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Fecal Sludge Management: Diagnostics for Service Delivery in Urban Areas

Case Study in Balikpapan, Indonesia

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Supporting document

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Preface / Acknowledgements

This report is a city case study of a World Bank Economic and Sector Work on *Fecal Sludge Management: Diagnostics for Service Delivery in Urban Areas* (P146128). The task team leaders were Isabel Blackett and Peter Hawkins and task team members were Zael Sanz Uriarte, Ravikumar Joseph, Chris Heymans and Guy Hutton.

This report is based on work conducted between January 2014 and February 2016 by Oxford Policy Management (OPM) in partnership with the Water, Engineering and Development Centre (WEDC) at Loughborough University. The core research team was Ian Ross (OPM), Rebecca Scott (WEDC), Ana Mujica (OPM) and Mike Smith (WEDC). The broader team who contributed to the study included Zach White, Rashid Zaman and Simon Brook from OPM, as well as Andy Cotton and Sam Kayaga from WEDC. Andy Peal (independent consultant) also contributed to certain aspects of the methodology.

The inputs of many other World Bank staff, consultants and data collection firms are acknowledged with thanks from the task team. They have contributed to the research, findings, analysis and reviews but are too numerous to mention.

Executive summary

Overview and key FSM service delivery challenge

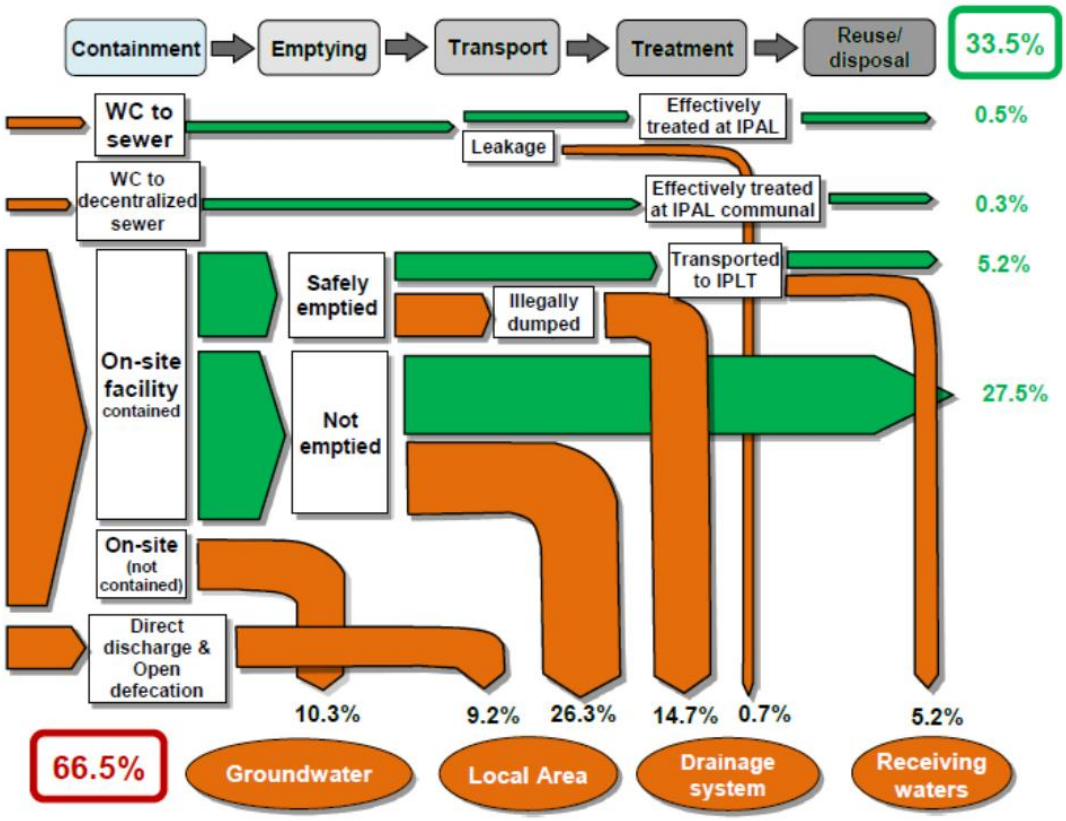
Balikpapan city, located in the province of East Kalimantan, Indonesia has a reported population of approximately 640,000 people and annual population growth of about 4.5% (approximately 1.5% due to natural growth and 3% due to immigration). According to the latest health census, 99.5% of households in Balikpapan own their own home, while only 0.5% rent their property.

A key challenge facing the development of Balikpapan's sanitation and FSM services is the lack of clarity around institutional roles and responsibilities, particularly in relation to the provision and regulation of emptying and transportation services. The DKPP (Agency of Cleanliness, Housing and Parks – the institution currently undertaking the role of managing any FSM activity in Balikpapan) manage the septage treatment plant, but play no direct role in the emptying and transportation elements of FSM services. DKPP focuses on solid waste management, constructing roads and drainage. It is unclear who, if anyone supervises and issues permits for the construction of on-site containment (tanks and pits), exacerbated by a lack of standards, guidelines and norms.

Study findings

The fecal waste flow diagram for Balikpapan shows that, while almost 90% of households have access to non-networked sanitation facilities (predominantly pour-flush latrines emptying into tanks), service arrangements for managing fecal sludge beyond these tanks are limited. Almost 60% of on-site facilities are reported to have never been emptied, limiting demand for the emptying services, provided by private providers. Where households do have fecal waste removed, it is often indiscriminately dumped, resulting in little of the fecal sludge generated being taken to the septage treatment plant.

Fecal waste flow diagram for Balikpapan city



Analysis of demand and supply for FSM services highlights that, while private providers of emptying services are available, the demand for these services is restricted. Results of a willingness to pay survey identified that the majority of households are prepared to pay for a monthly desludging service, at a price commensurate with the fees currently charged for emptying – if this is assumed to occur approximately every 5 years. The current low demand for emptying is however exacerbated by a combination of the poor quality of onsite infrastructure and the lack of regulation to enforce regular emptying. Households predominantly rely on non-compliant standards of containment facilities, where pour-flush latrines discharge to a single or double compartment "*cubluk*" (rather than a well-constructed septic tank). As its is only partially lined, the *cubluk* operates as a soak-pit. Other containment facilities have overflows that allow fecal sludge to discharge into drains or open water bodies. Both conditions significantly impact on the required demand and frequency of emptying.

The City Service Delivery Assessment of Balikpapan highlights priority areas for action to establish and implement city-wide plans to improve FSM services, together with associated budgets. It is important that private sector providers of emptying services are incentivized to both stimulate and meet demand for affordable FSM services, as well as to correctly use the disposal site in a way that is economical. This must be accompanied by attention given to improving technical standards and arrangements of on-site facilities, with consideration for a range of emptying services that can reach into poor areas and provide affordable services. Without this, demand for emptying services will continue to be constrained.

Next steps for the city

Presentation of the Fecal Waste Flow diagram to city officials in Balikpapan resulted in an immediate acceptance of the problems facing FSM services. This lead to a constructive discussion on "*How do we solve this?*" and "*Who should be responsible for doing what?*". A Sanitation Working Group has been established and a City Sanitation Strategy (CSS) developed that lays out targets and identifies required sanitation development activities. This in turn has enabled the Head of Bappeda (the City Planning Agency) and the city Mayor to identify and propose new institutional arrangements to enhance FSM services and effective treatment of septage from on-site sanitation systems at the treatment facilities. Policy, regulatory and legislative arrangements to support these changes will need to be developed. Budget allocations, poorly coordinated in the past, will need to be oriented in line with the new institutional arrangements as they are translated into law and responsibilities for asset ownership transferred.

The local House of Representatives has been formulating a sanitation law, with regulation focusing on issues of tariffs and off-site sewerage services. It has been identified that the development of a new city sanitation master plan should include regulation around non-networked services and private sector emptying, to ensure these issues are included in future legislation. While new institutional arrangements and plans for FSM services, as part of the sanitation master plan, are starting to be addressed, consideration will need to be given to the costings (investment and recovery) for a range of service levels and intervention options, to support implementation. Bappeda have indicated plans to invest in more private sector-operated desludging trucks and construction of a new septage treatment plant. Use of emptying services by households is currently constrained by cost, location and access (to the property and into the tank itself), especially for the urban poor. Those who use desludging services report being satisfied with them, but the sanitation master plan must also identify how these services will expand to meet future demand, to ensure safe transfer of fecal sludge to effectively managed treatment facilities.

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List of abbreviations

Bappeda	City Planning Agency, Balikpapan
CS	Customer satisfaction (component of the Social survey)
CSDA	City Service delivery assessment
Cubluk	Used to describe a ‘septic tank’ (effectively a leach pit)
DKPP	Agency of Cleanliness, Housing and Parks, Balikpapan
FGD	Focus group discussion
FS	Fecal sludge
FSM	Fecal sludge management
IPAL	Wastewater treatment plant
IPLT	Septage (fecal sludge) treatment plant
KII	Key informant interviews
OSS	On-site (non-networked/non-sewered) sanitation facilities
PDAM	Water Utility
ST	Septic tank
WTP	Willingess To Pay (component of the Social survey)

1 Introduction and Research Framework

1.1 About this report

This report summarises the main findings of a study on fecal sludge management in Balikpapan, Indonesia. It forms one of the city case studies within the project entitled 'Fecal Sludge Management: Diagnostics for Service Delivery in Poor Urban Areas', hereinafter "the FSM research project". This work is funded by the World Bank's Water Global Practice (formerly the Water and Sanitation Programme). There are five city case studies as part of this project (Balikpapan in Indonesia, Dhaka in Bangladesh, Hawassa in Ethiopia, Lima in Peru and Santa Cruz in Bolivia).

This project is led by Oxford Policy Management (OPM) in partnership with the Water, Engineering and Development Centre (WEDC) at Loughborough University. The full TOR for the global FSM research project can be provided on request. The overall objective of the global research is: "to work with the WSP urban sanitation team to develop the methodology, design, develop survey instruments and undertake analysis of data collected from field case studies (linked to World Bank operations projects), refine the diagnostic tools and develop decision-making tools and guidelines for the development of improved FSM services." The scope includes the need for city-wide fecal sludge (or septage) management services with a focus on poor urban communities.

This document is one of several that are part of the FSM research project, and is not intended as a stand-alone report. It is based on extracted data from several studies as part of technical assistance in Balikpapan by the World Bank, as indicated in Table 2. As such, this report does not contain much background information on Balikpapan as the assumed audiences are the World Bank project team together with others familiar with or interested in Balikpapan and its context, including the relevant municipal, regional and federal authorities. The full FSM research project Inception report, available on request, contains more background information on the global research project and the methodology, including the Research Framework.

The report's structure is detailed below. It begins with a brief introduction to the research and the city of Balikpapan, followed by sections analysing the overall urban sanitation context which are not specific to FSM. Thereafter, the report's focus is on the FSM services and market in particular.

