and services), textiles, sugarcane, and tobacco.

Like most Central American capitals, Tegucigalpa has seen rapid growth in the last 40 years. Its urban area has expanded from 2,360 ha in 1975 to 6,020 ha in 1987, and again to 8,360 ha in the year 2000.

Its population has increased at a similar rate. In 1975 it had only 317,000 inhabitants; by 2000 that number had grown to 830,000 (Angel 2004).

These two growth trends have led to aggressive disputes over land ownership:

In the absence of effective property rights, physical occupation or use becomes an important element in forcing legal or de facto resolution to land tenure. Therefore, available, fallow land at the margins of Tegucigalpa and its surroundings, as well as large tracts of communally held land in rural areas, are susceptible to contested land tenure, causing potential obstruction and delays in real estate development.
(Pearce Oroz 2001:6)

It is estimated that 1,300,000 people currently live in the Tegucigalpa metropolitan area. Of its 800 barrios and colonias, about 300 are located in peri-urban areas (Diaz et al. 2008).

If the current trend continues, the city's population will have doubled by 2031. This new population will require an additional 10,000 ha. Both of these estimated figures would pose serious problems for the supply of drinking water and sanitation services (Angel 2004).

In Tegucigalpa, 80.7 percent of all dwellings have access to the sanitary sewerage system. In terms of ranking of sanitation solutions, latrines are in second place, used by 12.6 percent of households. In third place are on-site hydraulic systems, used by 3.6 percent and, finally, 2.8 percent of the homes that have no sanitary facilities at all (World Bank - WSP, 2008:16).

4.4 Managua

The capital of Nicaragua is located on terrain that ranges from 48m to 600m above sea level. The city has a population of 1.3 million, and its entire metropolitan area has 2.0 million. In the seven districts that make up the metropolitan area, there are approximately 350 shantytowns (World Bank - WSP, 2008b).

FIGURE 4.2: LATRINE IN MARY FLAKES COLONIA, TEGUCIGALPA



The city was battered by earthquakes in 1931 and 1972, which is why urban development in the capital has focused on building new streets and barrios on the periphery of the old city. Also on the periphery, Asososca Lagoon is notable both for its size and because it is the main source of drinking water.

In Managua, the low-income barrios tend to be located either in the center or on the outskirts of the city (World Bank - WSP, 2008a). Several of them have community development committees and access to health and education centers. However, the average income for a large proportion of the households in these areas is about US\$210.00 a month (C\$4,460) (World Bank -WSP, 2008b). The sewerage system covers about 40 percent of the metropolitan area. The rest of the people rely on simple latrines or septic tanks or chambers, or else they have no sanitary facilities at all.

A recent World Bank study (World Bank - WSP, 2008b) analyzed the results of a household sampling survey in peri-urban areas and found that 50 percent of the households were connected to the sanitary sewerage network, 21 percent discharged their sewage into septic tanks, and 23 percent used ordinary latrines. Of this last group, a large majority of the households had inadequate latrines or no sanitary facilities.

The study also evaluated the hygienic conditions of the latrines and found feces in 42 percent of them and urine in 37 percent of them. Based on the indicators that have been cited, the study concluded that the peri-urban barrios have conditions that are even more precarious than those in the country's rural communities and other small localities.

FIGURE 4.3: MANAGUA: LATRINES IN PERI-URBAN AREAS



V. Collection and Disposal of Household Sludge

Latrine construction alone is not sufficient to banish the fecal threat: latrine and septic or interceptor tank contents, the so-called fecal sludges, have to be disposed of and treated in an adequate manner to safeguard public health and the environment. One truck dumping sludge indiscriminately is equivalent to the open defecation of 5,000 people!

—*The Dakar Declaration: Towards an Improved Fecal Sludge Management*

The previous chapters confirm how vital it is to design and implement on-site sanitation systems from a holistic perspective. For environmental, economic, and social reasons, proper collection and disposal of domestic sludge is crucial.

Collection of fecal sludge is essential both for conventional on-site sanitation systems (pit latrines and the like) and for ecological systems (dry latrines and dry bathrooms). Even though the latter solutions offer the opportunity to reuse the sludge, most households with on-site systems use the conventional types.

The present study focuses on peri-urban areas because this is the setting that has the largest volume of fecal sludge that needs to be collected and disposed of at appropriate locations.

5.1 User Perceptions of On-site Sanitation Services

Conventional sewerage networks and condominium sewers are commonly regarded as definitive solutions, whereas on-site sanitation is seen as a temporary solution.

Unless this perception changes, the coverage and quality of fecal sludge collection services will not improve. What is needed is better education and training, as well as standards in the following areas:

- Quality and durability of the sanitation option chosen

- Cost of investing in the latrine, septic tank, or other on-site sanitation option chosen (dry bathrooms, among others)
- Cost of maintaining the infrastructure
- Frequency of sludge removal, collection, and final disposal
- Quality of the services provided
- Regulation of collection and disposal services
- Family health status
- Degree of responsibility for household sanitation assumed by the family
- Sites for final disposal of the fecal sludge and wastewater that has been collected

5.1.1 Quality of Services

Based on the surveys administered to users of fecal sludge collection services and information gathered from the companies working in this area, it was confirmed that the quality of the services tended to be directly proportional to the fees paid.

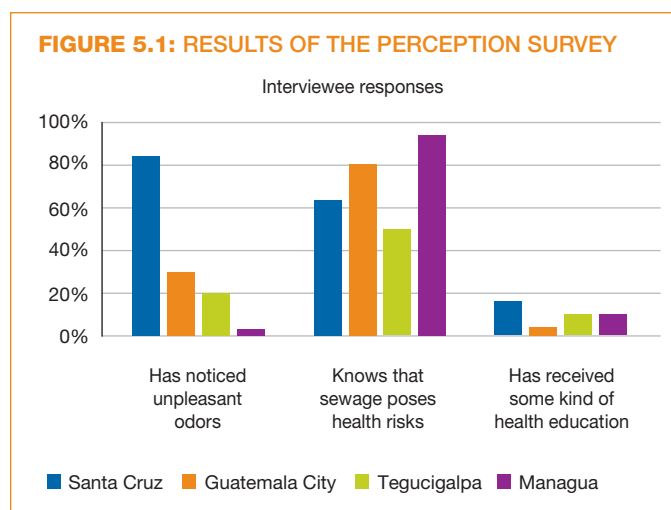
For example, the following **Table 5.1** the degree of user satisfaction with the services received in Santa Cruz.

TABLE 5.1: ASSESSMENT OF THE SERVICES

Criteria	Percentage of users
Reasonable price	36%
High-quality work	36%
Polite treatment of customer	88%
Adherence to schedule	15%
New, good-quality equipment	33%
Monitoring of services	100%
Much difference between the collection companies	16%

Source: Summary of 122 user surveys in Santa Cruz.

Another aspect of service quality taken into account in these studies was the acceptability of latrines or septic tanks located near the homes of the interviewees. The **Figure 5.1** figure summarizes their opinions regarding the presence of disagreeable odors and also their knowledge about the risks associated with wastewater.



Source: Summary of 354 user surveys in Santa Cruz, Guatemala City, Tegucigalpa and Managua.

The largest gap between the cities is seen under the heading of dissatisfaction with the presence of disagreeable odors, which was high in Santa Cruz and very low in Managua. This difference is probably due to design and construction standards – for example, regarding ventilation.

In addition, 97 percent of the users surveyed in Santa Cruz said that they constantly see insects, even in the winter. At the same time, 53 percent indicated that household members frequently suffer from gastrointestinal illnesses. Also, 63 percent stated that children often walk around areas near feces and wastewater.

Table 5.2 summarizes the interviewees’ interest in having fecal sludge collection services.

5.1.2 Frequency of Collection

The frequency of collection depends on the storage capacity of the latrine. In the case of septic tanks, it depends on how well they have been built. If the feces do not separate from the wastewater, the tank fills up more rapidly and will need to be cleaned more often.

TABLE 5.2: INTEREST IN HAVING COLLECTION SERVICES¹⁵

Sludge collection and disposal services			
City	Interested in having collection service	No interest/ cannot have service	Undecided
Santa Cruz (*)	50.0%	42.1%	7.9%
Guatemala City	46.0%	7.0%	47.0%
Tegucigalpa	40.0%	0.0%	60.0%
Managua	73.0%	27.0%	0.0%

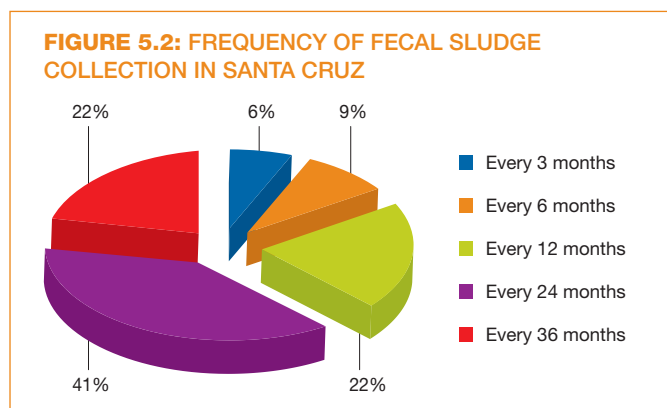
¹⁵ In Santa Cruz, most of the interviewees who did not use sludge collection services expressed interest in having them. However, it should be kept in mind that some of them had only a simple (pit) latrine. For those who were undecided, this would be an impediment to having the services. Finally, most of them cited the cost as a limiting factor.

In addition, the frequency of collection is also dependent on the experience of the users. A number of representatives from the collection companies said that new users wait until the tank overflows to call them. On the other hand, more experienced users have learned that collection is related to the size of the tank. It was reported that some of these users keep a record of past collection dates so that they can figure out when the next one is due.

