

# Juba Household Sanitation Survey and Mapping



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**SUWASA**  
Sustainable Water and Sanitation in Africa



# Juba Household Sanitation Survey and Mapping

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# Contents

<b>Executive Summary .....</b>	<b>1</b>
<b>1.0 Introduction.....</b>	<b>3</b>
1.1 Background.....	3
1.2 Juba Household Sanitation Mapping Survey .....	4
<b>2.0 Methodology: Mapping and Sampling Design .....</b>	<b>6</b>
2.1 Introduction.....	6
2.2 Satellite Image Processing.....	6
2.3 Juba City Expansion .....	7
2.4 Settlement Typologies.....	7
2.5 Survey Sampling.....	9
2.6 Household Survey Design.....	11
2.6.1 Definition of Research Questions .....	11
2.6.2 Finalization of Sanitation Survey Content.....	11
2.6.3 Survey Transfer to Electronic Format .....	11
2.7 Enumeration: Training and Implementation.....	13
2.7.1 Enumerator Selection and Training .....	13
2.7.2 Enumeration Team Deployment.....	13
2.7.3 Enumeration Team Oversight .....	14
2.8 Data Transfer and Progress Monitoring.....	14
<b>3.0 Findings of the Household Survey.....</b>	<b>15</b>
3.1 Demographic information .....	15
3.1.1 Role of Respondent.....	16
3.1.2 Education Level of Household Head .....	16
3.1.3 Household Characteristics .....	17
3.1.4 Land Tenure .....	18
3.2 Sanitation .....	19
3.2.1 Lack of Toilets and Open Defecation .....	22
3.2.2 Reasons for Not Having a Toilet.....	22
3.2.3 Type of Toilet Facilities.....	23
3.2.4 Toilet Construction Materials .....	24
3.2.5 Septic Management.....	27
3.2.6 Exhausting of Toilets .....	28
3.2.7 Financing of Toilets .....	30
3.2.8 Satisfaction with Toilet Facilities.....	31
3.3 Sources of Domestic Water .....	33
3.3.1 Safe Water Practices .....	33
3.3.2 Treating Drinking Water.....	35
3.4 Hygiene and Health .....	35
3.5 Communication Channels.....	38

<b>4.0 Discussion of Main Findings .....</b>	<b>40</b>
4.1 Sanitation Facilities.....	40
4.2 Building Blocks for Engaging Households.....	42
<b>5.0 Implications for SUWASA.....</b>	<b>46</b>
5.1 Possible SUWASA Interventions.....	46
5.1.1 Promotion of Good Sanitary Facilities .....	46
5.1.2 Hygiene Promotion .....	46
<b>6.0 Challenges and Lessons Learned .....</b>	<b>47</b>
6.1 Data collection.....	47
6.2 Data Management and Analysis.....	47
<b>References .....</b>	<b>49</b>
<b>Appendix A: .....</b>	<b>50</b>
Sanitation Survey Questionnaire.....	50

# Figures

Figure 1-1: Roton Wastewater Lagoon .....	3
Figure 1-2: Public Toilets in Juba .....	4
Figure 2-1: Juba City Expansion between 2002 and 2013 .....	7
Figure 2-2: Calculating Number of Households in Recent Formal Area .....	8
Figure 2-3: Juba Settlement Typologies .....	9
Figure 2-4: Densities by Settlement Typologies: Established Formal Areas, Transitional Formal Areas, New Formal Areas, Recent Informal Areas .....	10
Figure 2-5: Example Screenshots of Survey Appearance on Mobile Device.....	12
Figure 2-6: Enumerator iPad Training.....	13
Figure 2-7: Morning Briefing using Google Earth .....	13
Figure 2-8: Sanitation Survey Enumerators.....	14
Figure 3-1: Gender of Respondents.....	15
Figure 3-2: Role of Respondent.....	16
Figure 3-3: Education Level of Household Head from the Study.....	17
Figure 3-4: Infant in Household.....	18
Figure 3-5: Ownership of House.....	18
Figure 3-6: Ownership of House by Payam.....	18
Figure 3-7: Geographic Distribution of Toilets in Juba.....	19
Figure 3-8: Presence of Household Toilet by Payam .....	20
Figure 3-9: Unhygienic Toilet.....	21
Figure 3-10: Comparison of Access to Toilets in Juba, Central Equatoria and Urban South Sudan.....	21
Figure 3-11: What Do Those Who Have No Toilets Use?.....	22
Figure 3-12: Reasons for Not Having a Toilet .....	22
Figure 3-13: Toilet Types in Juba.....	23
Figure 3-14: Materials Used for Toilet Walls .....	24
Figure 3-15: Materials Used for Toilet Walls by Toilet Type .....	25
Figure 3-16: Concrete Block Toilet with Iron Roofing Sheet .....	25
Figure 3-17: Materials Used for Toilet Roofs .....	26
Figure 3-18: Materials Used for Toilet Roofs by Toilet Type .....	26
Figure 3-19: Roofless Iron Sheet Toilet .....	27
Figure 3-20: Flush Toilet with Manhole Leading to Septic Tank.....	28
Figure 3-21: Septic Management by Toilet Type.....	28
Figure 3-22: Exhaustion by Toilet Type .....	29
Figure 3-23: Methods of Toilet Exhaustion .....	29
Figure 3-24: Private Exhauster at Work in Juba.....	29
Figure 3-25: Method of Exhaustion by Toilet Type .....	29
Figure 3-26: Geographic Distribution of Mechanical and Manual Exhausting .....	30