1.2 Study rationale

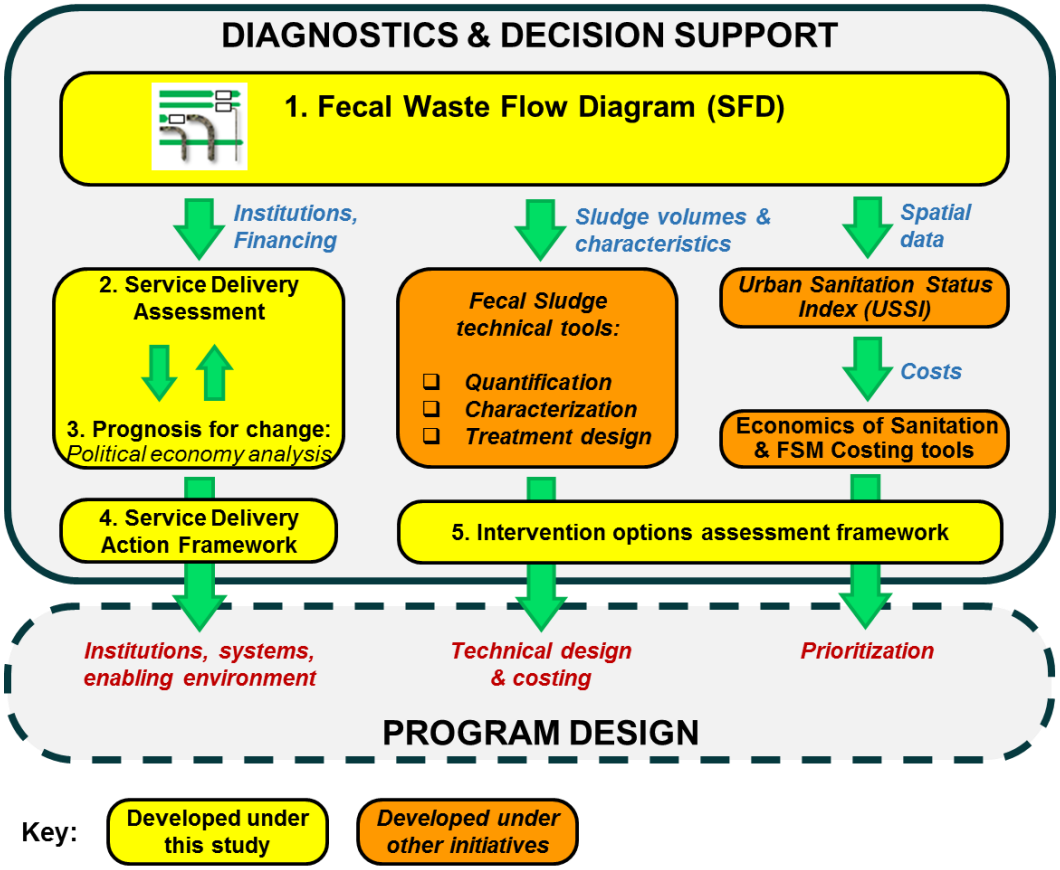
It is common for poor people living in the urban areas of most low-income countries to use on-site sanitation facilities, or to defecate in the open. Even when improved on-site options are used to contain excreta, in many cities there exist limited services for the collection, transport and disposal or treatment of the resulting fecal sludge. Few opportunities for resource recovery through end-use of fecal sludge exist. The service delivery gaps within and between the stages of the sanitation service chain become more apparent as urban sanitation access increases. Failure to ensure strong links throughout the fecal sludge management (FSM) service chain results in untreated fecal sludge (FS) contaminating the environment, with serious implications for human health.

Despite this, there are few tools and guidelines to help city planners navigate complex FSM situations, despite increasing demand. This study builds on existing frameworks and diagnostic tools, in particular the use of the City Service Delivery Assessment scorecard and Fecal Waste Flow Diagram (SFD), as indicated in Figure 1. The diagnostic and decision-support tools are themselves based on tried-and-tested strategic planning approaches and frameworks, with a focus on practicality, while the overall global research aimed to update and develop a wider range of

tools and guidelines based on the results of five case study cities. In most of the study cities, this has been supported by interaction with city stakeholders involved in ongoing World Bank lending. Acknowledging the difficulty of reforming FSM services in cities, the political economy dimensions of FSM are explicitly included as part of the overall analysis.

How the full set of diagnostic and decision-support tools and program design guidelines fit together is represented in Figure 1 that follows. It is more fully explained in accompanying study documents, available on request.

Figure 1 **Diagram of how the tools fit together**



The specific objectives of the Balikpapan city case study are:

- To provide quantitative and qualitative data on the sanitation situation in Balikpapan, from a socio-economic perspective, specifically as they relate to FSM;
- To provide initial recommendations to guide discussions around future interventions in the sanitation sector in Balikpapan, by contributing credible data and analysis; and
- To inform the development and use of the analytical tools and guidelines where applied to both current and supplementary studies, using a mix of results as sources of primary and secondary data.

The Balikpapan case study was primarily socio-economic rather than technical, although it did include a limited level of technical inspection of sub-surface infrastructure (tanks and pits) for the benefit of other World Bank operations.

1.3 Research framework

During the inception stage, the OPM/WEDC team developed a Research Framework (RF), based on the overarching research questions implicit in the TOR and draft research protocol. From these questions, a logical set of project components were developed, and data collection instruments devised that would help in the collection of data for the indicators making up each component. The approach taken in the research is to place all components – as well as ensuing results – of the study, within the context of the FSM service chain, to optimise its relevance and effectiveness. This is clear from the full version of the RF in the study Inception report, with all components and questions arranged along the service chain.

The initial structure of components from the Inception report is reflected in Table 1 below.

Table 1 FSM research project components

	Assessment	Objective		Component
1	City Service Delivery Assessment	To understand the status of service delivery building blocks, and the political economy of FSM services overall	1a	CSDA scorecard
			1b	Stakeholder analysis
2	Fecal Sludge (FS) situation assessment	To understand current FS management patterns and future scenarios	2a	Fecal Waste Flow Diagram (SFD)
			2b	FS characteristics and end-use potential
			2c	Public health risk analysis
3	Existing demand & supply assessment	To understand customer demand for FSM services and the current status of service providers	3a	Demand - mapping customer demand and preferences
			3b	Supply - mapping service provider supply and capacity
4	Intervention assessment	To identify a hierarchy of FSM intervention options and models for implementing and financing them	4a	Intervention options
			4b	Implementation and financing models
5	Appraisal	To appraise different interventions against the "business as usual" scenario	5a	Economic appraisal of intervention options

The study methodology used for the Balikpapan city study is described in the next section. It should be noted that the study methodology used for Balikpapan is different to that proposed in the Research Framework for the full FSM research project. Field studies were ongoing in Balikpapan, from which data sets were to be utilised for this research alongside commissioned consultancy-based research to identify data for aspects of this FSM study. This commissioned work was carried out prior to final agreement of all data collection instruments for the other city studies.

Primary data was *partially* collected in Balikpapan as part of this research (in relation to the demand/ supply assessment, FS characteristics and observation of service providers). As such, not all of the tools have been used to their full capacity. This report also draws on data collected by the World Bank for internal uses and synthesises the findings from several studies.

1.4 Report structure

This report is sub-divided into three groups of chapters. The initial chapters describe the city background and methodology. There is one chapter which addresses the urban sanitation context without a specific focus on FSM (accounting for all fecal waste flows in the city). The rest of the report considers FSM services and service delivery.

- Background
    - Section 2 summarises the study methodology
    - Section 3 provides background to the city
- Urban sanitation context
    - Section 4 shows a Fecal Waste Flow Diagram
- Analysis of FSM services
    - Section 5 contains the potential FSM service demand and supply assessment
    - Section 6 discusses the current characteristics and treatment of fecal sludge
    - Section 7 contains a City Service Delivery Assessment
    - Section 8 proposes next steps for Balikpapan in relation to FSM services
- Annexes
    - Annex A provides the full CSDA scoring table

2 Methodology

2.1 Overall design

The study in Balikpapan varied from the overall Research Framework identified in Section 1.3, as significant amounts of data had been collected prior to the global FSM study. The instruments used for this purpose are summarised in Table 2 below. The OPM/WEDC team did not oversee the collection of any additional primary data. In addition to the data collection outlined, the local Health Department and City Planning Agency (Bappeda) recently conducted a health 'census' which included survey questions relating to sanitation.

Table 2 Summary table of data collection instruments

	Instrument	Data source	Number conducted
Quantitative	1. Social survey (by WSP)	Willingness to Pay (WTP) for desludging services Customer satisfaction (CS) of desludging services	120 households 70 households
	2. Technical survey (by WSP)	Survey of on-site sanitation / septage management facilities	85 households (sub-sample from WTP study) *44 observations of containment facilities were made during the Technical survey*
	3. Observation of service provider practices (by consultant)	Observation of containment, collection, transport/disposal and treatment/disposal	4 observations of service providers (containment/ emptying/ transport)
	4. Testing fecal sludge characteristics (by consultant)	Samples from (i) pits/tanks during emptying, (ii) truck/vessel outflow, (iii) final drying bed or outflow	3 during emptying 2 at tanker outflow 2 at treatment outflow 1 at disposal 2 at end-use (fertilizer)
Qualitative	5. Key informant interviews (by consultant)	(a) government (e.g. council / utility, ministries) (b) service providers along the sanitation chain (c) other key FSM agencies	As required
	6. Focus group discussions	FGDs in low- and middle-income communities, as part of WTP survey	6 (3 women-only, 3 men-only)

Unlike other city studies, where the OPM/WEDC team led on methodology and analysis, for Balikpapan certain components of the study were integrated with an ongoing World Bank- WSP technical assistance project. Data collection was managed through an in-house Willingness-to-Pay and Customer Satisfaction survey (WTP/CS) plus a separate study using a contracted consultant. An intern supported the primary data collection using instruments 3, 4 and 5 in the table above.

This section briefly summarises each instrument and the following section describes the sampling approach.

Social and Technical surveys

The Willingness To Pay (WTP) survey collected data on the household's socio-economic status, attitudes to sanitation, previous experiences of pit/tank emptying, reasons for selecting service providers and willingness to pay for emptying services. The survey did not collect data on the containment facility itself.

The Customer Satisfaction (CS) survey also collected data on the household's socio-economic status, previous experiences of pit/tank emptying, reasons for selecting service providers and willingness to pay for emptying services. In addition, data was collected on the satisfaction with the emptying service.

For the technical survey, data was also collected about the household's containment facility, including design elements relevant to FSM service delivery (emptying fecal sludge from tanks/pits).

Table 3 Distribution of Willingness to Pay surveys [1]

Sub City	Administrative Villages	Number of Respondents	Income level
Balikpapan Tengah	Karang rejo	30	Low
Balikpapan kota	Klandasan Hulu	36	Low
Balikpapan Selatan	Sepinggan raya	15	Middle
	Sepinggan Selatan	36	Low
	Total	**120**	

Observation of service provider practices

An observation protocol involved making visual inspections about fecal sludge (FS) management from pits or tanks to final disposal, in particular watching service providers (SPs) go about their business. It required identification of hazards, hazardous events, and an assessment of possible risks at each stage (containment, emptying, conveyance, treatment and end-use or disposal) of the fecal sludge management chain.

Testing fecal sludge characteristics

The characteristics of fecal sludge will vary, depending on factors such as the length of time for which it has been stored, the season, and the storage conditions e.g. whether the sludge was in a lined or unlined pit. Assessment of the characteristics was required at three stages: (i) during removal, as this will influence the removal methods that could be used, (ii) prior to treatment, as this will influence how the fecal sludge can be transported and treated, and possible resource recovery options pre-treatment, and (iii) after treatment, as this will determine the resource value of the end product derived from the treated fecal sludge.

Key informant interviews (KIIs)

Key informant interviews (KIIs) are the way in which primary information was sought to address key questions about how both the 'enabling environment' and the operating environment affects FSM services (past, current and future). KIIs were held with stakeholders having responsibility or

[1] Due to the multiple levels of purposive sampling and the various conditions applied in selection of the households, it is not possible to say that the results are representative of Balikpapan city, or any of the sub-city locations. The Social survey report does not identify that the data is representative of Balikpapan, but rather refers to results as being in relation to the percentage of respondents.

interest in FSM services at city-level, allowing the enabling and operating environments to be better understood in relation to their influence within the city. Informants interviewed included Chairmen of city neighbourhoods, staff of local government departments (including Urban Planning and Settlement, Public Works), the Municipal Water Company and other agencies such as the Department of Revenue (in charge of land and building tax) and the State Electricity Company.

Focus Group Discussion (FGDs)

FGD participants were recruited by the research team, along with the head of the neighbourhood, based on certain characteristics. These included; having their own toilet, being from low- or middle-income socio-economic status and willing to participate. In FGDs with three groups of women, transect walks were added, in which the FGD participants were invited to see the condition of water and sanitation in the settlement community by observing and asking about issues related to sanitation.

2.2 Sampling

2.2.1 Sub-samples and sampling units

All three surveys (WTP and CS for the Social Surveys and the Technical Survey) draw from the same sample frame. Areas for the surveys were purposively selected in collaboration with local government: the City Planning Bureau (Bappeda), the Department of Hygiene, the Agency of Cleanliness, Housing and Parks (DKPP) and the Civil Order, Politics and National Unity Services. Three sub-districts were selected as the focus of the study: Tengah, Kota and Selatan.