The **Table 5.3** and **Figure 5.2** show that Santa Cruz was the participating city that reported the longest time between fecal sludge collection dates. However, 63 percent of all participants reported a collection frequency of 12 to 24 months.

TABLE 5.3: REPORTED FREQUENCY OF SLUDGE COLLECTION

	Frequency of collection (months) per household			
	Santa Cruz	Guatemala City	Tegucigalpa	Managua
Frequency	21 months	18 months	14 months	11 months



Source: Summary of 354 user surveys in Santa Cruz, Guatemala City, Tegucigalpa and Managua.

5.2 The Supply: Collection Companies

Most of the company representatives who were interviewed said that increasing their installed capacity was not a priority because they believed that the market was saturated. However, this position may well be just reactive, because they do not have information about the potential market, nor is there information or the means with which to increase the demand. It is still an undefined market in which the service providers could identify opportunities to innovate and expand their coverage.

Based on these interviews, the factors that affect fecal sludge removal services are summarized below.

TABLE 5.4: FACTORS THAT AFFECT OPERATIONS

COMPETITION	<ul style="list-style-type: none"> The industry is in its early stages and there is little competition. There are no entrance barriers of a technical, economic, or regulatory nature that would impede the participation of other companies. There is no control over discharging at unauthorized sites.
TRANSPORTATION COSTS	<ul style="list-style-type: none"> The cost of delivering the service is high. Demand for the services is widely dispersed, requiring more trips to pick up and haul the sludge. Each service requires individualized attention, which increases the number of trips to the final discharge point.
INSTITUTIONAL REGULATIONS	<ul style="list-style-type: none"> There are no penalties for failing to meet sanitation standards at the domestic level. There is little control over the companies' commercial and industrial activities. The formal requirements for permission to operate vary depending on the city. The institutional framework for the sanitation sector, especially the management of fecal sludge, is limited or nonexistent.
TREATMENT OF EFFLUENT	<ul style="list-style-type: none"> In some cases the companies operate under the aegis of the providers of drinking water and sanitation services. If there are no treatment plants, the sludge is dumped at sanitary landfills or even in the open air. There is no clearly defined policy for promoting the development of decentralized treatment solutions that the companies could explore.

5.2.1 Legal Nature of the Companies

In the four cities, most of the sludge collection companies focus on household services. However, in Guatemala City there are two companies that have diversified and are offering a broader portfolio of services.

In Santa Cruz, eight of the 10 companies interviewed said that they only collect domestic sludge. The two others are more diversified: one collects fecal sludge from oil field camps (within the Department of Santa Cruz) and the other offers irrigation services for sports fields in one of the peri-urban areas.

In the Central American cities, the companies were originally established for other types of business. It was the demand that prompted them to develop sludge removal, collection, transportation, and disposal services for the domestic market and, to a lesser extent, treatment plant services in the industrial sector.

These companies share the following characteristics in common:

- They have more than five and fewer than 15 employees and are therefore considered micro or small businesses.
- They keep accounting records.
- They have a price-based market strategy.
- They have limited access to information.
- Their managers do not have training in management or business development.

All the Central American countries interviewed are legally established—i.e., registered with the local city government. They pay taxes and have been granted a license to operate.

The situation in Bolivia is quite different. The survey would suggest that 40 percent of the companies working in this area are not legally established under the regulations in effect.¹⁶ They therefore have restricted access to credit and cannot belong to such groups as the Association of Sludge Removal and Transportation Enterprises (ADELTAR), which have been advocating for their corporate entitlements since the late 1990s.

In Guatemala City, a total of 27 companies offer septic tank sludge cleanup services. Some of them also offer other services, including maintenance, design, and operation of wastewater treatment plants.

Although they got their start in business renting portable sanitary facilities, the demand prompted them to start providing fecal sludge removal services. Their technology continues to be relatively basic, mainly involving the use of truck-mounted tanks and pumps.

In the case of Tegucigalpa, the national provider of drinking water and sanitation services (SANAA) competes with two private companies in the fecal sludge removal business. These three companies focus on industrial, commercial, and middle- and upper-income residential customers. Peri-urban communities are not accustomed to requesting this type of service.

In Managua, the companies that provide septic tank and cesspool sludge removal services were originally in the business of plumbing and selling water from trucks.

Subsequently, in response to the demand created by sectors of the population without access to the sanitary sewerage system, these companies began to engage in the removal, transportation, and final disposal of sludge from septic tanks, latrines, cesspools, and treatment plants in the industrial sector, which was also requesting sludge management services. Of the five companies interviewed, two are small family businesses.

5.2.2 Years in Business and Capitalization

In most of the cities, fecal sludge collection services have already existed for a couple of decades. The collection companies in Santa Cruz, for example have been in business for six to 29 years, and the overall average is 12 years.

The picture is similar in Guatemala City and Managua. In Guatemala City, the companies have been operating from four to 24 years. In Managua, they have been in business the longest: from 10 to 45 years.

¹⁶ In Bolivia, regulations require several registration steps in order to establish a sole proprietorship, including registration with Fundempresa company, the national income tax service (SIN), and the Pension Fund Administrators (AFP).

With regard to the capitalization of these companies, the firms in Santa Cruz have been valued at between US\$18,000 and US\$210,000, including equipment, machinery, and offices.

Information is not available regarding the monetary value of the companies in the Central American cities. However, the data in Annex 4 suggest that the range is equally broad.

5.3 Financing

Four of the 10 companies in Santa Cruz have had or have access to credit from the financial sector, either commercial banks, financial funds, or microlending institutions. The last-mentioned are preferred because loan processing is less complicated and fewer documents are required. However, the interest rate is higher than with commercial banks.

Their limited access to credit is due to several factors: the informal status of the business, high interest rates, and the many requirements that have to be met. A number of company owners borrow from relatives or even representatives of their immigrant communities.

In the three Central American cities, on the other hand, the companies tend to be legally recognized and they therefore have more options for getting credit.

5.4 Institutional Relations

5.4.1 Drinking Water and Sanitation Providers

One of the two water and sanitation providers studied was SAGUAPAC in Santa Cruz. This cooperative receives and treats sludge from 25 sludge collection services (10,000 m³/month). It charges one price for Class A companies and another price for Class B companies, as shown in **Table 5.5**. Together, these companies generate an annual income of slightly more than US\$21,000.

Classification of companies according to SAGUAPAC:

Class A companies: Industries with production processes that do not include water.

Class B companies: Industries with partial wet processes (using chemicals in small scale).

Class C companies: Industries with high water and chemical processes (tanneries, milk industries, etc.)

The other water and sanitation service cooperatives in the metropolitan area of Santa Cruz do not have treatment plants. This may be due in part to the fact that no records are kept of on-site sanitary facilities.

However, several of these cooperatives have been seeking government support in the form of subsidies for investments in sewerage systems. Everything would seem to indicate that in the near future at least some of these cooperatives will be able to discharge at the SAGUAPAC treatment plants.

TABLE 5.5: SANTA CRUZ: VOLUME OF SLUDGE AND PRICE CHARGED BY COLLECTION COMPANIES

Collection company	Monthly volume of sludge (m ³)	Fee (US\$/m ³)	Monthly total (US\$)	Annual total (US\$)
CLASS A				
1	268.80	0.15	40.32	483.84
2	0.00	0.15	0.00	0.00
3	14.14	0.15	2.12	25.45
4	2,660.05	0.15	399.01	4,788.10
5	821.79	0.15	123.27	1,479.22
5	585.60	0.15	87.84	1,054.08
6	167.62	0.15	25.14	301.72
7	324.75	0.15	48.71	584.55
8	360.60	0.15	54.09	649.08
9	1,037.07	0.15	155.56	1,866.72
10	1,259.10	0.15	188.86	2,266.37
11	21.79	0.15	3.27	39.22
12	877.70	0.15	131.65	1,579.86
13	120.28	0.15	18.04	216.50
14	7.42	0.15	1.11	13.36
15	70.07	0.15	10.51	126.12
16	180.64	0.15	27.10	325.15
17	393.92	0.15	59.09	709.05
TOTAL CLASS A	9,171.33		1,375.70	16,508.40
CLASS B				
18	255.0	0.52	132.60	1,591.20
19	0.0	0.52	0.00	0.00
20	303.8	0.52	157.98	1,895.71
21	202.4	0.52	105.25	1,262.98
22	0.0	0.52	0.00	0.00
23	0.0	0.52	0.00	0.00
24	0.0	0.52	0.00	0.00
25	18.0	0.52	9.36	112.32
TOTAL CLASS B	779.20		405.18	4,862.21w
TOTAL A + B	9,950.53		1,780.88	21,370.60

Source: SAGUAPAC, extrapolated from monthly records for 26-09-2009 to 25-10-2009.

The other provider studied was in Managua. Six of the 10 known collection companies discharge their fecal sludge at the wastewater treatment plant. Nicaragua's national drinking water and sanitation enterprise, ENACAL, charges them US\$0.30/m³. The collection companies generate a monthly sludge volume of 863.51 m³ and fees amounting to US\$3,165.16 (ENACAL 2011). These figures suggest that the plant's capacity for the treatment of sludge is probably greater than what it receives.¹⁷

In Guatemala City and Tegucigalpa, fecal sludge is discharged into sanitary landfills, although it is known that some of the companies dump sludge at unauthorized sites, such as sewage chambers in the sewerage system.

Generally speaking, the drinking water and sanitation providers in the cities studied do not keep a record of on-site sanitary facilities (number of latrines and similar facilities). Nor do they keep up-to-date information on services that clean septic tanks or collect and dispose of fecal sludge.