Figure 3-27: Financing of Toilets .....	30
Figure 3-28: Satisfaction with Toilet Facilities .....	31
Figure 3-29: Comparison of Satisfaction with Other Municipal Services.....	31
Figure 3-30: Toilet with Limited Privacy and Security.....	32
Figure 3-31: Reasons for Dissatisfaction with Sanitation Facilities.....	32
Figure 3-32: Sources of Drinking Water .....	33
Figure 3-33: Presence of Water Storage Facility .....	33
Figure 3-34: A Typical Water Storage Tank next to a Toilet Block.....	34
Figure 3-35: Covering of Water Storage Facility .....	34
Figure 3-36: Frequency of Cleaning Water Storage Facility.....	34
Figure 3-37: Treating Drinking Water .....	35
Figure 3-38: Methods of Treating Water.....	35
Figure 3-39: Importance of Washing Hands.....	36
Figure 3-40: What Do You Use to Wash Your Hands.....	36
Figure 3-41: Hand-washing Basin Outside a Toilet Block .....	37
Figure 3-42: When Do You Wash Your Hands? .....	37
Figure 3-43: Visits to the Clinic for Stomach Ailments.....	38
Figure 3-44: Common Diseases Experienced in Household .....	38
Figure 3-45: Most Watched TV Stations .....	39
Figure 4-1: Building Blocks of Fecal Sludge Management.....	41
Figure 4-2: Geographic Distribution of Toilet Substructures.....	42
Figure 4-3: Uncollected Solid Waste in Front of a Public Toilet.....	43
Figure 4-4: A Poorly Maintained and Unhygienic Toilet.....	44
Figure 4-5: Mixed land Use in Juba City.....	44
Figure 4-6: Signs of Gentrification in Juba .....	44

# Tables

Table 2-1: Settlement Typologies in Juba.....	8
Table 2-2: Juba Typology by Area .....	8
Table 2-3: Sample Size by Typology.....	10
Table 2-4: Survey Interviews by Typology .....	14
Table 3-1: Respondents by payam .....	15
Table 3-2: Household Size Characteristics.....	17
Table 3-3: Do You Have a Working Toilet? .....	19
Table 3-4: Do You Share Your Toilet with Other Households.....	20
Table 3-5: Toilet Type by Payam .....	24
Table 3-6: Septic Management by Toilet Type.....	27
Table 3-7: Do You Watch TV?.....	38
Table 3-8: Do You Read a Newspaper.....	39
Table 3-9: What Radio Station Do You Listen to? .....	39

# Acronyms

CPA	Comprehensive Peace Agreement
ePORT	Electronic Project Observation Reporting and Tracking
GIS	Geographic Information System
GPS	Global Positioning System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ICT	Information and Communication Technology
JICA	Japan International Cooperation Agency
MDTF	Multi-Donor Trust Funds
NBS	National Bureau of Statistics
RSS	Republic of South Sudan
SISP	Sudan Infrastructure Services Project
SUWASA	Sustainable Water and Sanitation in Africa Project
U.N.	United Nations
USA	United States of America
USAID	United States Agency for International Development
UTM	Universal Transverse Mercator



# Executive Summary

In the past 10 years, the rapid growth of South Sudan's capital, Juba, has presented municipal authorities with a multitude of challenges. One of them is providing adequate sanitation facilities for the growing population.

The challenge is compounded by a lack of information on city size and population density, information that is ordinarily available for planning purposes. As a result, there is a risk that future utility investments will be based on circumstantial evidence and will not target the areas of the city that should be prioritized.

Accurate data on current household sanitation conditions is a priority for the government of South Sudan because new investments are expected in the city soon. Sustainable Water and Sanitation in Africa (SUWASA), a project funded by the United States Agency for International Development (USAID), is supporting the water and sanitation sector in South Sudan. It is working with the Juba City Council to plan and prioritize sanitation investments throughout the city. To fill current information gaps on sanitation in Juba, SUWASA staff developed and executed a household survey, which was conducted by local enumerators in September 2013.