Within each sub-district four *Kelurahan* (Administrative Villages) were then also purposively selected. This selection was based on: wealth status (low and middle-income); population density (high); location (coastal and inland); and areas without any sanitation programmes. Within each *Kelurahan* a list of households who were beneficiaries of the subsidised rice scheme (Raskin) was provided by the head of the neighbourhood. From this list households were randomly selected for interview for the WTP survey. For the CS survey, neighbourhood heads identified suitable households, i.e. those that had emptied their pits in the last three years. Households that had been interviewed for any sanitation-related survey in the last 6 months were excluded.

From the households selected for interview in the WTP and CS surveys, a sub-set were also selected to be included in the Technical survey. An additional 11 households who receive Raskin were also selected randomly from other sub-districts.

Because of the multiple selection criteria used, the surveys cannot be said to be random household surveys, or representative of Balikpapan as a whole. Where possible in the report, data from the WTP and CS surveys are presented alongside data from a recent city-wide Health Census, to allow for a comparison.

2.2.2 Sampling in the other instruments

Testing FS characteristics

Grab samples of FS were taken from a range of sample locations across the city and across the sanitation chain. All samples were collected between 12pm and 5pm on the same day. The samples were then flown to a laboratory in Jakarta and as such were tested the following day.

Samples of initial FS were taken from three sites in Balikpapan: one sample from a factory septic tank and two samples from households. Samples were also taken from stages of the fecal sludge treatment plant (IPLT), two manure fertiliser sites and from an emptying company dumping site. Details of the samples are shown in Table 4.

Table 4 Sampling sites for FS characteristics data

Name given	Description of sample location	Helminth egg count	Other tests
Household 1	Factory Tank (4 access holes)	X	X
Household 2	Household: Bayu office. 1 household member, full, emptied in 2002.	X	X
Household 3	Household: good access taken from technical survey	-	X
IPLT liquid outflow #1	Septage works (IPLT) liquid effluent in discharge chamber	-	X
IPLT liquid outflow #2	Septage works (IPLT) liquid effluent in discharge chamber	-	X
IPLT Tank 3	Septage works (IPLT) Tank 3 contents	X	X
IPLT Tank 4	Septage works (IPLT) Tank 4 contents	X	-
IPLT dumped sludge	Septage works (IPLT) dried dumped sludge	X	X
Manure Fertiliser #1	End product of organic fertiliser	X	X
Manure Fertiliser #2	Manure used to produce organic fertiliser	X	X
	Total number of samples	**7 samples (Duplicated)**	**9 samples (Duplicated)**

Source: Kennedy-Walker, 2014

Key informant interviews (KIIs) and Focus Group Discussion (FGDs)

The total number of interviews required, as well as the range and extent of questioning, was influenced by the availability of current and reliable data from other sources, as well as constraints on time and resources. Selection of interviewees was purposive, based on advice received from stakeholders and existing knowledge of the World Bank consultant.

Six FGDs were conducted either with a group of men and women, from poor households and middle economic status. FGD participants involved members of the community who are in the Willingness To Pay survey area for regular desludging services, but different households to survey respondents were recruited, to gain a different insight.

3 Background to Balikpapan city

3.1 Balikpapan overview

Balikpapan city is located in the province of East Kalimantan. The city is the gateway to East Kalimantan and has ports for activities related to petroleum. The latest population data (2012) reports 637,448 people living in Balikpapan (Population and Civil Registration District Municipality). Balikpapan is the second largest city in East Kalimantan after Samarinda. Population growth is 4.5%; 1.5% due to natural growth and 3% from immigration. Table 5 shows the population levels of the 6 sub-cities.

Table 5 Population figures for Balikpapan

	2013	
	Population	**Households**
Balikpapan City	**664,595**	**132,919**
West Balikpapan	99,862	19,972
South Balikpapan	133,989	26,798
North Balikpapan	144,305	28,861
Central Balikpapan	115,235	23,047
Balikpapan Kota	96,250	19,250
East Balikpapan	74,954	14,991

Data based on projection by the Civil and Population Dinas Office (Disduk) of Balikpapan City Planning Department (BAPPEDA)

The city is roughly 50,000 hectares (~500 Km^2), with the majority of areas below 100 metres above sea level. The topography of the city is reported to be 85% hilly and 15% flat. Geologically, the soil is mainly yellow-red podsols and silica sand, which is extremely prone to erosion and landslides. Weathered rock material, usually hard and eroded, can be found in the area.

The average year-round temperature is about 27°C and annual rainfall approximately 2,800 mm which occurs steadily throughout the year.

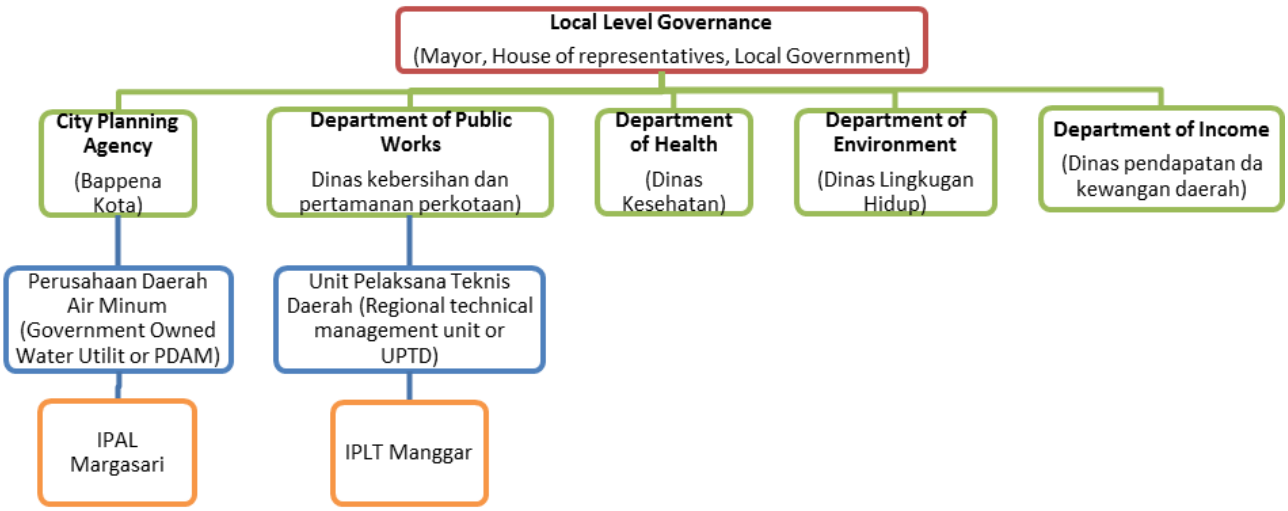
According to the Department of Health's Balikpapan Health Census, or *Survei Jaga Kelurahan*, 2014, 99.5% of households in Balikpapan own their own home, while only 0.5% rent.

3.2 Balikpapan's sanitation context

The local government has established an active Sanitation Working Group and developed a City Sanitation Strategy which lays out the targets and required sanitation development activities in an action plan for 2011-2016.

Within Balikpapan, there are a range of organisations involved in santiation. These are shown in the following Figure 2.

Figure 2 Institutional arrangement for sewerage and septage management, Balikpapan



The IPLT (septage treatment plant) falls under the DKPP (Agency of Cleanliness, Housing and Park) with the UPTD (Unit Pelaksana Teknis Daerah), acting as the technical implementing unit. UPTD does not manage the septage treatment plant well, focussing more of their capacity on solid waste management activities. There is also little interaction between those responsible for septage management (the DKPP and/or UPTD) and the Water Utility (PDAM) who is responsible for managing the wastewater treatment plant (IPAL).

The ocal government City Planning Agency (Bappeda) has identified that a new Technical Unit will be created to manage fecal waste only, taking the responsibility away from the current responsible agencies into one combined unit. Reasons for the development of this new Technical Unit have been noted as:

- to improve efficiency in the management of the whole fecal sludge sector, through one unit;
- to make it easier to manage the planning, budgeting and implementation of projects related to fecal sludge; and
- to allow for cross-subsidy of service provision between rich and poor households.

For the purposes of this study, the focus is primarily the management of fecal sludge from household latrines (the containment stage) through to its end-use/disposal. The study does not focus on the structural conditions of the latrine itself, so much as the extent to which it contains / does not contain fecal sludge and what happens to the fecal sludge from this stage onwards. For this reason, later sections of this report refer to different categories for household sanitation facilities and assesses fecal sludge management in relation to the service chain indicated in Figure 3 below.

Figure 3 The sanitation service chain

3.3 Balikpapan's FSM context

Later sections of this report will identify the scale of FSM services and its implications, based on qualitative and quantitative data collected during the study. Table 6 that follows identifies the key stakeholders involved in FSM services in Balikpapan, together with their interests in providing services, based on key informant interviews and field experience.

Table 6 Key FSM stakeholders

Stakeholder categories	Relevant stakeholders	Interest
Local level government	Mayor	Vice Chairman of APOKKSI (Association of Cities Who Careabout Sanitation), and as such perceived to be committed to issues around sanitation
	Local House of Representatives	Currently formulating a sanitation law (Perda Sanitasi) focusing on tariffs and off-site sewerage services
	City Planning Agency (Bappeda)	Bappeda is responsible for coordination of all work, including waste water and budgeting. They also chair the water and sanitation working group (Pojka AMPL)
	Dept. of Health (Dinas Kesehatan)	Conducts annual water quality testing in each Kelurahan (administrative unit of health ministry at local level) of piped water supply, hand dug wells etc. The number of tests depends on the annual budget
	Dept. of Environment	Currently only focuses on enforcing environmental standards for real estate housings
	Perusahaan Daerah Air Minum (PDAM) - Water Company	Regional state-owned provider of water. Operates IPAL (WWTP) through a sub-unit. Is the regional state owned water provider.
	Agency of Cleanliness, Housing and Park (DKPP)	Responsible for operating the IPLT (seepage treatment plant). Also manage the Unit Pelaksana Teknis Daerah (UPTD); a technical implementing unit responsible for solid waste.
Civil society	Consumer groups and advocacy NGOs	1-2 local NGOs. Opposed to increased costs to the public and also see the State as having responsibility to provide services.
Private sector	Septic tank contractors and emptiers	Private operator has invested in new trucks, reflecting confidence that their business will continues. View that council would support policies that would support private operators business. There are five private operators at the moment. One has recently been elected on to the city council

4 Fecal Waste Flow Diagrams

4.1 Introduction

Fecal Waste Flow Diagrams (also known as SFDs) in their current form arise from WSP's 12-city study of FSM (Peal et al., 2013). In short, an SFD is a visualisation of how FS flows along the sanitation service chain. At each stage of the chain, the proportion is indicated which is or is not effectively managed to the next stage of the chain. At the end of the chain, the proportion of FS which is effectively managed is indicated as "safe", with the remaining proportion deemed "unsafe", and the primary destination of that FS indicated (e.g. groundwater, local environment, drains etc.)[2]

Thus far, SFDs in different cities have been undertaken using different methodologies, as is often necessary in the context of poor data availability. Furthermore, most SFDs so far (including those in the 12-city study) were undertaken using secondary data and expert estimates. This study is the first to use primary household survey data and field-based observations to construct SFDs. A group of urban sanitation experts is currently discussing the 'roll-out' of the use of SFDs, for which other methodologies will be developed.[3]

4.2 Methodology

For this analysis, several key indicators from the Technical survey can be used for assessing the containment facility used and household blackwater disposal. Particular data from the survey questions can be used to identify information relating to:[4]

i) Toilet type: response options are Pour flush / Cistern flush / Other

ii) Where black water is discharged to: response options are Underground tank, Storm water drain, Stream/canal/river, Pond, City sewerage/communal system, Unknown

iii) If there is an underground tank, where the tank discharges to: response options are Pipe to soil/ soak pit/leach field, Pipe to city sewerage/ communal system, To drain/ stream/river, No outlet pipe, Other, Unknown

iv) How often the tank has been emptied in the last 5 years

v) When the tank was last emptied

vi) Why the tank was emptied

vii) Who emptied the tank

The Health Census also collected comparable data, on all but item iii).

Of these, question ii) is the most crucial for the construction of the SFD. It should be noted that the household's response is taken as given in the case of the health census. In the case of the Technical survey, observations were made on the above ground infrastructure and measurements taken of below ground infrastructure (dimensions and depth) from the surface.