To a large extent, both these situations are due to the lack of legal norms (except in Bolivia) that specify the duties of the drinking water and sanitation providers with regard to the management and disposal of domestic fecal sludge from on-site facilities.

5.4.2 Role of National and Local Governments

The Ministries of Environment in Bolivia, Guatemala, Honduras, and Nicaragua are responsible for establishing

legal norms for the management and protection of natural resources.

Because of limited human and financial resources, enforcement of these norms depends on third-party complaints. The lack of resources also precludes the implementation of better policies and programs for reuse of the sludge.

Local governments do not play a very active role in managing the collection and disposal of fecal sludge. For example, the Santa Cruz Municipal Government does not get involved in the control, monitoring, or regulation of fecal sludge collection and disposal services. Its role is limited to granting a business operating license for tax purposes. For this reason, it is hoped that the new legislation that came out at the end of 2010 will improve control over registration and fulfillment of requirements.

In Guatemala City, Tegucigalpa, and Managua, the local governments register the companies and recognize them as formal businesses. In addition, the companies pay taxes and they can have operating licenses. However, they are not specifically certified for the management of hazardous solid waste or special waste.

There is opportunity for local governments to participate more actively in promoting on-site hygiene solutions, providing technical assistance to users, and balancing the supply and demand.

¹⁷ In one year, the human body produces 500 L of urine plus 50 L of feces, not including flush water. Thus, a household of five persons will discharge an average of 2.7 m³ of excreta annually (urine and feces), to which the volume of graywater has to be added. Source: Esrey, Steven A., et al., *Ecological Sanitation*. Stockholm: SIDA, 1998.

VI. Characteristics of the Market

6.1 Marketing Mix

6.1.1 Product

6.1.1.1 Collection

Septic tanks and dry and conventional latrines are cleaned by suctioning the fecal sludge from the on-site facilities.

The next step in the process is to transfer the fecal sludge in hermetically sealed tanks, which are then emptied into the sanitary sewerage system or at wastewater treatment plants.

The storage capacity of the tanker trucks that transport the sludge ranges from 2.5m³ to 10m³. In theory, a typical trip would consist of starting out from company's site, traveling to the various collection points, and discharging the sludge at an authorized site. In practice, however, the collection

companies are not properly monitored, and they often dump the sludge in clandestine locations.

The sludge trucks (**Figure 6.1**) may be custom-built by specialized manufacturers, or they may be fuel tankers that have been retrofitted for the purpose. In the latter case, a vacuum pump (2 hp to 20 hp) is added. The suction and discharge hoses, 3" to 6" in diameter, are made of flexible corrugated polyvinyl chloride (PVC).

The system is usually operated by a driver and a pump operator, although one person can perform both functions.

A point worth mentioning is that depreciation of these vehicles is rarely considered and they are not properly maintained. This situation poses a serious ongoing hazard.

FIGURE 6.1: SANTA CRUZ: TANKER TRUCKS FOR SLUDGE COLLECTION



6.1.1.2 Excreta Disposal

As it was mentioned earlier, 60 percent of the sludge collected in the peri-urban areas of Santa Cruz (approximately 10,000 m³/month) is taken to the SAGUAPAC stabilization ponds. There it goes through anaerobic and facultative treatment and, finally, maturation.

The destination of what is left is unknown. According to representatives of the Santa Cruz municipal government, it is believed to end up on vacant land (in peri-urban areas) and in crop fields (in rural areas).

The six most well-known collection companies in Managua discharge 10,000m³ of sludge at the treatment plant each year. In this case, the treatment consists of the following steps: thickening, digestion, pressing, and drying in sheds. Once it is dried, it can be used in agriculture.

The characteristics of the sludge collection and disposal services are summarized in **Table 6.1**.

TABLE 6.1: CHARACTERISTICS OF THE SLUDGE COLLECTION AND DISPOSAL SERVICES

Characteristics	Companies in Santa Cruz, BOLIVIA	Companies in Guatemala City, GUATEMALA	Companies in Tegucigalpa, HONDURAS	Companies in Managua, NICARAGUA
Number of collection companies	40	27	4	10
Type of enterprise	Family-owned or sole proprietorship	Family-owned; one company is international	Water & sanitation provider (SANAA) and family-owned	Three are well-established private firms, the rest are family-owned
Years in business	75% over 10 yrs	15 yrs average	10 yrs average	24 yrs average
Formally registered companies	25	27	3	5
Informal companies	15	0	1	5
Activities they engage in	Mainly septic tank cleaning, sludge collection and disposal; one company also collects sludge from oil fields	Some offer maintenance, design, and operation of wastewater treatment plants	SANAA provides drinking W&S services to most of the country. It is currently undergoing decentralization. It collects sludge from industries, businesses, and population in areas without sewerage connections	Plumbing services; one company also rents portable toilets and designs, builds, and operates wastewater treatment plants
Companies that discharge at treatment plants	24	Instead of discharged, it is deposited in landfill sides	N/A	6
Environmental license	NO	YES	YES	YES
Role of drinking water and sanitation provider	Receives more than 60% of sludge generated in peri-urban areas, treated like other domestic sludge	Supervises to ensure that sludge is not discharged into the sewerage system or wastewater treatment plant	SANAA (the national water & sanitation provider) is one of the 3 companies responsible for sludge collection	Receives more than 50% of sludge generated in peri-urban areas, which is treated like other domestic sludge

Source: Field studies conducted in the four cities in 2010.

6.1.2 Price

The collection companies operate by request in various peri-urban areas. In other words, unlike a water truck that distributes water to those who need it, these trucks don't go out unless they are called. Although the price is unregulated, competition is based precisely on offering the lowest price, often to the detriment of service quality.

The number of companies in Santa Cruz (40), Guatemala City (27), and Managua (10)¹⁸ confirm that there is an open market. Tegucigalpa, on the other hand, has an oligopoly market, since one of the four companies that provide these services in the capital of Honduras is the national drinking water and sanitation provider.

The manner in which fees are charged amounts, in effect, to a subsidy: as long as they remain within the urban metropolitan area, the collection companies charge a fixed amount without regard for the distance between the company and the customer. In Santa Cruz, moreover, there is a cross-subsidy between services to households and those provided to businesses and industries.

Table 6.2¹⁹ summarizes the average amounts charged in the four cities. It can be seen that there are sizable gaps between

the highest and the lowest figures. In the case of Guatemala City, the highest rate is 1.55 times the lowest one. In Managua, moreover, it is 2.57 greater. In Santa Cruz, it is 1.71 greater, and in Tegucigalpa, “only” 1.11 times greater, although the prices in that city are the highest of the four.

In all cases, the majority of users interviewed said that the cost is high in relation to their income. This increases the risk that they may end up not using the service, placing both the environment and their family's health at risk.

For the foregoing reasons, the prices, like the quality of service, should be regulated. It is also possible that, if the company cooperatives got together and agreed to raise prices as a group, the end users could end up hiring people to clean up the sludge manually, and those people could dump it next to the nearest watercourse.

Therefore, while it is important to regulate fees and sanitation quality, it is also important to have adequate resources for enforcement; otherwise, people can get around the rules.

¹⁸ Information estimated by ENACAL staff, April 2011.

¹⁹ Since purchasing power parity (PPP) needs to be taken into account, these amounts are not strictly comparable.

TABLE 6.2: CHARGE FOR SLUDGE COLLECTION SERVICES IN PERI-URBAN AREAS

City	Company	Average trips per day	Payment per trip (US\$)
Santa Cruz	1	3.5	35.7
	2	5	39.3
	3	1.5	27.1
	4	2.5	33.6
	5	3	39.3
	6	1.5	35.7
	7	3.5	35.7
	8	2.5	39.3
	9	1.5	35.7
	10	4.5	46.4
	15 other formal companies	37.5	43.3
	15 other formal companies	37.5	28.6
	TOTAL or average price	104	36.3
Guatemala City	1	4.5	128.2
	2	1	116.9
	3	1	181.8
	4	1.5	168.8
	23 other competing companies	34.5	142.9
	TOTAL or average price	42.5	145.7
Tegucigalpa	1	1.5	205.3
	2	0.75	184.2
	3	1.5	197.4
	1 company	1	190.8
	TOTAL or average price	4.75	195.4
Managua	1	3.5	141.4
	2	3.5	55.0
	3	4.5	59.1
	4	1	121.8
	5	1.5	81.8
	5 other companies	7.5	81.8
	TOTAL or average price	21.5	85.5

Source: Field studies conducted in the four cities in 2010.

6.1.3 Market

The market for paid fecal sludge collection services tends to be concentrated in peri-urban areas, and the customers are usually households, although some businesses use these services as well.

In Santa Cruz, the demand comes mainly from low- and middle-income households and, to a lesser extent, from industries, businesses, and upper-income households.

In Guatemala City, on the other hand, the services are requested by middle-income households and, increasingly, industries and businesses.

In Tegucigalpa, the demand is divided between industries, businesses, establishments that serve the public such as schools and health centers, and middle- and high-income households in peripheral areas.

In Managua, a sizable percentage of users are commercial and industrial establishments such as hotels, restaurants, and manufacturing plants. About 15 percent of the services are offered to middle- and upper-income residential customers and condominiums, while low- and middle-income families in peri-urban areas account for only 5 percent of the market at most.

The average income of households in the peri-urban areas of these cities is below the poverty line (World Bank - WSP 2007, 2008a, 2008b). **Table 6.3** shows a comparison of their average income and the cost of building an improved latrine or septic tank.

This comparison shows that a latrine/septic tank costs between 0.86 and 3.36 times the average monthly family income. The data above also lead to the following observations:

- This cost is higher than the fee charged by drinking water and sanitation providers to connect a home to the sewerage system.
- Interest and effort are required of families in order for them to have sanitation facilities. This observation is confirmed by similar observations in other places like Vietnam, for example, where households pay 25 percent to 30 percent of their *annual* income (Trémolet 2010).
- The cost needs to be reduced for low-income households.

6.1.4 Advertising

6.1.4.1 Santa Cruz

The companies' efforts to advertise their services in Santa Cruz have been improvised and haphazard. The field study showed that three of them use signs or posters in front of their businesses and on walls in peri-urban areas. Four of them promote their services with blowups on the side of their tanker trucks. Three others advertise in the print media. Only a few of them reported using printed media like the "yellow pages."

All the participating companies felt that they were doing enough to promote their services.

6.1.4.2 Guatemala City

The following marketing tools are used most often in Guatemala City: "yellow pages," distribution of flyers, websites, classified ads, and participation in and sponsorship of events having to do with sanitation services.

TABLE 6.3: AVERAGE INCOME IN PERI-URBAN AREAS AND COST OF IMPROVED LATRINES

Income	Santa Cruz	Guatemala City	Tegucigalpa	Managua
Average monthly household income 2010 (local currency)	Bs 1,200	Q2,000	L. 5,800	C\$ 4,460
Average monthly household income (US\$)	US\$ 171	US\$ 260	US\$ 305	US\$ 203
Minimum cost of improved latrine	US\$ 200	US\$ 273	US\$ 263	US\$ 227
Cost of septic tank	US\$ 229	US\$ 403	US\$ 316	US\$ 682
Minimum cost of latrine/monthly household income	1.17	1.05	0.86	1.12
Minimum cost of septic tank/monthly household income	1.33	1.55	1.03	3.36

Note: The cost of septic tanks does not include the cost of absorption wells or filtration beds.

The public is quite familiar with septic tank cleaning services. Thus, marketing strategies tend to involve direct contact between the service company and the customer, usually by telephone or e-mail.

Most of the companies interviewed get new customers through recommendations from older customers.

6.1.4.3 Tegucigalpa

The market for fecal sludge collection in Tegucigalpa is geared to businesses and upper middle-class families who live in residential areas that do not have sanitary sewerage service (for example, El Hatillo and colonias along the highway to the south as it leaves the city). However, there are also low-income peri-urban barrios with on-site sanitation systems that offer a potential market for fecal sludge collection.

6.1.4.4 Managua

In the Nicaraguan capital, the marketing tools used most often are also the “yellow pages,” distribution of flyers, and classified ads. Two of the companies interviewed have a website on which they advertise their services and show the work they have done. However, most of the companies interviewed get new clients exclusively from word-of-mouth advertising.

6.2 Costs and Income from Services Rendered

Table 6.4 lists the annual costs of operating, maintaining, and managing the fecal sludge collection and disposal companies in Santa Cruz. The data show that nearly 40 percent of the

costs are for personnel and 20 percent for depreciation of equipment and vehicles.²⁰

TABLE 6.4: SANTA CRUZ: AVERAGE ESTIMATED OPERATING AND MANAGEMENT COSTS (US\$/YEAR)

Item	Santa Cruz
Fuel	2,789.7
Lubricants	279.0
Salaries: workers	7,203.9
Salaries: management	1,782.9
Replacement parts	558.0
License fees	85.7
Environmental studies and permitting	857.1
Subtotal	13,556.3
Services	1,355.6
Subtotal	14,911.9
Pump operating costs	2,982.4
Subtotal	17,894.3
Gastos generales	894.7
Health Fund contributions	68.9
Pension Fund contributions	12.1
Depreciation	4,682.7
Total	23,552.7

Table 6.5 shows the price ranges for the domestic and industrial segments of the companies’ clientele.

²⁰ Unfortunately, it was not possible to break down costs to this level for the Central American cities.

TABLE 6.5: TARIFFS, BY CATEGORIES

City	Company	Domestic		Industrial	
		Min. (US\$)	Max. (US\$)	Min. (US\$)	Max. (US\$)
Santa Cruz	1	28.6	42.9	42.9	57.1
	2	35.7	42.9	50.0	64.3
	3	25.7	28.6	35.7	50.0
	4	31.4	35.7	42.9	57.1
	5	35.7	42.9	50.0	64.3
	6	28.6	42.9	42.9	57.1
	7	31.4	40.0	42.9	57.1
	8	35.7	42.9	50.0	64.3
	9	28.6	42.9	35.7	50.0
	10	42.9	50.0	57.1	71.4
	Average	32.4	41.1	45.0	59.3
Guatemala City	1	102.6	153.9	190.0	250.0
	2	77.9	155.8		
	3	181.8	181.8		
	Average	120.8	163.9		
Tegucigalpa	1	157.9	252.6		
	2	157.9	210.5		
	3	157.9	236.8		
	Average	157.9	233.3		
Managua	1	141.4	141.4		
	2	50.0	60.0	Free zone; price according to the study	
	3	54.5	63.6		
	4	113.6	130.0		
	Average	89.9	98.8		

Source: Field studies conducted in the four cities in 2010.

As part of the interviews, the company representatives reported how many trips they are required to make per day. **Table 6.6** summarizes this information. As it can be seen, the figure ranges from one to five trips.

TABLE 6.6: NUMBER OF TRIPS PER DAY

City	Company #	Minimum trips/day	Maximum trips/day	Average
Santa Cruz	1	2	5	3.5
	2	4	6	5.0
	3	1	2	1.5
	4	2	3	2.5
	5	2	4	3.0
	6	1	2	1.5
	7	3	4	3.5
	8	2	3	2.5
	9	1	2	1.5
	10	4	5	4.5
	Average	2.2	3.6	2.9
Guatemala City	1	4	5	4.5
	2	0	2	1.0
	3	0	2	1.0
	4	1	2	1.5
	Average	1.25	2.75	2.00
Tegucigalpa	1	1	2	1.5
	2	0	1.5	0.75
	3	1	2	1.5
	Average	0.67	1.83	1.25
Managua	1	2	5	3.5
	2	2	5	3.5
	3	2	7	4.5
	4	0	2	1.0
	5	1	2	1.5
	Average	1.4	4.2	2.80

Source: Field studies conducted in the four cities in 2010.

Based on the rates charged and the number of trips per day, an average-sized company in Santa Cruz takes in US\$28,500 a year, while its operating costs come to US\$23,000 a year. Thus, its profit margin is 20 percent to 25 percent. The Central American companies verbally reported similar profit margins (between 20 percent and 30 percent). Although the income in the cities studied ranged between US\$25,000 and US\$35,000, one of the companies in Guatemala City reported a much higher figure because it made more trips.

Table 6.7 shows the estimated sales volume for each city studied. It can be seen that the market for collection services in Tegucigalpa is still in the incipient stage. In Santa Cruz, on the other hand, the volume is close to US\$1 million, although this amount is shared by 40 companies. In the Guatemala City metropolitan area, sales exceed US\$1 million.

TABLE 6.7: ESTIMATED SALES VOLUME (US\$)

City	Company	Trips per day to domestic customers	Payment per trip (US\$)	Annual sales
Santa Cruz	1	3.5	35.7	30,000
	2	5	39.3	47,143
	3	1.5	27.1	9,771
	4	2.5	33.6	20,143
	5	3	39.3	28,286
	6	1.5	35.7	12,857
	7	3.5	35.7	30,000
	8	2.5	39.3	23,571
	9	1.5	35.7	12,857
	10	4.5	46.4	50,143
	15 other formal companies	37.5	43.3	389,571
	15 other formal companies	37.5	28.6	257,143
	TOTAL or average price	104	36.3	911,486
Guatemala City	1	4.5	128.2	115,422
	2	1	116.9	23,377
	3	1	181.8	36,364
	4	1.5	168.8	50,649
	23 other competing companies	34.5	142.9	985,714
	companies	42.5	145.7	1'211,526
Tegucigalpa	1	1.5	205.3	61,579
	2	0.75	184.2	27,632
	3	1.5	197.4	59,211
	1 company	1	190.8	38,158
	TOTAL or average price	4.75	195.4	148,421
Managua	1	3.5	141.4	98,955
	2	3.5	55.0	38,500
	3	4.5	59.1	53,182
	4	1	121.8	24,364
	5	1.5	81.8	24,545
	5 other companies	7.5	81.8	122,727
	TOTAL or average price	21.5	85.5	239,545

Source: Field studies conducted in the four cities in 2010.

6.2.1 Estimating the Domestic Tariff

The companies record their operating and management costs regularly, usually updating their books once a month. In Santa Cruz, as a rule they do not record capital expenditures or depreciation of their assets.

Most of them have not calculated their performance yield for labor, vehicles, and pumps. Therefore they do not have a unit cost structure that would enable them to set a minimum price for their services.

Based on the surveys, it is possible to estimate the average tariff for fecal sludge collection, or for that matter the monthly household payment for these services. A collected volume per household²¹ of 4m³ is assumed. In Santa Cruz, the amount reported by the collection companies differs from that reported by the users (an average of US\$54), which is the figure that has been used to determine the average tariff. **Table 6.8** shows this information for the four cities.

TABLE 6.8: DOMESTIC TARIFF AND MONTHLY PAYMENT FOR SLUDGE COLLECTION (US\$)

Breakdown per customer	Unit	Santa Cruz	Guatemala City	Tegucigalpa	Managua
Charge per trip	US\$	54.0	145.7	195.4	85.5
Volume collected	m ³	4.0	4.0	4.0	4.0
Average tariff	US\$/m ³	13.5	36.4	48.9	21.4
Breakdown per customer	Unit	Santa Cruz	Guatemala City	Tegucigalpa	Managua
Charge per trip	US\$	54.0	145.7	195.4	85.5
Average frequency of collection per household	Months	21.0	18.0	14.4	10.8
Monthly charge per household	US\$/month	2.57	8.10	13.57	7.92

Source: Field studies conducted in the four cities in 2010.