[2] It is acknowledged that FS may pass from drains into other water bodies, e.g. rivers, but the diagram focuses on the *primary* destination.
[3] See website for the SFD promotion initiative: http://sfd.susana.org/
[4] Taken from the On-site sanitation survey and Customer Satisfaction survey

To analyse this data, an SFD matrix is created, as shown in **¡Error! No se encuentra el origen de la referencia.** below. It shows which data sources are used and how they are analysed into levels of effective / ineffective management of fecal waste through the stages of the service chain – with results in the next section.

First, the Technical survey data on types of infrastructure is used to allocate households to five categories shown in the column marked (1) in Table 9 that follows below:

A. **"Sewered - centralised system"** – toilets connected to sewers (not on-site sanitation)
B. **"De-centralised communal system"** – Networked sewerage not connected to the main network (i.e. not on-site sanitation or centralised sewerage).
C. **"On-site storage – contained and emptied"** – on-site toilets (either pits or tanks) which can be emptied
D. **"On-site storage – not emptied"** – on-site toilets where pits or tanks are sealed and/or abandoned once they have filled up
E. **"Open defecation and direct discharge"** – self-explanatory

The data from questions (A) to (E) are allocated in column (2) below (a key shows the meaning of the colour-coding of cells by data source). Next, the proportions for each of the stages of the chain are allocated. As can be seen from the 'collected' column, a certain proportion of the population's FS which makes it to that stage is emptied by a service provider, and the rest is not emptied (e.g. overflows to drains). This is estimated by dividing the number of households which reported having had their pit emptied (question (iv) and (v) above), by the number of households using emptiable technologies as self-reported.

Since data comes from a range of surveys, proportions in the matrix are proportions of households, not proportions of people or of FS volumes. In Balikpapan, the mean household size was 4.8.[5]

4.2.1 Sewered households

Details for this section were established from the water utilities records of customer connection, Euroconsult report and from key informant interviews held at the Wastewater Treatment Plant at Margasari.

The in-depth analysis done by Euroconsult (2014) on the sewerage system at Margasari did not define the type of containment facilities that are used by households with access to the sewerage system. However, it can be assumed from observations made throughout Balikpapan that pour flush toilets would be used in the majority of households. 99% of respondents stated they had their own private toilets.

The existing sewerage network and wastewater treatment plant (known locally as *Instalasi Pengolahan Air Limbah,* IPAL) was built in the year 2000. The wastewater treatment plant currently serves two of Balkipapan's 34 villages (Kelurahan Margasari and Kelurahan Baru).

Records held at the IPAL at Margasari indicate that 1,308 households are connected to the treatment facility by a conventional sewerage system. Based on 5 people per household, it is estimated that 6,780 people are served by the sewerage system – or only 1% of the total population of Balikpapan. As the majority of the population in Balikpapan use pour flush toilets

[5] The SFD involves assumptions that (i) each person produces the same amount of FS and (ii) pit accumulation rates are constant across the city. This is an approximation but the most pragmatic approach in the context of uncertainty around FS volumes. FS volume only really becomes an issue when considering the extent of change in service levels needed to deal with the amounts. This study is primarily about identifying the broader picture of *where* the management of FS is or isn't effective, not what volumes are being managed or mismanaged.

(WSP technical survey indicated 97.6% of respondents use a pour flush toilet), an assumed value of 60 l/capita/day is used on which to make an assumption about the flows entering the sewerage system in Balikpapan.

Once the sewage reaches the IPAL the effluent from the sedimentation tanks pass through a series of chamber for dewatering. The sludge produced from the IPAL is then dried and is utilised for internal gardening and for landscaping at some PDAM offices (There is approximately 4-5m^3 of sludge removed per month which is mixed with rice husk (using 25 bags of 50kg at Rp4000/bag per month). This is dried onsite for about 2 weeks. The liquid effluent is used for gardening, cleaning and collected for the fire department.

4.2.2 On-site, non-networked facilities

Data in this section was gathered from interviews with the private emptying companies which currently provide tank emptying in Balikpapan, interviews with informants from the DKPP who are currently operating the IPLT, the Technical survey and from results of the Euroconsult household survey.

Containment

The Technical survey results show that the majority of fecal sludge is discharged to an underground tank. 98% of adults report using their own toilet, while 2% use a facility shared with neighbours. For children the results indicated that 65% of children use their own toilet, 5% use a shared toilet, 3% openly defecate and 27% of respondents dispose of their children's fecal waste into a plastic bag which goes into the trash.

The Technical survey undertaken in Balikpapan showed that the location of the tank varies; 36% being located under the floor in the house, 2.6% under the floor but visible, 41% located at the back of the house, 9% at the front of the house, 10.3% at the side of the house and 13% did not know. Overall, 16.7% of tanks had good access available to them, 32.1% had no access but the tank was visible and 48.7% had no access and were under tiles. The survey results showed that 27.9% of household's surveyed were over 70m from an access road. Also, the majority of tanks were shown to be over 10 years old (57.7%).

The Technical survey found that most on-site sanitation systems are emptied infrequently. It is difficult to indicate the frequency of emptying because the number of respondents who had actually emptied (n=4) was so low. However, it does raise the question of whether the tanks used are actually containing the fecal sludge in a sealed tank. The Technical survey results, for which 49% of respondents are using an onsite facility which has an unsealed base, may provide an indication as to why the tanks do not need emptying as fecal sludge is then percolating through the bottom of the tank. Another reason why tanks do not require emptying may be their size, as the Technical survey showed the average volume of the tanks measured was over 4m^3. Further analysis of filling rates (depending on the local context) would be required to confirm whether these are valid reasons why the demand for desludging is so low in Balikpapan.

A similar figure was found by the Euroconsult survey which indicated only 9% of respondents (88 people) with underground tanks had ever undertaken tank emptying. The frequency of emptying was shown to vary, but the mode was every 10 years and the average approximately every 6.4 years. A recent study focusing on the assessment of sludge accumulation and pit filling rates in Indonesia (Mills, et al, 2014) indicated the contributing factors for the low frequency of accumulation in Indonesia are;

- High year-round ambient temperatures,

- No solid waste content in tanks,
- Type of tank used (bottomless) and the contents of the tank being low strength (high water content) causes the majority of contents to easily infiltrate into the ground,
- Tanks containing outlet pipes which discharge contents out of the tank and reduce accumulation rates,
- Low numbers of users,
- Limited understanding of household for the need to regularly desludge.

Emptying/ transport

There are currently three private tank emptying companies working in Balikpapan. Previously, the local government ran their own vacuum tanker but this broke down 2 years ago and has not been replaced. Only vacuum tankers are used for the emptying and transportation of fecal sludge in Balikpapan and no manual emptying or other methods were observed. Most of the trucks are Mitsubishi trucks and consist of a steel tank, vacuum pump, hose (70-80m length) and bucket.

During interviews with the owners of the emptying companies in Balikpapan information was collected on the standard operating procedures. The standard operating procedures for tank emptying is observed to be non-written, verbal and ad-hoc. Only one of the three emptying companies (Bunga Lemo) was shown to keep records of their customer base and operations.

Treatment

Only two of the private sector tank emptying companies transport the septage collected to the designated IPLT at Manggar. The largest private sector emptying company, Bangu Lemo, transports and dumps the septage indiscriminately on their own land located close to the site of the IPLT. A recent technical review of the IPLT showed there to be a number of fundamental problems with the design and functionality of the IPLT and indicated the facility is impossible to operate efficiently so therefore recommends that a new facility should be built (ensuring properly considered design).

End-use/disposal

Currently none of the solid effluent from the IPLT is reused. Disposal of dried septage sludge occurs adjacent to the IPLT bed structure. The sludge is removed periodically (every 6 months, but there are no records of this operation and the growth of vegetation on the drying beds suggests that it is done infrequently. The liquid effluent from the tanks outflows to the IPAL downstream of the landfill.

4.3 Results

4.3.1 Survey results as an input to the SFD

Due to the structure of the survey questions it is not possible to map the survey responses to JMP questionnaires. However, the surveys do tell us the sanitation situation in Balikpapan is relatively uniform. As per the Technical survey, 99% of respondents have their own private latrine; 92% are squat toilets (99% in the health census); 98% are flush latrines; 92% of these empty to a septic tank or pit (97.7% in the health census).

Arguably the most important question in our survey is where the contents of toilets go after flushing or similar. The standard question in the Demographic and Health Surveys (DHS) incorporate this into the overall sanitation question (see WHO/UNICEF core questions), but it needs to be asked separately in order to get better quality data.[6] We rely on household-reported data for this indicator, while noting that households may not always know the full detail.

The Technical survey identified that 97.6% of the 85 latrines examined were pour-flush latrines discharging to a septic tank, pit or to an open water body. 1.2%, or 1 household system, was found to discharge to a sewer. The Health Census report similarly identified that 97.7% of households use septic tanks for onsite containment, 1.9% of households are connected to the sewer network and the remaining 0.4% use other means of disposal. Table 7 presents the two sets of survey data.

Table 7 Management of blackwater – where toilets discharge to

	Technical Survey		Health Census	
	No. of households	%	No. of households	%
Septic tank or pit latrine	78	91.8%	76,772	97.7%
Canal or river	2	2.4%	-	-
Sewerage network	1	1.2%	1,549	1.9%
Sea	3	3.5%	-	-
Other	-	-	288	0.4%
Do not know	1	1.2%	-	-
Total	**85**	**100.0%**	**78,321**	**100%**

Source: World Bank Technical survey and Department of Health Census

60% of households in the Technical survey reported constructing their containment facility outside of the house itself, with 38% reporting constructing the facility within the household. The Health Census data reported that 99.5% of respondents have the tank located 'in the yard', which may equate to both categories of response in the Technical survey.

The Technical survey identified that 88.5% of respondents reported making use of a single tank as their containment facility, with 70% reporting the tank as having two or more compartments. Similarly, the Health Census reported over 67% of tanks having two or more compartments.

The Health Census also reported just over 2% of housholds having their containment facility located in a flood-prone region. In the Technical survey just under 6% of respondents reported that they were flooded at least once per year (the remaining 94% reported never being flooded).

Table 8 Proportion of pits/tanks which have ever been emptied

	Technical Survey		Health Census	
	No. of households	%	No. of households	%
Never	14	77.8%	45,489	59.3%
At least once	4	22.2%	31,283	40.8%
Total	**18**	**100%**	**76,772**	**100%**

[6] As stated above, the question asked in the Technical Survey sought to answer the questions "Where is blackwater discharged to?" and "Where is the discharge from the underground tank?".

Taking the Health Census results, approximately 41% of households have emptied their containment facility. The Technical survey puts this figure at a much lower value of 22.2%. Both results highlight that FSM emptying services have not been engaged by the majority of the surveyed population.

The following table show details of the values used to generate a fecal waste flow matrix for Balikpapan based primarly on the Technical survey results. Further consultation between staff of the World Bank and consultants knowledgeable about the city, values were refined and adjusted to better suit the realities and experiences known to the staff. This also includes assumptions made about the safety of discharges of FS and effluent into the various geographical domains – particularly in relation to the groundwater.