6.2.2 Comparison with Payment for Sewerage System Services

Table 6.9 shows monthly payments for sludge collection versus those for sewerage services.²²

TABLE 6.9: COMPARISON OF BILLING FOR SEWERAGE AND SLUDGE COLLECTION (US\$)

Breakdown per customer	Santa Cruz	Guatemala City	Tegucigalpa	Managua (Settlements)
Tariff for sewerage service, 1 to 20m ³ (US\$/m ³)	0.39	0.45	0.04	0.05
Average monthly sewerage bill (US\$)	7.74	9.09	0.86	1.14
Equivalent monthly bill for sludge collection (US\$)	2.57	8.10	13.57	7.92

Source: Field studies conducted in the four cities in 2010.

²¹ The average volume of 4 m³ is based on the fact that a simple pit latrine is usually 1.0 and 1.5m in diameter and about 3m deep (EAWAG 2008:57). Therefore, a latrine can hold between 2.4m³ and 5.3m³. At a depth of 4m, the stored volume would be 7m³. A septic tank or chamber should hold at least 3m³, and it is not unusual to find ones that hold larger volumes (4m³ to 5m³).

²² A domestic use figure of 20m³/month was assumed, which is the usual lower limit billed for sewerage system services.

In Santa Cruz, the user's charge for septic sludge collection is one-third what SAGUAPAC charges for sewerage and wastewater treatment services. However, in 2010 SAGUAPAC reduced its rate by 80 percent for this group and volume of wastewater. Therefore, the amount paid for fecal sludge collection would be about 41 percent of the average SAGUAPAC bill. This ratio undoubtedly encourages on-site sanitation.

However, it should be noted that sanitary sewerage systems are being built with subsidized investment in some of the peri-urban areas that currently do not have sewerage connections. It is very likely that the sewerage tariffs in these areas will be lower than the rates charged by SAGUAPAC.

The situation is quite different in the Central American cities. In Guatemala, the monthly sewerage tariff charged for 20m³ is nearly the same as the amount paid for sludge collection. Moreover, in Tegucigalpa and Managua the charges for sewerage system services are actually lower.²³

In fact, a household in Managua with on-site sanitation can pay up to seven times more than a household with a sanitary sewerage connection, and in Tegucigalpa, the difference is 15 times greater.

This comparison shows that it is common to find households with on-site sanitation paying more than those with sewerage services. This situation occurs because some governments subsidize sewerage services but fail to offer financial assistance for on-site sanitation.

6.3 Potential for Demand and Capacity of Supply

The demand for these services is highly inelastic. Moreover, it is accentuated by shortcomings in household sanitary infrastructure, which produces large volumes of diluted sludge and therefore the need for more frequent collection.

The potential demand is determined by the price for the services and the income of potential consumers. It also depends on such other variables as:

- The presence of recently built latrines (which take two to three years to fill);
- The possibility of building a new septic tank (sealing off and discarding the previous one);
- Inadequate cleaning of the septic tank (for example, when it is done by unqualified workers, who might even dump the sludge at clandestine sites).

6.3.1 Potential Demand

In all four cities there are proposals to build sanitary sewerage systems in peri-urban areas. Thus, in estimating the potential demand, it has to be assumed that a fraction of it may be met by the construction or acquisition of on-site sanitation solutions.

In addition, with a view to including low-income households, it is assumed that the potential consumers' ability to pay is 50 percent of the price currently being paid (in Santa Cruz, 52 percent). Based on these assumptions, **Table 6.9** shows the potential demand.

²³ In Tegucigalpa, the tariff for sewerage system services is 25 percent of the tariff for drinking water. Studies of tariffs in several countries indicate that the real price for sewerage services is nearly the same as for drinking water, and it may even be higher when the service involves pumping and has wastewater treatment plants. In Managua, the tariff for sewerage and wastewater services is equivalent to 46 percent of the charge for drinking water.

TABLE 6.10: POTENTIAL DEMAND

Item	Santa Cruz	Guatemala City	Tegucigalpa	Managua
Population of the metropolitan area	1'700,000	2'700,000	950,000	1'300,000
Percentage of the population without sewerage connections	60.4%	13.0%	30.0%	61.0%
Current and potential population with on-site sanitation (A)	770,100	263,250	213,750	594,750
Current population using sludge collection services (B)	153,273	59,856	4,557	13,106
Potential population that would use collection services	616,827	203,394	209,193	581,644
Potential households that would use collection services	118,621	42,374	41,839	111,855
Current sales (thousands of US\$)	910	1,212	148	240
Additional sales (thousands of US\$) (C)	1,830	2,058	3,407	5,315

(A) Not all households without sewerage connections are potential users of the sewerage projects under way.

(B) Inferred based on sales, cost of the service, and frequency of trips by collection trucks.

(C) Based on the Santa Cruz survey, it is estimated conservatively that the potential population would pay up to 50 percent of the current price for collection.

Experience in other regions indicates that if government-supported programs are developed, whether by direct subsidy or through a subsidized interest rate, there is high leverage²⁴ and households can even resort to microcredit. The Peruvian experience in “Creating Sanitation Markets” also shows the importance of household savings once a product is offered that is within reach. Therefore, it is necessary to establish a program that offers the possibility for joint public and private initiatives that will be not only affordable but also long-term.

6.3.2 Capacity of Supply

The supply situation differs in the four cities studied. Whereas in Guatemala City and Managua the collection companies provide other kinds of services and sludge collection is a complementary activity, in Santa Cruz it is their main activity. In Tegucigalpa, the companies work in middle- and upper-income neighborhoods and with businesses and industries.

Nevertheless, the potential market appears attractive in the light of:

- Potential for additional income;
- Potential for peri-urban development based on greater environmental awareness;
- Policies that promote access to on-site sanitation as a valid and necessary option for the population.

The interviews conducted with representatives from the collection companies made it clear that more information and guidance are needed in order to improve the quality of service. They also pointed up the need to promote the marketing of treated sludge in the agricultural industry. For this latter, it is necessary to regulate its sale, prevent asymmetric competition, and restrict the marketing of sludge that has not been properly treated.

In the case of Santa Cruz, which applies to the other cities as well, a large percentage of the collection companies said that in order to penetrate new markets they would have to not only increase their installed capacity but also be sure they had enough properly trained human resources and be backed by policies that would give them the confidence to make operational decisions.

This view is reinforced because these companies are family businesses or sole proprietorships with limited human resources at the operational and decision-making level. Usually decisions are made by one person, who is both owner of the businesses and head of the family, while the operations aspect, such as driving the trucks, is handled by another family member.

24 Domestic investment/public investment.

VII. Conclusions and Recommendations

A number of factors make the peri-urban context more complex than rural areas; not only is there a confluence of different ethnic, religious, and cultural groups, but also high population density, limited land use planning, unsafe streets, and inadequate basic services. Therefore, designing and executing sanitation service programs in these areas calls for special techniques (World Bank - WSP, 2011).

Once they have been proven effective, these techniques should be reflected in public policies and incorporated into sanitation practices on a large scale. An example is the case study in Santa Cruz, where Regulatory Administrative Resolution 227/2010 was issued shortly after these techniques were presented to AAPS authorities.

7.1 Conclusions

7.1.1 Legal Norms and Regulations

The lack of public policies and adequate legal norms governing the sector make it difficult to expand the use of on-site sanitation, which tends to be overlooked as a sustainable option. More specifically:

- There has been a failure to disseminate technical criteria for the construction of septic tanks and accessory installations (such as filtration beds or absorption wells), which has resulted in facilities that are unfinished and short-lived.
- The use of maintenance cards for septic tanks has not been promoted, and as a result, in most cases cleaning is not done as often as it should be.
- Sludge collection services are not regulated, posing a health hazard for their workers and the community in general.
- There is inadequate control, monitoring, and surveillance of authorized sludge disposal sites. This situation results in storage by unacceptable means and the marketing of contaminated products.

It is therefore necessary to strengthen legal norms and regulations on both the construction of on-site sanitation facilities and the dissemination of best operating and maintenance practices. At the same time, it is equally crucial to regulate and monitor fulfillment of the requirements that govern sludge removal, collection, and disposal services.

7.1.2 Institutional Structure

The cases studied show that governments have not been actively involved in the management of on-site sanitation in urban or peri-urban areas. However, as the peri-urban population with on-site sanitation solutions continues to grow, it will be essential to review the role of ministries of environment, sanitation, and health, as well as municipal governments and the sanitation providers.

The experience in Honduras shows that it is possible to get drinking water and sanitation service providers involved in the sludge collection and disposal cycle. While the quality of sludge collection and final disposal would improve, there would also be increased risk of creating a monopoly.

A mixed situation such as the one described is complicated, because the government can easily end up in the position of placing demands on some and being flexible with others in terms of equipment, collection requirements, and haulage and disposal of the sludge.

Moreover, the coexistence of formal and informal enterprises engaged in sludge collection generates an asymmetrical situation, which has prompted active intervention by local governments and national institutions in the sector, as was the case in Bolivia and Guatemala.

7.1.3 Financing and Tariffs

Although there have been cases in which governments have become involved with on-site sanitation systems in urban,

peri-urban, and rural areas (Trémolet 2010), this research did not reveal another example to add to the list.

Tariffs for sewerage services in two of the four countries are subsidized either by the drinking water and sanitation provider or directly by the government. In contrast, households that use sludge collection services do not receive any benefit from the government.

7.2 General Recommendations

The following recommendations are aimed at strengthening the management of fecal sludge in terms of institutional structure, partnerships, technical assistance, training, and marketing.