Table 9 Fecal Waste Flow Matrix: based on Technical Survey data and further details

Type of system	% of FW	Contained[4]		Collected[5]		Delivered		Treated		Total Safe
		not safely	*safely*	*not safely*	*safely*	*not safely*	*safely*	*not safely*	*safely*	**33.5%**
Centralised sewer system[1]	1.2%	0.0%	100.0%	0.0%	100.0%	60.0%	40.0%	0.0%	100.0%	
		0.0%	1.2%	0.0%	1.2%	0.7%	0.5%	0.0%	0.5%	**0.5%**
Decentralised communal system[2]	0.3%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	
		0.0%	0.3%	0.0%	0.3%	0.0%	0.3%	0.0%	0.3%	**0.3%**
On-site: contained & emptied[3]	25.2%	0.0%	100.0%	0.0%	100.0%	58.0%	42.0%	50.0%	50.0%	
		0.0%	25.2%	0.0%	25.2%	14.7%	10.5%	5.2%	5.2%	**5.2%**
On-site: not emptied	64.1%	16.0%	84.0%	49.0%	51.0%					
		10.0%	54.0%	26.3%	27.5%					**27.5%**
Open defecation & direct discharge[6]	9.2%	-	-	100.0%	0.0%					
		-	-	9.2%	0.0%					**0.0%**
Total Unsafe	**66.5%**	**10.3%**		**35.5%**		**15.4%**		**5.2%**		
Affected zones		*Groundwater*		*Local Area*		*Drainage System*		*Receiving water*		

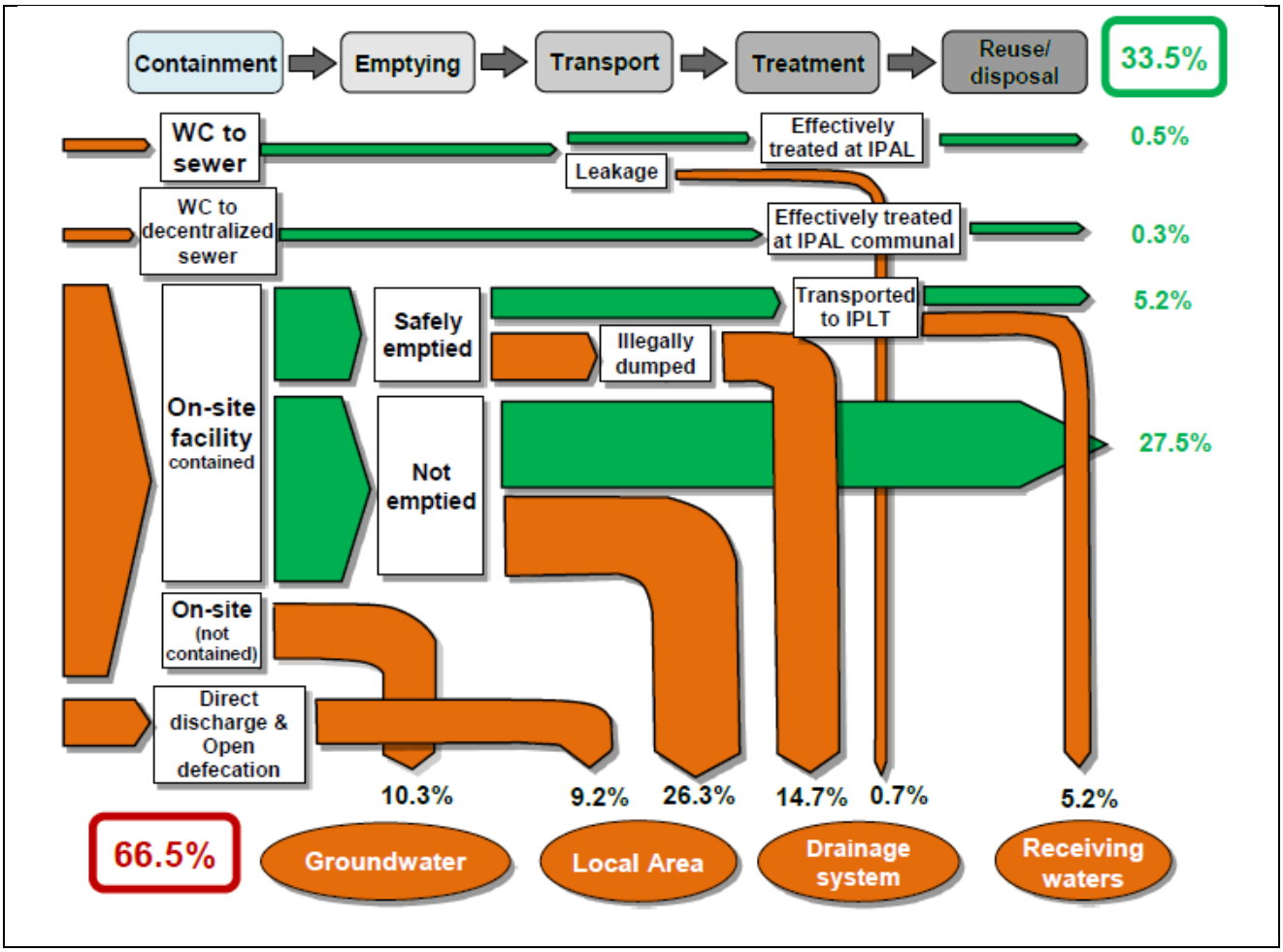
Notes:

1. Leakage based on expected IPAL inflow (300L/hh/dx1374hh) vs measured inflow 161m^3/d (only one flow measurement). Treatment performance from effluent target compliance. (Euroconsult Mott MacDonald Balikpapan Sanitation Sector Project Feasibility Study 2014)
2. Estimate from 12 Decentralized treatment systems, assume 25hh connections. Assume good performance.
3. Contained (see below) and previously emptied (WSP study). Delivery to IPLT based on WSP private sector survey 2.5/6 trucks. Treatment based on WSP IPLT assessment of treatment performance.
4. On-site sanitation systems classified as non-contained when groundwater <5m depth & distance to well <10m. Households missing groundwater data were found to not use well water and assumed contained. Households missing distance to well and not using well water were assumed contained. Use of groundwater is otherwise not considered.
5. On-site systems classified as not safely collected are system with overflow to drain/river (this has the same effect as direct discharge, see 6). Un-emptied and contained systems without an overflow are considered safely stored.
6. Direct discharge when no on-site system, ie. helicopter toilet or pipe from WC to drain/river

4.4 Presentation of SFD

Using all these results, we are able to construct a fecal waste flow diagram (SFD) for Balikpapan city. This is presented as Figure 4 below. SFDs work on the same principle as the matrix shown above. Household's toilet technology and associated containment method is shown on the left, with intermediate steps and primary destination of the FS shown along the sanitation service chain. What is clear from this SFD is that the proportion of waste entering the environment due to poor containment is far less than that entering the environment through other parts of the chain.

Figure 4 Fecal waste flow diagram for Balikpapan city



4.5 Implications of the SFD for FSM in Balikpapan

As visualised in the SFD, roughly 19% of the fecal waste that is not safely managed is due to poor, or a lack of, onsite containment. The remaining 47% of the fecal waste that is unsafely managed is due to what happens after containment.

While almost 90% of households have access to non-networked sanitation facilities (predominantly pour-flush latrines emptying to tanks), service arrangements for managing fecal sludge beyond these tanks are limited. Almost 60% of on-site facilities are reported to have never been emptied, limiting demand for the emptying services, provided by private providers. Where households do have fecal waste removed, it is often indiscriminately dumped, resulting in very little of the fecal sludge generated actually being taken to the septage treatment plant.

On a more positive note, the SFD clearly shows that the FSM services in the city are functional to some extent through all stages of the service chain, in the sense that over 10% of fecal waste reaches treatment centres via FSM services and that some of that waste of safely managed. Similarly some of the fecal waste entering the conventional sewer system and the decentralised networks are safely treated.

5 FSM service potential demand and supply assessment

5.1 Introduction

This chapter provides a brief assessment of demand and supply for FSM services in Balikpapan. At this stage, it is important to note the difference between potential (or notional) demand and effective demand. We consider the *potential* demand for FSM services to be the type and quantity of services which would be demanded in the absence of any market failures or distortions. This is different from *effective* demand, which is the type and quantity of services actually purchased in the context of current supply and current prices. As only approximately 2% of the respondents in the Health Census and Technical Survey have a sewer connection and there is very little open defecation, the *potential* demand for FSM services would appear to be signficiant. This is partially reflected in the already functioning FSM services in the city.

On the supply side, we consider what types of FSM services the market is currently providing to households.[7] Dimensions of supply include the number of service providers of different types (manual, mechanical etc.), the geographical areas they serve and the prices they charge.

5.2 Household demand for FSM services

The research framework (Section 1.3) set out to answer the following question: *"What is the existing customer demand and preferences for FSM services?"*, i.e. the current effective demand.

Results are presented below in relation to four key area affecting demand: tenancy status, accessibility of facilities for emptying equipment, age of the containment facility and willingness to pay for emptying services. The full report (Kennedy-Walker, 2014) contains further results taken from the Technical survey and results from a Euroconsult Study.

5.2.1 Tenancy status

The incentives that drive demand for improved FSM services are influenced by who is responsible for the ongoing maintenance to keep toilets functioning. Overwhelmingly the respondents of both surveys report that they either own their home or it is owned by a family member; 86% in the Technical survey and 99.5% in the Health Census. This makes the households themselves as an extremely important stakeholder, being responsible for the emptying of their own facility. This is more so than in other cities where landlords or the government themselves own or manage a much larger proportion of properties.

Table 10 Tenancy status

	Technical survey		Health census	
	No. of households	**%**	**No. of households**	**%**
Owned	73	84.9%	78,139	99.38%
Owned by family member	1	1.2%	125	0.16%
Rented	12	14.0%	364	0.46%
Total	**86**	**100%**	**78,628**	**100%**

[7] FSM services are obviously also demanded by the government, businesses etc. but households are the focus of this study.

5.2.2 Accessibility of the containment facility

Focusing on the containment facility itself, Table 11 below shows the accessibility of the main pit/tank structure based on findings from the Technical survey. This reports that nearly 50% of respondents do not have a tank with an access point and that the tank is under the floor; presenting considerable difficulty with regards to emptying. A further 32% of respondents report that there is no access point but that the tank itself is visible. Only 16.7% of respondents observed have a tank access suitable for easy emptying.

The enumerators of the Technical survey were required to make a judgement on whether an emptying point could be created. For over 82% of the sample the enumerators judged that an entry point to the tanks could not be created. In the Willingness to Pay and Customer satisfaction surveys the respondents who had emptied there pit (n=78) were asked about access; 46% reported that access had to be made by breaking through the floor or concrete. This suggests that in addition to any amount paid for emptying services there are additional costs associated with repairing parts of the house and pit/tank. Despite this 96.9% of respondents were satisfied with the access to their tank (see Table 14 below)

Table 11 Accessibility of toilet for emptying equipment

	Technical survey	
	No. of households	**%**
Visible manhole	7	9.0
Manhole filled with cement	2	2.6
Closed PVC	4	5.1
No access but the tank is visible	25	32.1
No access and tank is under the floor	38	48.7
Other	2	2.6
Total	**78**	**100.0**

The Health Census and the Technical survey do not have comparable results for this aspects, as the Health Census asked a simple yes/no question on access via manhole – resulting in 80.4% of respondents reporting that their tank had manhole access. Though the Health Census has a considerably larger sample size, the degree to which the observed Technical survey data disagree with the self-reported Health Census data is beyond that observed around other questions. In this case more credence should be given to the Technical survey data as the observational data was collected by trained enumerators and is considered as more reliable. Due to the Technical Survey's purposive sampling methodology however, the results cannot be said to be representative of Balikpapan as a whole.

5.2.2.1 Fill rate

Data on the type of containment was already shown in Table 7**¡Error! No se encuentra el origen de la referencia.** above. Neither survey has detailed information on the average time taken for tanks to fill. However, in both surveys a large majority stated that they had never emptied their tank; 77.8% in the Technical Survey and 59.3% in the Health Census. Table 12 below shows the ages of the tanks as reported in the Technical Survey. 42.3% of tanks are less than 10 years old. Of the respondents of the Willingness to Pay Survey and the Customer Satisfaction survey 62.8% of respondents that report having emptied their tank in the last 5 years have a tank aged over 10

years. 58.3% of the respondents who reported never to have emptied their tank have a septic tank aged 10 years or less. This suggests then that current demand for FSM services is a poor guide to what future demand may, be even if household access to sanitation and the containment facilities used for blackwater does not change.

Table 12 Age of tanks

	Technical survey	
	No. of households	**%**
< 3 years	16	20.5%
3 - 5 years	10	12.8%
5 - 10 years	7	9.0%
> 10 years	45	57.7%
Total	**78**	**100.0%**

5.2.2.2 Financial aspects

The Willingness to Pay survey asked respondents directly the amount they would consider paying for a monthly emptying service. The results are presented Table 13 below, the figures are presented as an annual cost of subscription as opposed to a monthly cost. The exchange rate taken is the 2014 period average as the original survey was conducted in early 2014.