7.2.1 Legal Framework

There is clearly a need to define a legal and institutional framework that is in alignment with policies on sanitation, public health, the environment, and occupational safety. Legal provisions, procedures, and regulations should be clearly defined in order to ensure optimum quality of fecal sludge removal services. For this purpose, the following will be needed:

- Discussion and analysis of the existing legal framework governing fecal sludge management.
- Consultations and discussions both among institutions and with civil society to develop on-site sanitation programs, especially for peri-urban areas. These preliminary steps will help to ensure that policies are not dictated from the top down, but rather that they are of good quality and take a bottom-up approach, in alignment with criteria for good governance.
- Models of effective management and public-private-community partnerships for the development of sanitation solutions in peri-urban areas.

In peri-urban areas, it will be necessary to make progress in the drafting and dissemination of:

- Norms regarding on-site sanitation options, bearing in mind the concept of improved sanitation. These norms should incorporate a communication strategy that will promote best practices.
- Norms that define the characteristics and specifications of the sludge collection vehicles and drivers, including:

- a) Identification of the vehicle used for the purpose (color, signage);
 - b) Length of the vehicle and capacity of the tank (the figures to be posted on the vehicle itself);
 - c) Arrangement for securing the suction hose so that it will not fall off during transit;
 - d) Arrangement to ensure that the valves are hermetically sealed, to prevent spills during transit;
 - e) First aid equipment and an oxygen tank;
 - f) Equipment for communicating directly with the home office in case of emergencies;
 - g) Suction device approved by the sanitation authority;
 - h) Professional chauffeur license for the drivers;
 - i) Safety records, especially as they relate to occupational safety; and
 - j) Maintenance records for the vehicle, the tank in particular.
- Norms governing the conditions, requirements, and specifications for sludge collection, haulage, and disposal, as well as specifications regarding its reuse in agriculture.
 - Norms governing occupational safety (proper clothing, use of equipment when personnel are directly exposed to household sludge).
 - Norms governing the establishment of companies that clean on-site sanitation facilities, collect household sludge, and dispose of the sludge at authorized sites.

In addition, it is recommended that alternative approaches be studied, such as the construction of condominium networks that discharge into multifamily septic tanks that are easy to access for maintenance, cleaning, and collection of sludge. Such an approach could also help to reduce per household costs.

7.2.2 Financial Policies

To move more rapidly towards meeting sanitation targets, there is a need for an integrated sanitation financial policy that will generate synergies and greater investment capacity.

Dynamic progress will be unlikely unless governments provide support in the form of subsidies. Therefore, the question is what form these subsidies should take.

The case studies have featured a variety of subsidies for investment in on-site sanitation, ranging from the establishment of a Revolving Fund for concession capital (like seed capital, which leverages the investment of the households concerned) to a results-based 75 percent subsidy for on-site infrastructure typical of output-based aid (OBA).²⁵ In such contexts, it is desirable for governments and the various cooperation agencies to join forces, in keeping with the logic of the sector-wide approach,²⁶ which seeks to align and harmonize objectives, criteria, and procedures.

It is common for the tariff charged by sewerage systems to cover their operating (maintenance and replacement) costs, and, depending on the financial policy that has been adopted in the particular country, partial or total investment costs.

However, the operating costs of sewerage systems can be subsidized by the drinking water provider, which can generate differences such as those seen in Nicaragua and Honduras. This approach should, however, be equitable: sludge collection and disposal should also be subsidized.

Another alternative is for the regulatory agency to participate through an approach in which it determines an average monthly bill for sludge collection based on a review of amounts paid in the past, then sets a ceiling of approximately the same amount and establishes a subsidy plan under which the government covers anything in excess of that cap.

This could be implemented in various ways. One possibility would be to make a contribution to the water and sanitation provider that receives the sludge from the collection trucks at its treatment plant. The collection companies would be charged less for dumping the sludge, and they, in turn, could lower the rates they charge to their customers. To make this approach work, it would be helpful to conduct explicit information campaigns and have a system for effective accountability between the parties concerned.

To engage the support of local stakeholders, it would also be important for municipal governments to have guidelines

on sanitation investments that would enable them to make informed decisions on new investments and assess the desirability of subsidizing investments in local solutions.

7.2.3 Stakeholder Partnerships

The development of sanitary infrastructure requires investment amounts that exceed the capacity of governments. It is therefore necessary to enlist the participation of local entrepreneurs.

Currently, their participation is low. Fecal sludge collection and disposal companies have not developed economies of scale, nor have they adopted technologies that would enable them to expand their services to cover the majority of low-income inhabitants in peri-urban areas.

Progress will require effective synergy and coordination of activities, resources, and strategic guidelines within partnerships between governments (especially local governments), local companies, and bilateral and international cooperation agencies. This will involve the following steps:

- Systematize and regularize the fecal sludge removal companies (create an association of small and medium-sized companies engaged in the business).
- Develop a model and arrange for financing to cover the cost of digging and building on-site sanitation systems for individual or collective use.
- Come to an agreement on a tariff policy that will set a ceiling on rates for sludge collection and a subsidy scheme that will favor the user if the amount to be paid exceeds the cap on sanitary sewerage services.
- Improve on-site systems.
- In implementing the foregoing steps, the importance of local leadership and the proactive involvement of local government is clear.

7.2.4 Technical Assistance and Training

On the demand side, given the current state of sanitation service in peri-urban areas, it is important for the population to learn about hygiene and proper management of wastewater and graywater. For example, there is a need for instructional

²⁵ Under an output-based aid (OBA), explicit subsidies are designed to reward the performance of services, efficiency, or innovation in reducing prices. This mechanism supplements other sources of financing.

²⁶ Also known as SWAp.

materials and socialization mechanisms for reaching the users of on-site systems.

On the supply side, the workers who are employed must be capable of performing sludge collection and disposal services in a safe and environmentally acceptable manner. Therefore, it is necessary to establish an education program at the community level that will emphasize improving quality of life and teach local entrepreneurs about the importance of preserving water and environmental resources. In addition, it would be well to consider reinforcing their knowledge about:

- Environmentally responsible disposal of fecal sludge;
- Occupational safety;
- Analysis of fixed and variable costs as a basis for setting prices;
- Business management;
- Advertising of the companies' services.

As for promoting improved services, a marketing strategy should be developed that will make the service known to the population using both formal and informal information tools that will:

- Improve the market for all the companies' services;
- Encourage the widespread use of improved on-site sanitation services.

7.3 Recommendations for Public Policies

Defined here as the set of actions, processes, and interactions that take place between stakeholders at the level of political power, public policies can and should guide the development of on-site sanitation throughout its complete cycle, from the discharge and storage of excreta to the collection and final disposal of sludge. It is important to keep looking for other systems to complement traditional sanitary sewerage systems, since these systems will not be able to meet the needs of the entire urban population.

In this regard, it is sufficient to recall and abide by the Bellagio Statement for sustainable sanitation (EAWAG 2000):

1. Human dignity, quality of life, and environmental security should be at the center of any approach to sanitation.
2. In line with principles of good governance, decision making should involve the participation of key stakeholders, especially the consumers and service providers.
3. Waste³⁰ should be considered a resource, and it should be an integral part of a management approach that also includes water resources, nutrient flows, and waste management processes.

Properly stabilized and dehydrated, fecal sludge can be of great usefulness in agriculture.

4. Solutions to environmental sanitation problems should be undertaken on a small scale (at the level of the household, immediate vicinity, district, or city) and as soon as possible. This is especially important in the peri-urban interface, where a variety of technologies can coexist.

The management of sludge collection should meet the following criteria (SuSanA 2008):

1. **Health and hygiene:** analysis of the risk of exposure to pathogens and hazardous substances that could affect public health at all points (discharge, storage, collection, haulage, final disposal, and reuse of the sludge).
2. **Environment and natural resources:** analysis of the possible reuse of sludge and its impact on agriculture.
3. **Technology and operations:** analysis of the functionality of on-site sanitation systems at all points in the process, from collection to reuse.
4. **Financial and economic issues:** analysis of the households' capacity to pay, as well as external costs and benefits.
5. **Sociocultural and institutional aspects:** evaluation of socio-cultural acceptance of on-site sanitation systems, including perceptions, gender issues, and impact on the quality of life of households.

27 For example, feces and urine.

The greatest challenge for public policy makers, government authorities, and public administration in general is figuring out how to make these guidelines a reality.

Sanitation 21²⁸ has proposed an integral approach that consists of analyzing sanitation systems ranging from the individual dwelling to the barrio, city, or municipality. Each of these levels is identified as a specific domain, and for each of them the following criteria should be analyzed:

- **Context:** the interests at stake and how power is distributed between the various institutional groups, civil society, and social organizations. The analysis should focus on how external factors (poverty levels, land tenure, decentralization processes, political priorities, and others) influence decisions.
- **Potential for sanitation technologies:** measures to ensure that solutions at the household, for example, do not generate negative impacts on higher domains such as the barrio, city, or municipality. It is important to consider whether the solutions being analyzed involve a single technical option (sewerage systems, for example) or whether it is possible to analyze and combine on-site sanitation or decentralized options.
- **Fit for the intended purpose:** for example, analysis of whether the proposed solution meets quality parameters and is within permissible discharge limits. This analysis should take into account associated costs, financing schemes, and managerial requirements for the services at both levels (decentralized or centralized).

The question then becomes: How can all of this be applied in peri-urban areas?

The approach is to apply several sanitation technologies in a given city, in specific areas. Thus, for example, the following solutions might be implemented:

- One sanitation system for high-density peri-urban barrios (shantytowns);
- Another sanitation system for peri-urban areas with lower population density, being more apt for decentralized solutions;
- Another system for fully developed urban areas; and finally
- A system for nonresidential areas, such industrial or business corridors.