Table 13 Willingness to pay for a regular emptying service (annual price)

Willingness to Pay Survey (n=190)	
Annual cost	**%**
6,000 Rs (0.5 USD)	1.3%
12,000 Rs (1.0 USD)	1.3%
24,000 Rs (2.0 USD)	1.3%
36,000 Rs (3.0 USD)	4.4%
48,000 Rs (4.0 USD)	5.0%
60,000 Rs (5.1 USD)	24.4%
84,000 Rs (7.1 USD)	1.3%
108,000 Rs (9.1 USD)	3.1%
120,000 Rs (10.1 USD)	39.4%
132,000 Rs (11.1 USD)	0.6%
180,000 Rs (15.2 USD)	4.4%
240,000 Rs (20.3 USD)	13.1%
300,000 Rs (25.3 USD)	0.6%
Total	**100%**

1 USD = 11,865.2 Indonesian Rupiah

81% of respondents expressed an interest in having a regular desludging service. 37.7% of respondents were willing to pay up to 5.1 USD annually for this and a further 44.4% of respondents were willing to pay between 5.2 – 11.1 USD for the service, with the remaining 18.1% willing to pay over that amount.

Four (4) respondents in the Technical Survey reported paying an average of 287,500 Rs (24 USD) (range: 150,000–450,000 Rs) for emptying services. For current service levels and assuming tanks

would have to be emptied every 5 years, respondents are expressing a willingness to pay at a rate suited to the current service level. However, given the relatively small number of respondents to this question, it is not possible to draw any conclusions for Balikpapan as a whole.

During the FGDs with the communities, the majority of participants queried the monthly payment method for regular desludging. It was also highlighted that those who had had their tank emptied before felt that regular emptying every 4 years was acceptable, however those who hadn't felt that this time period was too short, as the tank would not be full in that time. The following issues were raised:

- If people do not pay all their instalments (over 4 years) how will they be punished?
- Is it possible for the service providers to implement the program where they live? (e.g. respondents in narrow streets)
- Who is responsible for the programme? If there is a problem with the programme who do they contact? It should be clear.
- For those renting- if they are involved in the scheme and pay on a monthly basis but they then move before the emptying how does that work?
- Female participants from the middle income community raised concerns about if the programme didn't sustain and they have paid monthly instalments.
- If instalments were utilised then there were three alternative payment mechanism preferred; PDAM billing, PLN and head of RT. However, each payment must be transparent and evidence of payment must be provided.

Respondents from the middle-income community were shown to be less interested in the monthly payment scheme, as they perceived that they could afford to pay for the service in one lump sum rather than in monthly instalments. These respondents also highlighted that each tank should be assessed for its feasibility for regular desludging. Those tanks that are not up to standard should then be repaired prior to regular desludging being conducted. These findings highlight issues which may affect peoples' willingness to accept/pay for regular emptying services.

Community leaders indicated that they thought regular emptying was an interesting idea which could bring benefits to health and the environment in the community. It was highlighted that before such a scheme could be implemented socialisation within the community about the idea would be needed. This would be needed to highlight to the community why regular emptying was needed, the benefit of the service and how it would be managed. The community leaders highlighted that there would need to be agreement from the community as it involves monthly payments from them.

5.2.3 Household satisfaction with current services

Households were asked to express their satisfaction with current services – both the sanitation facility itself and the emptying services used – across a range of factors, as shown in the tables following. Overall, as shown in Table 14, the respondents of the WTP and CS surveys who have had their tanks emptied showed a high degree of satisfaction with the services provided.

Table 14 Satisfaction with emptying service provider (n=70)

	Satisfied (%)
Time taken between ordering and arrival of service providers to empty the tank	87.7%
Technical knowledge of the emptying staff	100%
Equipment that was used to empty their tank	100%
The ease of access to their tank	96.9%
How the tank was opened	100%
With the clean up after the emptying of their tank	95.2%
The cost of the service	89.1%

5.3 Supply of FSM services

The majority of **containment** facilities in Balikpapan are constructed by locally trained masons that function in an informal way. It can be assumed that they receive no formal training (unlike 'builders') and their capacity to construct a range of domestic and public facilities is unclear.Iit would appear from the range and types of facilities observed during the Technical study that there is limited knowledge of standards of the facilities built (i.e. many are non-compliant with national regulations).

In terms of **emptying and transport** services, Table 15 highlights certain elements of current institutional capacity of these private operators.

Table 15 Institutional capacity of current FSM emptying and transportation services

Indicators of capacity	Response
Number of providers	3 private emptying services functioning: Bayu, Bunga Lemo and Suyanto UPTD previously ran one 3m³ sludge tanker but this has not been operational for the last two years. In 2013 the local government won a 4m^3 tanker but currently this is not being used.
Formal/Informal nature	On appearance, Bunga Lemo and Bayu, seem to run as a formal business with advertisement, business cards etc. On closer inspection the ad-hoc nature of business (on call), the lack of record keeping, lack of permits in place mean they actually runs in quite an informal manner.
Current capacity	Based on 2 trips/tanker achieved per day: - Bayu: Empty 4 households per day - Bunga Lemo: Empty 10 households per day - Suyanto: Empty 2 households per day
Business and cost data records	Very limited record keeping done. Costing data (see section above) was collected through interviews with owners.
Compliance with local regulations	Bayu indicated that they follow oral rules which highlight they should dump waste at IPLT. During interviews none of the emptying services indicated there were any local regulations they must follow.
Household satisfaction levels with service provided	Majority of respondents are happy with the current service provided by the private sector.
Potential for expanding services	Two stated there is increased capacity and potential to expand services with the trucks they currently have (assume 2 households/day) Also Bunga Lemo indicated potential to expand into smaller truck sizes to target a new sector of the market.
Training plans	No training plans in place.

The estimated physical capacity of these service providers is highlighted in Table 16 below. A number of assumptions have been made to create this table. Firstly, it is assumed that the process

of emptying and transportation takes 2 hours per household (in the case where one load is equivalent to emptying one households tank) and 3 hours where one tanker has emptied from 2 households. Secondly, it is assumed that the tankers could be active for 6 hours a day and that the tankers would work 250 days a year (or 21 days/month equivalent).

Table 16 Physical capacity of existing private emptying providers

Company name	Number of Trucks	Volume	Emptying frequency per truck	Number of trips/day	Total volume collected/day
Bunga Lemo	3	3.5m^3	1 household	3	31.5m^3
	2	3m^3	1 household	3	18m^3
Bayu	2	4m^3	2 households	2	16m^3
Suyanto	1	4m^3	2 households	2	8m^3
Total	**8**				**73.5m^3 (14 households)**

The annual physical capacity of the trucks is then 18,375m^3 based on serving 3,500 households. The current volume of sludge collected annually from domestic sources is reported as 3,110m^3 (serving 1,404 households).

Private sector emptying companies demonstrate a willingness to invest in FS emptying and transportation services as they all own at least one of their emptying trucks.

The emptying and transportation stages of the service delivery have been shown to be the most functioning aspects of FSM services. Support for private sector activity is currently however non-existent in terms of institutional support, permits to work, support for business expansion and so on. Very little interaction was observed between private sector providers and local government / managing institutions – which would be required as components to improve and provide incentives to scale-up these operations.

6 Fecal sludge characteristics, treatment and possible end-use options

6.1 Fecal sludge characteristics

Two sets of fecal sludge samples were collected and tested from a range of locations in Balikpapan, to investigate the chemical composition and physical characteristics of the sludge. The first round of samples (March 2014) were undertaken as a test run for the laboratories and the process of taking the samples, with a second round of samples taken in May 2014. The sampling methodology for the fecal sludge characteristics are outlined in Section 2.2.2.

Samples of primary fecal sludge were taken from three sites in Balikpapan: one sample from a factory septic tank and two samples from households. Samples were also taken from two manure fertiliser sites and from two emptying company dumping sites, see Table 4 above for details.

Samples taken at the IPLT drying beds were from the discharge chamber, and drying beds (tanks) 3 and 4:

- Samples taken within the discharge chamber consisted of fecal sludge that had accumulated over time within the chamber (the inlet to the works). The sample was wet-dry in consistency and was brown/black in colour with some smell.
- Samples taken from the start of the two drying beds in use (3 and 4) consisted of fresh sludge received by the drying beds directly after discharge by the tankers. The sample was wet in consistency and black in colour with some smell.
- Samples taken from the end of the two drying beds in use (3 and 4) consisted of fecal sludge that had been left to dry for approximately 6 weeks. The sample was wet-dry in consistency, black in colour and with some smell (but not as strong as from the start of the drying beds).

Samples were also taken of dried fecal sludge that had been removed from the drying beds and dumped on adjacent land, about 2 months previously. This sludge was observed as being of dry consistency, black in colour with very little smell.

Details of the chemical and physical characteristics of the fecal sludge are contained in the full report by Kennedy-Walker, 2014 and in particular Appendix D of that report. The results show that, for the samples taken from the households, all samples were of a very liquid consistency that flowed easily and contained no solid waste.

Calorific value tests were performed on samples taken from the end of the two drying beds, by the company Sucofindo. The analysed sample was a well-mixed composition from two tanks at the fecal sludge treatment plant (total sample volume of 1 litre). The sample was taken during the first round of sampling for testing. The tests were performed using a bomb calorimeter and the results are indicated in Table 17 below.

Table 17 Calorific value test results for IPLT, Balikpapan

Parameter	Unit	Results	Method
Total Moisture	%, (as received)	86.0	ASTM D. 3302-10
Moisture in Analysis	%, (air dried basis)	24.7	ASTM D.3173-11
Gross Calorific Value	Kcal/kg, (air dried basis)	2552	ASTM D. 5865-10

The favoured units of Calorific Value for this study is MJ/kg so therefore converted from Kcal/kg the result achieved is **10.68MJ/kg** (conversion used 1 kcal = 0.0041868 MJ).

Additional tests were conducted to analyse FS samples for helminth eggs. Table 18 below provides the results received from the department of parasitology at the University of Indonesia for samples taken at two households and the FS drying beds. The techniques used were; direct examination, sucrose flotation from 5 gram of sludge sample and quantitative analysis of egg/larvae recovered.

Table 18 Results indicating helminth eggs/larva per gram of fecal sludge samples

Sample Code	*Ascaris lumbricoides* eggs	Hookworm larvae	*Trichuris trichiura* eggs	*Strongyloides stercoralis* larvae
HH#1 (liquid waste)	**30**	**0**	**0**	**0**
HH#2 (liquid waste)	**13**	**0**	**0**	**13**
IPLT Tank 3 (semi solid waste)	**150**	**267**	**0**	**0**
IPLT Tank 4 (liquid waste)	**50**	**0**	**20**	**0**

The results highlight that samples are contaminated with some form of helminth egg and therefore pose a possible risk to humans that may come into contact with sludge directly or soil it has been applied to through the skin or oral digestion. The laboratory highlighted during analysis that for the case of *A. lumbricoides* eggs, there were more fertilised than non-fertilised eggs observed, with samples from HH#1 and IPLT Tank 4 having fertilised eggs. The lab also found only *S. stercoralis* and hookworm in larvae form with no eggs, suggesting the eggs had already hatched.

Chemical characteristics of samples were also analysed using the Environmental Engineering department at the University of Indonesia. The full report (Kennedy-Walker, 2014) contains details of the test results.

6.2 Current treatment and end-use

There is currently one fecal sludge treatment facility serving Balikpapan, consisting of a discharge chamber and four drying beds. The volume of each drying bed is approximately 207m^3 (measured tank size 23*6*1.5m). Therefore the total volume of the IPLT is 828m^3. If the physical capacity of the existing private emptying equipment was achieved (73.5m^3 /day) the IPLT would reach its volumetric capacity in approximately 11 days.

Two drying beds were not functioning at the time of observation and with no operating procedures or design manuals available, the actual operating capacity is unclear.

Records at the IPLT show 159 loads of FS to the treatment facility in 2013 (no indication of volume of truck used). The recorded number of loads at the IPLT is much less than those expected (564 loads per year) when calculating from information received from emptying companies (based on 42 trip/month for companies that empty into IPLT). The contrasting information is either down to poor record keeping at IPLT, incorrect information supplied by emptiers or some of the sludge not being dumped at the IPLT.

Currently testing of treatment efficiency occurs annually on the liquid influent and effluent to the IPLT and adjacent IPAL. The sample results observed from interviews held at the IPLT show that the results do not meet the required effluent standard. Independent samples taken also show that the effluent does not meet the standards. Interviewees indicated that if the sample results do not

comply with environmental standards nothing is done to change procedure or operation of the IPLT.

Currently none of the solid effluent from the IPLT is reused, with dried septage sludge disposed of adjacent to the IPLT bed structure. Operational staff state that the sludge is removed periodically (every 6 months), but there are no records of this operation and the growth of vegetation on the drying beds suggests that it is done infrequently. The liquid effluent from the tanks outflows to the IPAL downstream of the landfill.

Future options for end-use?

Results of recent studies carried out by Sandec/Eawag to analyse the calorific value of fecal sludge taken from various sources highlight that on average the calorific value of untreated sludge is 17.3MJ/kg dry solids (Gold, 2013), which compares well with other biomas fuels. Average values for fecal sludge from on-site sanitation systems in the Sandec study (based in 3 cities in Africa) were significantly higher than results obtained in Balikpapan. The lower calorific value is possibly influenced by local diet as well as the practice of using water for anal cleansing. Also given the humid climate, the level of pre-drying required to achieve a sufficiently low moisture content for the fecal sludge to act as a viable fuel-source would be technically challenging and unlikely to be cost-effective.

Together with the chemical and physical characteristics of the fecal sludge, the calorific value results point to the fact that the fecal waste is very liquid, very dilute and very weak. Collectively these characteristics suggest that the fecal sludge is likely to be too weak or dilute to be of much value for any type of beneficial, market-based end-use. Effluent re-use in nearby agricultural areas may be the most viable option available, if deemed acceptable and the process can be safely managed.

In relation to potential expansion of the site and services, a new government-owned 4m³ tanker could provide more loading to IPLT if commissioned. A new IPLT is due to be built in the future- details of the design and when are unknown. Expansions of service may come about if the running of the IPLT moves to a new technical unit. Mining companies have indicated they may be interested in using large qualities of treated sludge for mandatory land reclamation.

7 City Service Delivery Assesssment

7.1 Introduction

The FSM City Service Delivery Assesssment (CSDA) is a crucial part of the analysis of FSM services. It answers an overarching question around the quality of the FSM enabling environment, the level of FSM service development and the level of commitment to FSM service sustainability. The aim of the CSDA is to allow an objective assessment of FSM service performance through all stages of the service chain, so as to identify priorities for reform. The political economy analysis (in the next section) then attempts to explain *why* some the CSDA looks like it does.

Like the Fecal Waste Flow Diagram (see section 4), the CSDA format builds on an approach developed under the 12-city study (Peal et al. 2013). In turn, the 12-city method was based on similar exercises in water and sanitation (e.g. Country Status Overviews produced by WSP).

The CSDA is arranged around three broad areas: enabling services, developing services, and sustaining services. This is illustrated in Table 19 below, alongside the key question associated with each area, and the indicators used.

Table 19 The CSDA framework for FSM

Area	Question in research framework	Indicator
Enabling	What are current policies, planning issues and budgetary arrangements?	Policy
		Planning
		Budget
Developing	What is the level of expenditure, degree of equity and level of output?	Expenditure
		Equity
		Output
Sustaining	What is the status of operation and maintenance, what provisions are made for service expansion and what are current service outcomes?	Maintenance
		Expansion
		Service Outcomes

7.2 Methodology

The CSDA aims is to be fully objective and transparent, so the analysis is clear and stakeholders can engage with it and update it over time as the situation improves. It is primarily a qualitative analysis, based on a review of key documents and interviews with stakeholders at the city level. As set out in section 2.1, WSP's overall study design was that the OPM/WEDC team designed the methodology, but did not do primary data collection. For analyses such as the CSDA and PEA, it is very hard to separate data collection from analysis.

The collection and preliminary analysis was conducted by a short-term consultant contracted by WSP, Ruth Kennedy-Walker. Further analysis and additional data were provided by members of the WB-WSP staff team in Balikpapan in December 2014, with support from Isabel Blackett – to ensure full scoring of the CSDA.

There are several questions beneath each of the nine overall indicators in Table 19 above, with 21 questions in total. For each question, there are objective criteria to enable a score to be given for the city, with 0 (poor), 0.5 (developing) or 1 (good) on that question. Each question is scored along

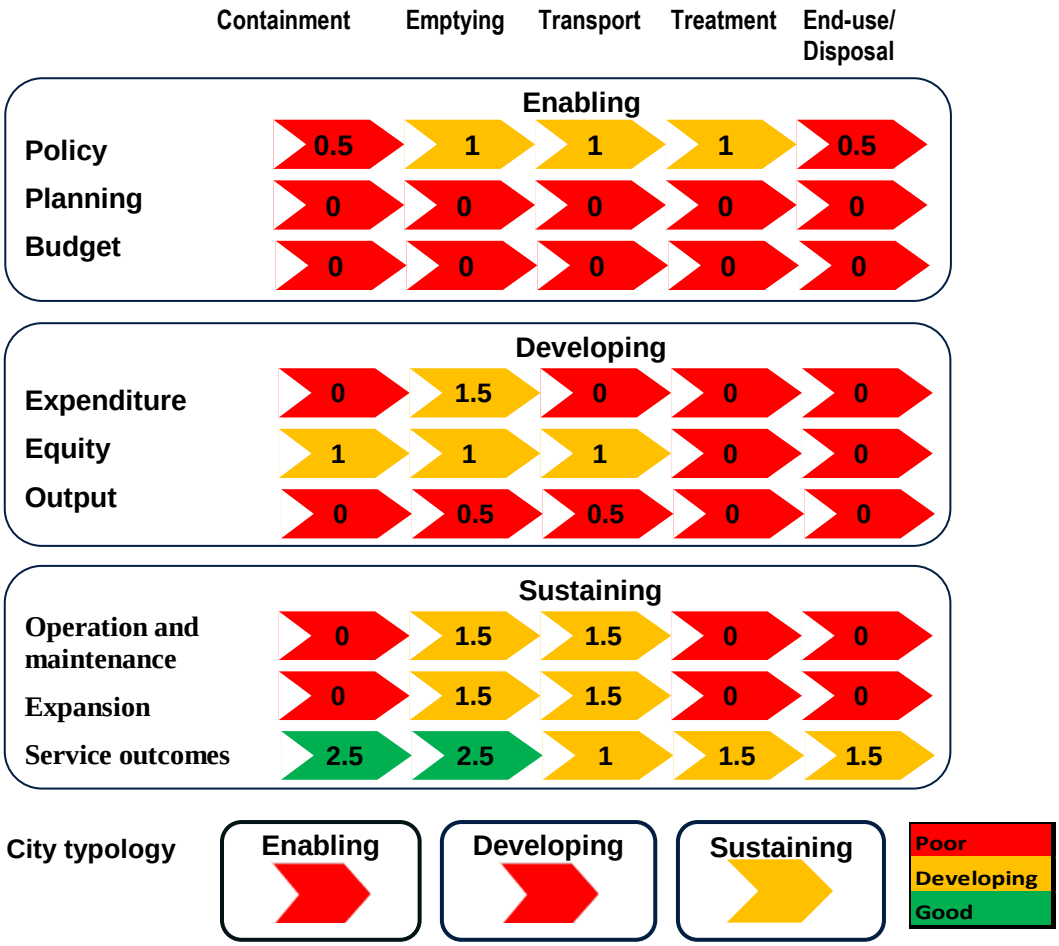
the whole service chain from containment to disposal. An example is given in Table 20 below, for the first question under the “policy” indicator.

Table 20 Example CSDA question, criteria and scoring

Question	Containment	Emptying	Conveyance	Treatment	End-use / disposal	Indicator/ Score
Policy: Is FSM included in an appropriate, acknowledged and available policy document (national / local or both)?	0.5	0	0	0	0	• 1: policy is appropriate, approved (or in draft form), acknowledged and available • 0.5: policy is appropriate, approved (or in draft form), but not clearly acknowledged / available • 0: policy not available, or inappropriate to the context

Once all 21 questions are scored, the next step is to aggregate those scores into a city scorecard, by summing together the scores for each indicator (policy, planning etc.). Because there are different numbers of questions for each indicator, a final step is required, which is to normalise the scores to a total out of 3 for each indicator. This is achieved by dividing the city score for that indicator by the maximum possible city score, multiplying by 3, and finally rounding to the nearest 0.5. This process delivers the overall CSDA scorecard. The output for Balikpapan is shown in Figure 5 below.

Figure 5 CSDA scorecard for Balikpapan



7.3 Findings

The overall CSDA scorecard for Balikpapan is shown above as Figure 5. An explanation for each score allocated to the full set of 21 questions is shown in Annex A, while the following summaries the implications of those results.

7.3.1 Enabling

While the policy environment for FSM in Balikpapan remains relatively weak, it is rapidly developing. The work of the Sanitation Task Force has enabled the new Head of Bappeda and the city Mayor to identify and propose new institutional arrangements to enhance FSM services and effective treatment of septage from on-site sanitation systems at the treatment facilities. Policy, regulatory and legislative arrangements to support these changes will need to be developed.

Budget allocations have been poorly coordinated in the past – and will need to be oriented in line with the new institutional arrangements, as they are translated into law and responsibilities for asset ownership transferred.

7.3.2 Developing

There has been a notable lack of government financial support to FSM services, with provision only for attempting to maintain operation of the septage treatment facility. Bappeda have indicated plans to invest in more desludging trucks, to be operated by the private sector. Currently emptying services are mainly provided by private sector providers. Use of emptying services by households are constrained by cost, location and access (to the property and into the soak pit/ septic tank itself), especially for the urban poor. Those who use desludging services report being satisfied with them, but the city sanitation plan does not identify how services will expand to meet future demand and ensure safety in the transfer of FS through the whole of the service chain.

While FS may be safely collected from containment systems, it is not all transferred to a safe treatment or disposal location. The treatment facility is not well managed and does not provide effective treatment at the current loading rates.

7.3.3 Sustaining

The new Sanitation Master Plan – being developed under the leadership of Bappeda – is to include FSM as a component. The Health Agency census data is also beginning to account for sanitation and FSM services at household level. These are encouraging signs that the city is moving towards addressing FSM as a significant component of future investment options.

While private operators of desludging trucks appear to break even financially, other stages of the service chain – notably operation of the septage treatment facility – do not currently achieve cost-recovery. There are no current plans reported to strengthen the role of private emptying service providers, although this may be affected by a new Mayoral decree affecting new institutional arrangements for septage management, as noted in February 2015.

Regarding compliance with national standards for FS services, these only exist in relation to the construction of on-site containment systems, not to further stages of the service chain. Even then, households are predominantly using non-compliant standards of containment facilities, with pour-flush latrines discharging to a single or double compartment “cubluk” (rather than a septic tank). Not fully lined, the cubluk acts as a soak-pit, with implications for both the frequency of emptying requirements and the extent of contamination of the groundwater in the meantime. In spite of this,

households are not that reliant on groundwater for direct consumption, but rather for showering, toilet use, laundry and personal washing. Health risks associated with FSM services are considered to be low – backed-up by a reported incidence of diarrhoea at less than 2% of children of families questioned during a Willingness to Pay study.

However, in the long-term, without attention given to improving technical arrangements of on-site facilities and consideration for a range of emptying services that can reach into poor areas and provide affordable services, demand for safe and effective emptying services will continue to be constrained.

7.3.4 Implications of the CSDA scorecard

The resulting CSDA scorecard and city typology of the FSM City Service Delivery Assesssment in Figure 5 reveals that the city is beginning to make progress in areas of supporting improvements to FSM services – with these mainly being demonstrated through the emptying and transportation stages of the service chain. As the service outcomes are generally good from the household perspective (containment and emptying of fecal sludge), attention needs to be paid to the safe transfer of fecal sludge to effective treatment facilities.

While new institutional arrangements and plans for FSM as part of the Sanitation Master Plan are starting to be addressed (see next section), consideration will need to be given to the costings (investment and recovery) for a range of service and intervention options, to support implementation.

8 Next steps for Balikpapan city

The World Bank - WSP technical assistance in Balikpapan ran in parallel, and often slightly ahead of the global FSM research study. Findings from an assessment of the city's FSM services were reached at an early stage and presented to all key stakeholders during a workshop held in August 2014.

At that meeting, significant buy-in to the results of the study was generated – leading to discussions of proposed actions. In particular, the Head of the City Planning Department was noted to take a strong lead on actions to follow. In particular, the findings related to customer preferences and willingness to pay for regular desludging, was greeted with a response of "*well let's do it – how do we start?".*

The SFD was a significant mechanisms to draw people's attention to discussing next steps. These discussions were structured around the sanitation chain, in relation where the flow of fecal waste "drops out" of the service chain.