This approach has been used successfully in Indonesia (Parkinson et al. 2011), and now several peri-urban areas have the benefit of long-term on-site sanitation systems. In order for it to work, however, social and political acceptance is crucial, and the approach must also be economically feasible. Moreover, the solutions must take health promotion into account and be eco-friendly.

In this approach, access to drinking water and sanitation will—as it should—contribute to the process of social inclusion, human development, and democratic governance.

28 For further information, see <http://www.iwahq.org/dx/development/technical-expertise/sanitation-21.html> (consulted 05/09/11).

Bibliography

1. Angel, Schlomo, et al. 2004. *Rapid Urbanization in Tegucigalpa, Honduras*. Woodrow Wilson School of Public & International Affairs Princeton University, Princeton USA.
2. Carranza F., Medina, N. 2008. *El Estado del Saneamiento en Nicaragua. Resultados de una Evaluación en Comunidades Rurales, Pequeñas Localidades y Áreas Periurbanas*. World Bank - Water and Sanitation Program (WSP). 2008b. Washington D.C. USA.
3. Díaz Porfirio, Zelaya Saúl, and Mairena Ricardo. 2008. *El saneamiento en los barrios en desarrollo de Tegucigalpa*. Chac Magazine. Tegucigalpa, Honduras.
4. EAWAG. 2000. *Swiss Federal Institute for Environmental Science and Technology, Water Supply and Sanitation Collaborative Council, Bellagio Statement*, See: http://www.eawag.ch/forschung/sandec/publikationen/sesp/dll/Bellagio_Statement.pdf.
5. Economic Commission for Latin America and the Caribbean. 2010. *Millennium Development Goals: Advances in Environmentally Sustainable Development in Latin America and the Caribbean*. Santiago de Chile, Chile.
6. ENACAL, Jefatura de Pozos y Alcantarillado. 2011. *Verbal Consultation to Wells and Sewage Office*. May 2011.
7. Hogrewe William, Steven Joyce, and Eduardo Pérez. 1993. *The Unique Challenges of Improving Peri-urban Sanitation*. WASH. Washington D.C. USA.
8. Inter-American Bank. 2009. *Programa de Inversión en Agua y Alcantarillado en Áreas Periurbanas: Análisis Ambiental*. Washington D.C. IADB, September 2008. Project BO-L1034.
9. International Water Association. 2006. *Sanitation 21, Simple Approaches to Complex Sanitation*. London, UK. See: <http://www.iwahq.org/dx/development/technical-expertise/sanitation-21.html>.
10. Klingel Florian, Agnés Montangero, Doulaye Koné, and Martin Strauss. 2002. *Fecal Sludge Management in Developing Countries: A Planning Manual*. Swiss Federal Institute for Environmental Science and Technology. Duebendorf, Switzerland.
11. Lüthi C., A. Panesar, T. Schutze, A. Norstrom, J. McConville, J. Parkinson, D. Saywell, and R. Ingle. 2011. *Sustainable Sanitation in Cities: A Framework for Action*. Papiroz. The Netherlands.
12. Muench, Elizabeth. 2011. *Compilation of 27 Case Studies on Sustainable Sanitation Projects*. SuSanA. Eschborn. See: <http://www.susana.org/images/documents/06-case-studies/book/susana-cs-book-ssa-2011.pdf>
13. Pan American Health Organization. 2010. *Health Situation in the Americas: Basic Indicators 2009*. PAHO. Washington, D.C.
14. Pearce-Oroz, Glenn. 2001. *Causes and Consequences of Rapid Urban Spatial Segregation: The New Towns of Tegucigalpa*. In: Varady, David (ed.). *Desegregating the City: Ghettos, Enclaves, and Inequality*. Albany: State University of New York Press. Chapter 6.
15. SENASBA/PROAPAC. 2011. *Arreglos Institucionales en Agua y Saneamiento en Bolivia*. PROAPAC. Bolivia.
16. Sustainable Sanitation Alliance. 2008. *SuSanA: Towards More Sustainable Sanitation*. Version 1.2. http://www.susana.org/docs_ccbk/susana_download/2-267-en-susana-statement-version-1-2-february-2008.pdf

17. Tilley E., C. Lüthi, A. Morel, C. Zurbrugg, and R. Schertenleib. 2008. *Compendium of Sanitation Systems and Technologies*. Swiss Federal Institute of Aquatic Science and Technology (EAWAG). Dübendorf, Switzerland.
18. Trémolet Sophie, Pete Kolsky, and Eddy Perez. 2010. *Financing On-site Sanitation for the Poor: A Six Country Comparative Review and Analysis*. World Bank / Water and Sanitation Program. Washington D.C. USA.
19. UN-Habitat. 2005. *Slums of the World: The Face of Urban Poverty in the New Millennium?* Working paper. Nairobi, Kenya.
20. World Bank - Water and Sanitation Program. 2008. *Poverty and Sanitation: An Analysis of the Linkage between Poverty and Access to Basic Sanitation in Honduras, Tegucigalpa*.
21. World Bank - Water and Sanitation Program. 2011. *The Political Economy of Sanitation: How Can We Increase Investment and Improve Service for the Poor?*. Washington, DC. USA.
22. World Bank - Water and Sanitation Program. 2007. *Pobreza y Saneamiento. Un análisis del vínculo pobreza y acceso a saneamiento básico en Honduras, Tegucigalpa*.
23. World Bank - Water and Sanitation Program, 2008a, *Agua y saneamiento para las zonas marginales urbanas de América Latina, Memorias del Taller. Lima (Perú)*.
24. WHO / UNICEF Joint Monitoring Programme for Water Supply and Sanitation. 2010. *Estimates for the Use of Improved Sanitation Facilities: Bolivia*.
25. WHO / UNICEF Joint Monitoring Programme for Water Supply and Sanitation. 2010. *Estimates for the Use of Improved Sanitation Facilities: Guatemala*.
26. WHO / UNICEF Joint Monitoring Programme for Water Supply and Sanitation. 2010. *Estimates for the Use of Improved Sanitation Facilities: Honduras*.
27. WHO / UNICEF Joint Monitoring Programme for Water Supply and Sanitation. 2010. *Estimates for the Use of Improved Sanitation Facilities: Nicaragua*.

Annex 1: Key Concepts

- **Unimproved sanitation:** Unimproved sanitation facilities are unsatisfactory from the standpoint of public health, although it is possible to improve various types of existing facilities to prevent human contact with excreta—the following, in particular:
 - discharge siphon (manual or automatic) to a site other than a sewerage network
 - septic tank or pit latrine
 - pit latrine without slab/open pit latrine
 - bucket
 - overhung latrine or overhung toilet
 - shared facilities of any kind
 - no facilities (open defecation)
- **Improved sanitation:** A sanitation facility that prevents human contact with excreta in a hygienic manner. The following facilities are considered acceptable:
 - discharge siphon (manual or automatic) to a:
 - o sewerage network
 - o septic tank
 - o pit latrine
 - pit latrine improved with ventilation
 - pit latrine with a slab
 - composting toilet

For monitoring targets under the Millennium Development Goals, *shared sanitation facilities* are defined as any improved facilities for public use or shared by two or more households.

The use of improved shared sanitation facilities is common in densely populated urban areas because often there is not enough space to build private facilities (WHO/UNICEF JMP 2010:23).

- **On-site sanitation:** A system of installations for the safe and sustainable collection, storage, treatment and disposal of feces and urine within the dwelling or for a group of households, as distinguished from a sanitary sewerage system. The most common on-site systems are simple pit latrines (with or without ventilation), dual chamber septic tanks, urine-diverting dry toilets (UDDTs), discharge siphon systems, flush toilets, septic chambers with or without an absorption well, and composting chambers.

Decentralized systems for a group of households can be anaerobic baffled reactors (ABRs), anaerobic filters, or Imhoff tanks, among others.

- **Types of on-site sanitation** (Klingel 2002):
 - **Conventional sanitation systems:** These include pit latrines, bucket toilets, pit and flush toilets, and toilets connected to septic tanks, among others. In these systems the feces and urine are mixed.
 - **Ecological sanitation systems:** These are based on minimizing waste and re-circulating it into the natural cycles. After the urine and water are removed, the feces are stored separately, which facilitates dehydration and decomposition. This approach takes less space and makes the waste easier to handle and reuse.

Annex 2: Details on the Collection of Information

This annex provides details on where and how the survey was conducted. The responses were gathered by three groups of key stakeholders: end users, service providers, and government officials.

As explained earlier, this report summarizes the results of four studies, conducted in Santa Cruz (Bolivia), Guatemala City (Guatemala), Tegucigalpa (Honduras), and Managua (Nicaragua).

The studies in Central America were done in two complementary phases, the first in August and September 2008, and the second, between March and June 2010. In Santa Cruz, the study was conducted in 2009.

Users

- **Santa Cruz.** Seven peri-urban areas without access to sanitary sewerage services were selected for the study. Most of the participants lived in moderately poor areas, although in some of the areas the poverty was extreme.
- **Guatemala City.** With the assistance of local authorities, 53 surveys were administered in peri-urban areas. The participants were selected because they were living in areas of high population density and severe poverty without sanitary sewerage service. Another 26

surveys were administered later. All the interviewees had a sanitary facility into which they discharged excreta, and more than half of them used the same facility to discharge graywater as well.