Key issues identified related to:

- poor households having poorer quality latrines that act more like open defecation, overhung or overflowing. They are often in narrow lanes and far from main roads, making emptying difficult. This would need to be considered.
- the need for a more regulated private sector, contracted to do regular desludging and having an improved 'on call' system. This would need to be supported by communications with the public and how this be bets done.
- resolving institutional responsibilities, leading to institutions knowing who should do what

Bappeda, PDAM and other key stakeholders have since identified steps to improve FSM services in the city. This led to a series of proposed or achieved actions in December 2015:

Area for action	Action / responsibility
Lead agency for FSM services	The Mayor has appointed the PDAM (the Water Utility) to manage FSM services and clarified this in regulation.
Task Force to address FSM service issues	PDAM is to establish the services team including technical, planning, MIS, marketing and financial staff
Communication / promotion initiatives	PDAM are to develop materials and a communication strategy
Asset ownership	Arrangements for ownership and / or paying charges for use of local government assets (fecal sludge treatment plant) to be established
Private sector partnership	A form of partnership with private sector providers is to be developed by the PDAM
Regular desludging	PDAM will provide both an on-demand and regular desludging services. A tariff to cover regular desludging and financial aspects is to be established, starting with a pilot project covering 1,000 households. Improved record-keeping and MIS, necessary for managing the regular desludging program, will be developed.

A Sanitation Working Group has been established and a City Sanitation Strategy (CSS) developed that lays out targets and identifies required sanitation development activities. This in turn has enabled the new Head of Bappeda (the City Planning Agency) and the city Mayor to identify and propose new institutional arrangements to enhance FSM services and effective treatment of septage from on-site sanitation systems at the treatment facilities. Policy, regulatory and legislative arrangements to support these changes will need to be developed. Budget allocations, poorly coordinated in the past, will need to be oriented in line with the new institutional arrangements as they are translated into law and responsibilities for asset ownership transferred.

The local House of Representatives has been formulating a sanitation law, with regulation focusing on issues of tariffs and off-site sewerage services. It has been identified that the development of a new city sanitation master plan should include regulation around non-networked services and private sector emptying, to ensure these issues are included in future legislation. While new institutional arrangements and plans for FSM services, as part of the sanitation master plan, are starting to be addressed, consideration will need to be given to the costings (investment and recovery) for a range of service levels and intervention options, to support implementation. Bappeda have indicated plans to invest in more private sector-operated desludging trucks and construction of a new septage treatment plant. Use of emptying services by households is currently constrained by cost, location and access (to the property and into the tank itself), especially for the urban poor. Those who use desludging services report being satisfied with them, but the sanitation master plan must also identify how these services will expand to meet future demand, to ensure safe transfer of fecal sludge to effectively managed treatment facilities.

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Annex A CSDA scoring table criteria

Indicator	Question	Containment	Emptying	Conveyance	Treatment	End-use disposal	Comment	Evidence / Data
Policy	**Policy:** Is FSM included in an appropriate, acknowledged and available policy document (National/ local or both)?	0	0	0	0	0	No clear acknowledgment or inclusion of Fecal Sludge Management from onsite systems within local policy or the city sanitation strategy and the mid-term plan.	RPMD /mid- term plan 2011-2016 does not say anything related on FSM SSK (City Sanitation Strategy) 2011
	Institutional roles: Are the institutional roles and responsibilities for FSM service delivery clearly defined and operationalized?	0.5	1	1	1	0.5	The roles of the institutions involved in FSM are not yet clearly defined and in reality the current FSM provision is not well operated, managed or maintained. Dec 14 Update - Local Council have passed a regulation making the water utility responsible for FSM while the treatment plant is still operated by a Unit under the Department of Works. Feb 15 Update – Water and Sanitation Task Group, including the new Head of Bappeda and the Mayor, have agreed an arrangement for FSM, from containment through to transporting FS to treatment plants. Mayoral decree of the new arrangement yet to be issued, which will require hand-over process of treatment plant assets.	Local regulation 12/2009 on tasks and functions of DKPP (Cleanliness, Parks and Cemetery department) states only for solid waste management Mayor's decree 41//2012 on technical unit (UPTD) under DKPP as operator for solid waste management, the unit responsible only to operate and maintain the septage treatment plant Head of Bappeda commitments in Bappeda – WSP Workshop at Balikpapan, Aug 21, 2014
	Regulation: Are there national and/or local regulatory mechanisms (i.e. bylaws and means of enforcement) for FSM?	0	0	0	0	-	The policy, legislation and regulatory framework does not support private sector investment in FSM. Currently, private sector is filling a gap in the emptying and transportation part of the chain as the local government has no provision for this.	The private sector does play some role but they are not under formal license and their activities are not monitored by the appropriate institutions.
	Service provision: does the policy, legislative and regulatory framework enable investment and involvement in FSM services by appropriate service providers (private or public)?	0	0.5	0	0	0	There are minimal local laws in place related to FSM. One is being drafted currently but this has not been observed so not sure of the detail included relating to FSM. There is a plan on establishing standards for septic tank, sanitation guideline and new housing must use communal system and implementation supervise by city planning agency	Local Regulation 9/2011 regulates tariff for emptying and no other regulation for FSM BTOR, 28 November 2013 Head of Bappeda commitments in Bappeda – WSP Workshop at Balikpapan, Aug 21, 2014

Indicator	Question	Containment	Emptying	Conveyance	Treatment	End-use disposal	Comment	Evidence / Data
Planning	**Targets:** Are there service targets for (each part of) the FSM service chain in the city development plan, or a national development plan that is being adopted at the city level?	0	0	0	0	0	No service targets discussed. During interviews with local government representatives it was highlighted that the cities target for cleanliness retribution was Rp 6.5 Billion in 2013[8]. This target does not include FSM .This is collected through fee collection through water bill.	No data
	Investment: Is FSM incorporated into an approved and used investment plan (as part of sanitation) - including ensuring adequate human resources and Technical Assistance? (Ideally a medium term plan, but if not, at least an annual plan)	0	0	0	0	0	City Investment plan for sanitation does not include FSM. It focuses on the provision of SANIMAS community facilities, Waste Water Treatment facilities and hygiene promotion in schools.	City Sanitation Strategy 2011
Budget	**Fund flows:** Does government have a process for coordinating FSM investments (domestic or donor, e.g. national grants, state budgets, donor loans and grants etc.)?	0	0	0	0	0	Coordination of funding from government was shown to be complicated and it appeared that local government were not involved in coordinating how funds were selected or how they are utilised at the local level.	No data
	Adequacy & structure: Are the public financial commitments to FSM commensurate with meeting needs/targets for Capex and Opex (over the coming 5 years)?	0	0	0	0	0	Currently there are no annual public financial commitments made to FSM. The only aspect financed which is the building of decentralised treatment systems through the SANIMAS (*Sanitasi Oleh Masyarakat*-Sanitation by Communities) programme.	No data
Expenditure	**Capital funding:** What is Capex expenditure per capita on FSM (3 year average)?	0	0.5	0	0	0	Currently the only money that is spent by local government on FSM is through the IPLT which is poorly maintained and has very limited operational costs. There is a plan by Bappeda to buy 6 desludging trucks with budget of Rp.500 million each, in 3 year ahead.	No data Head of Bappeda commitments in Bappeda – WSP Workshop at Balikpapan, Aug 21, 2014

[8] Findings of FGD and interview (WTP-Balikpapan)- Combined

Indicator	Question	Containment	Emptying	Conveyance	Treatment	End-use disposal	Comment	Evidence / Data
Equity	**Choice:** Is there a range of affordable, appropriate, safe and adaptable technologies for FSM services available to meet the needs of the urban poor?	0	0	0	0	0	Options such as tank emptying do exist and in some cases are used by the urban poor. Barriers such as cost, location, access and support for ensuring proper maintenance may inhibit use.	Social and On-site sanitation study, October 2014 on main findings: 53% of households are located in the lane of less than 2 meters wide 83% of soak pits/septic tanks have no access hole and need breaking the top slab or ceramic/ floor for emptying
	Reducing inequity: Are there specific and adequate funds, plans and measures to ensure FSM serves all users, and specifically the urban poor?	0.5	0.5	0.5	0	0	The current city sanitation plan does not detail how improved sanitation for the urban poor will be met in detail. One of the private sector companies' has plans to provide tanks suitable for accessing low income areas.	No data
Outputs	**Quantity / capacity:** Is the capacity of the FSM chain growing at the pace required to ensure access to FSM meets the needs and targets that protects public & environmental health?	0	0.5	0.5	0	0	Capacity at each part of the chain is not growing. The actual demands for FSM are met by the current provision but this does not ensure protection for public and environmental health.	No data
	Quality: Is the quality of FSM sufficient to ensure functioning facilities and services that protect against risk through the service chain?	0	0	0	0	0	The quality of FSM is poor with the only part of the chain that is properly functioning being the emptying and transportation part which is run by the private sector and not all septage is transported to septage treatment plant. The majority of on-site system used by households is not proper septic tank . The septage treatment plant is not properly operated.	Final Balikpapan Report For FSM Diagnostic and Guidelines Development Project, June 2014 Balikpapan Report: Social and on-site sanitation study, October 014 Sludge Treatment Facility Balikpapan: Present operational procedures and options for improvement , October 2014
	Reporting: Are there procedures and processes applied on a regular basis to monitor FSM access and the quality of services and is the information disseminated?	0	0	0	0	0	There is no reporting of the current FSM access and quality of service provided by the city authorities. The health department conduct surveys which have a part that assesses containment but this is done every 3 years.	No data
O&M	**Cost recovery:** Are O&M costs known and fully met by either cost recovery through user fees and/or local revenue or transfers?	0	1	1	0	0	Operation and maintenance fees for IPLT treatment facility are not met by fees collected for dumping at IPLT or local revenue for FSM. For emptying and transport it was reported that most months the companies break even.	BTOR, 28 November 2013 : total revenue in 2012 and 2013 was IDR 3 million respectively and could not cover the operational costs

Indicator	Question	Containment	Emptying	Conveyance	Treatment	End-use disposal	Comment	Evidence / Data
	Standards: Are there norms and standards for each part of the FSM service delivery chain that are systematically monitored under a regime of sanctions (penalties)?	0	0	0	0	0	No standards currently exist or are used relating to the FSM service chain. There are national standards for containment facilities; however, these are not monitored at the city level. From the discussion with private sector, its found that they have a concern that they need to dispose the sludge to IPLT, otherwise will get punished	No data One of Bunga Lemo driver had been jailed because of illegal dumping
Expansion	**Demand:** Has government (national or city authority) developed any policies and procedures, or planned and undertaken programs to stimulate demand of FSM services and behaviours by households?	0	0.5				No policies, procedures or programs have been undertaken (yet) in Balikpapan city to stimulate demand for FSM. The government has started to initiate inclusion of FSM services and sanitation at households level in the census that held by Health Agencies	No data
	Sector development: does the government have ongoing programs and measures to strengthen the role of service providers (private or public) in the provision of FSM services, in urban or peri-urban areas?	0	0.5	0.5	0.5	0	No programmes are currently in place to strengthen the private sector. Regarding planning of buy 6 desluding trucks, the local government will involve private sector and will have monitoring together	No data Head of Bappeda commitments in Bappeda – WSP Workshop at Balikpapan, Aug 21, 2014
Service outcomes	**Public Health:** What is the magnitude of public health risk associated with the current FS flows (through the stages of the FS service chain)?	1	1	0.5	0.5	0.5	Updates based on WSP staff discussions and assessment, 23rd December 2014	No data
	Quantity: Percentage of total FS generated by the city that is managed effectively, within each part of the service chain	1	1	0.5	0.5	0.5	Updates based on WSP staff discussions and assessment, 23rd December 2014	SFD presentation in Balikpapan workshop , 21 August 2014
	Equity: To what extent do the city's FSM systems serve low-income communities? (Containment, Emptying and Transport services only)	0.5	0.5	0			The cities current FSM systems services are used (emptying and transport) and available in low-income communities, however, there are some barriers including cost and access.	Balikpapan Report : Social and on-site sanitation study, October 2014 : 44% of lower to middle income households had their tanks emptied.

Annex B Links to data collection instruments

See the instruments and Terms of Reference report here.