- **Tegucigalpa.** The information from this city was collected through focus groups with the assistance of the Villa Cristina community water board. The participants lived in areas without access or connections to the sewerage system. Instead, they had septic tanks or pits. In the first phase, a total of 59 people were interviewed in seven areas; in the second phase, 10 more people were interviewed in four other peri-urban areas. Of those interviewed, 90 percent had a sanitary facility into which they discharged excreta and, to a lesser extent (less than one-fourth of them), graywater.
- **Managua.** On the city's outskirts, 55 people from seven barrios were interviewed during the first phase and 29 more from two other barrios in the second phase. None of the areas had sewerage services, and almost all of the interviewees used septic pits into which they discharged both excreta and graywater.

A summary of the surveys administered is shown in the **Table 6.11**.

Table 6.11: Localities and Number of Participants Interviewed

Santa Cruz									
Localities	Cotoca	El Bajío-Santa Cruz	El Torno	La Guardia	Los Chacos - Santa Cruz	Pampa de la Isla-Santa Cruz	Yapacaní		
No. of interviewees	14	26	13	26	15	13	15		
TOTAL OF INTERVIEES	122								
Guatemala City									
Localities	Various areas	Buena Vista	Las Charcas	(between Calles 35 and 36, and Avenidas 8 and 10)	Zona 118	Zona 12 (between Avenida Petama and Calzada Atanasio Sul and Calles 35 and 45)			
No. of interviewees	53	10	9		2		5		
TOTAL OF INTERVIEES	79								
Tegucigalpa									
Localities	Ramón Amaya Amador	Villa Cristina	Nueva Capital	Mary Flakes	Nueva Jerusalén	Aldea Villa Nueva	Colonia Villa Viejo	Los Pinos	
No. of interviewees	10	15	12	12	10	1	5	4	
TOTAL OF INTERVIEES	69								
Managua									
Localities	Camilo Ortega	Nuevo Ticomo	18 de Mayo	Esquipulas	Sabana Grande	Villa Reconciliación	Memorial Sandino	Ciudad Sandino	Barrio San Patricio
No. of interviewees	10	4	1	10	10	10	19	11	9
TOTAL OF INTERVIEES	84								

Source: Field studies conducted in the four cities in 2010.

Service Providers

Santa Cruz. Ten of the city's 40 providers of sludge removal and sanitation maintenance services were interviewed.

Guatemala City. First, three meetings were held to talk with representatives from a number of the city's 27 collection companies. After that, with a view to exploring certain topics in greater depth, representatives from the three most well-known companies were interviewed again.

Tegucigalpa. The three most important operators in the city's outskirts were interviewed. One of them is

the operator that provides drinking water and sanitation services at the national level (SANAA). As it was mentioned earlier, SANAA is in the process of decentralization. In addition, local operators in the following municipalities were interviewed:

- San Pedro de Sula (two companies)
- La Ceiba (one company)
- Puerto Cortés (one company)

Managua. Five of the ten sludge collection companies were interviewed.

Government Officials and Related Agencies

Santa Cruz

Interviews were held with officials from the following government agencies and institutions related to the water and sanitation sector:

- Vice Ministry of Drinking Water and Basic Sanitation in the Ministry of the Environment and Water
- Government of Santa Cruz Department
- Santa Cruz Municipal Government
- Japan International Cooperation Agency
- Santa Cruz Services Cooperative
- Andrés Ibáñez Services Cooperative, and
- La Guardia Services Cooperative.

In addition, researchers with experience in the water and sanitation sector were also interviewed.

In the Central American cities, interviews were conducted with officials from the following institutions related to the water and sanitation sector:

Guatemala City

- Guatemala City Municipal Water Supply (EMPAGUA)
- Municipal Development Institute (*Instituto of Fomento Municipal*)
- Ministry of Environment and Natural Resources
- Ministry of Health and Social Assistance, Ministry of Planning (SEGEPLAN)

Tegucigalpa

- National Autonomous Water and Sewerage Service (SANAA)
- Ministry of Natural Resources and the Environment (SERNA)
- Ministry of Health
- Tegucigalpa City Government
- Pollution Research and Control Center (CESCO)

Managua

- Nicaraguan Water and Sewerage Service Supply (ENACAL)
- Ministry of the Environment and Natural Resources (MARENA)
- Nicaraguan Water and Sewerage Institute (INAA)
- Ministry of Health (MINSAL)
- Managua City Government

Annex 3: Legal and Institutional Frameworks

BOLIVIA

Aspects	SAGUAPAC	AAPS	Ministry of Health and Sports	Ministry of the Environment and Water
Role	Provider of drinking water and sanitation services; Supervises to ensure that sludge is not discharged into sewerage systems	Regulatory authority for drinking water and sanitation at the national level, under Supreme Decree 0071/2009	Oversight of drinking water quality	Environmental oversight
Legal instruments	Ministry of Urban Affairs Resolution 510, October 1992, National Regulations on the Provision of Drinking Water and Sanitary Sewerage Services to Urban Areas	Administrative Regulatory Resolution 227/2010	Bolivian Standard NB-512 Water Quality for Human Consumption: Requirements	Law 1,333, April 1992, Law on the Environment; Regulations on Water Pollution, approved by Supreme Decree 24,176, 8 December 1995.
Impact on issues affecting fecal sludge management	Receives sludge collected by removal companies and treats it in its treatment plants	Fecal sludge collection companies operating in the service area of drinking water and sanitation providers must obtain authorization from the AAPS. Tariffs for the treatment of fecal sludge received from tanker trucks have to be approved by the AAPS. The drinking water and sanitation provider must present a plan for the disposal of fecal sludge in its service area.		Establishes norms governing the quality of wastewater discharged into receiving water bodies

GUATEMALA CITY

Aspects	EMPAGUA	Ministry of Public Health and Social Assistance	Ministry of Environment and Natural Resources
Role	Provider of drinking water and sanitation services; Supervises to ensure that sludge is not discharged into sewerage systems	Oversight of sanitary conditions in fecal sludge management	Environmental oversight
Legal instruments	Executive Order 236-2006, Regulations on the Discharge and Reuse of Wastewater and the Disposal of Sludge	Decree 90-97 of the Congress of the Republic, Health Code, Article 4	Decree 68-86 of the Congress of the Republic, Law on Protection and Improvement of the Environment
Impact on issues affecting fecal sludge management	Reviews norms to update aspects related to the fecal sludge removal companies		Inspects, regulates, establishes norms, and imposes penalties under the legislation governing fecal sludge; Handles complaints of improper discharge of sludge by the service companies

HONDURAS

Aspects	SANAA	Ministry of Natural Resources and the Environment (SERNA)	Ministry of Health	Tegucigalpa City Government
Role	Provider of drinking water and sanitation services	Grants operating licenses to the companies through Pollution Research and Control Center (CESCO); Together with Environmental Management Directorate, performs technical evaluation of sludge collection and disposal companies	Sanitary oversight of wastewater, rainwater, and disposal of excreta	In transition toward ownership of the drinking water and sanitation services under the Framework Law
Legal instruments	Decree 118-2003 of the National Congress, Framework Law on Drinking Water and Sanitation	Law 104-93 General Law on the Environment	Agreement 058, April 1996, on discharge of wastewater into receiving water bodies and sanitary sewers, sets technical standards and parameters for regulating quality of wastewater discharged into sewerage system	
Impact on issues affecting fecal sludge management	Grants permission to discharge sludge into sewerage system en route to treatment plant			

NICARAGUA

Aspects	ENACAL	INAA	Ministry of Health (MINSa)	Ministry of the Environment and Natural Resources (MARENA)	Managua City Government
Role	Provider of drinking water and sanitation services	Regulatory agency	Oversight of sanitary conditions in fecal sludge management	Environmental oversight	Registers the companies and vouches for environmental safety
Legal instruments	Law 297, General Law on Drinking Water and Sanitary Sewerage Services; Technical Resolution CD-RT-011-00, General Standards for the Regulation and Control of Drinking Water and Sanitary Sewerage Services	Law 297, General Law on Drinking Water and Sanitary Sewerage Services; Technical Resolution CD-RT-011-00, General Standards for the Regulation and Control of Drinking Water and Sanitary Sewerage Services	Law 423, General Law on Health, Chapter 1, Environmental Sanitation, Art. 69	Law 217, General Law on the Environment and Natural Resources; Technical Standard 05 013-01, Environmental Control of Use of Sanitary Landfills for Nonhazardous Solid Waste	
Impact on issues affecting fecal sludge management	Specific regulations on fecal sludge, currently under review by the institutions involved		Participates in drafting norms related to the control, disposal, and elimination of hazardous waste	Together with MINSa, issues regulations on disposal and discharge or elimination of substances that can pollute the soil, subsoil, aquifers or surface water bodies (Art. 113)	There are no relevant norms, but it coordinates actions with MINSa and MARENA

Annex 4: Assets

City	Company	Assets			
		Tanker trucks up to 4m ³	Tanker trucks up to 4m ³	Light vehicles	Offices
Santa Cruz	Company 1		2	Yes	Yes
	Company 2		9	Yes	Yes
	Company 3		1	Yes	Yes
	Company 4		2	Yes	Yes
	Company 5		2	Yes	Yes
	Company 6		1	Yes	Yes
	Company 7		3	Yes	Yes
	Company 8		2	Yes	Yes
	Company 9		1	Yes	Yes
	Company 10		5	Yes	Yes
Guatemala City	Company 1	5	3	Yes	Yes
	Company 2	3	3	Yes	Yes
	Company 3		3	Yes	Yes
Tegucigalpa	Company 1		2	Yes	Yes
	Company 2	1	1	Yes	Yes
	Company 3	N/A	N/A	Yes	Yes
Managua	Company 1	2	2	Yes	Yes
	Company 2	1	3	Yes	Yes
	Company 3		4	Yes	Yes
	Company 4		1	Yes	Yes
	Company 5	N/A	N/A	Yes	Yes