In a collaborative process, a representative of the USAID Mission in South Sudan, the SUWASA team in Juba and Tetra Tech staff from the United States determined the survey content prior to field deployment. The survey questionnaire contained components including sanitation access and habits, household water sources, waste management practices, sources of information about sanitation, and public perceptions about the importance of good sanitary practices in child and adult populations.

Developing a statistically representative survey sample was challenging because reliable and up-to-date population data were lacking in Juba. The survey design team also had to target priority areas for investment and deliver a statistically representative survey sample despite the challenges. The team, therefore, deployed a geospatial, stratified, random sampling approach using the hypothesis that multiple sanitation practices existed in Juba's urban typologies. In other words, the hypothesis assumed that established neighborhoods were likely to have different knowledge, attitudes and practices about sanitation than areas that were recently settled and not part of the formalized road network. The result was a stratified random sample based on proportionate allocation that allowed for in-depth analysis by urban typology and a comparison of patterns across typologies.

In order to streamline data collection and reduce issues commonly associated with paper surveys, enumerator teams conducted the household survey using the Tetra Tech-ARD Electronic Project Observation Reporting and Tracking (ePORT) approach, which runs on mobile devices .

The survey management team selected 16 local enumerators to conduct the survey and provided training over three days. Enumerator training included instruction on the use of iPads for enumeration, familiarization with survey questions and an introduction to proper household sampling technique. Supervisors divided enumerators into eight teams who conducted the survey from Sept. 11 to Oct. 10, 2014.

Once completed, the survey generated more than 1,000 points of data. All survey points were georeferenced and used to create a series of initial map outputs (Appendix D). The Tetra Tech team

undertook the analysis of all geographic information and the SUWASA project staff in Juba undertook quantitative analysis of the survey data for presentation to local authorities and USAID.

The survey developed new information:

- A map of Juba's geographic growth;
- Identification and definition of settlement typologies;
- An understanding of household sanitation and hygiene practices;
- Recommendations for possible SUWASA interventions.

# I.0 Introduction

## I.I Background

Since its independence, the Republic of South Sudan has continued to face new challenges as it works to promote peace, development and stability. Since the signing of the Comprehensive Peace Agreement (CPA), the government of South Sudan has progressed. But it struggles to meet increasing demand for basic services and to develop a broad economic base with sources of revenue outside the extractive industries.

USAID and other development partners have proactively engaged in helping South Sudan meet the challenges of maintaining stability while supporting the development of governance capacity.

Shortly after the CPA was signed in 2006, South Sudan suffered from a significant cholera outbreak that left more than a thousand people dead. The outbreaks centered on areas with relatively high population densities such as urban and periurban areas and military barracks. At that time, Juba's population mostly consumed untreated water from the Nile River. Urban sanitation coverage was estimated to be below 10 percent. The result was high mortality rates from waterborne diseases. During the emergency, USAID and other development partners invested in emergency responses to the sanitation disaster.

By 2009, it was estimated that urban sanitation coverage in South Sudan had increased to approximately 19 percent. However, Juba continues to rapidly expand and basic services such as sanitation have failed to keep pace with the change.



Figure I-1: Roton Wastewater Lagoon

Exact population numbers for Juba remain contested. But in 2005, the population was estimated to be 163,000 and the current population is estimated to be approximately 500,000. Despite the significant challenges in urban sanitation, there have been only limited government or donor investments because of the many competing priorities.

The only major investment was by the World Bank managed Multi-Donor Trust Funds (MDTF), which was for the Roton Wastewater Lagoon. The lagoon was constructed on the outskirts of Juba to accommodate discharge from septic exhauster trucks.

The lagoon system was completed in 2010 and the licensing of exhauster trucks and management of the lagoon system is the responsibility of the Juba municipal government. The use of septic tank exhauster trucks has grown significantly. In 2006, there were no exhauster trucks in the city and by 2012, the city had an estimated 100 exhauster trucks licensed and operating the city. Problems remain with the system, but the growth of the exhauster truck business represents the single biggest sanitation advancement in South Sudan.

Additionally, USAID has made investments in urban sanitation in Juba through its Sudan Infrastructure Services Project (SISP), which was implemented by the Louis Berger Group (Figure 1-2).

SISP built five public latrine blocks in market centers in Juba (Figure 1-2) and subsidized the construction of approximately 100 household latrines within Juba. SISP's latrines are managed and operated by the Payam Block local government on a pay-per-use model. High-use locations subsidize low-use locations.

Other than these examples, there have been few public investments in sanitation and it is estimated that there have been few household investments in sanitation.



Figure 1-2: Public Toilets in Juba

## 1.2 Juba Household Sanitation Mapping Survey

It is against this backdrop that this sanitation mapping and household survey was undertaken. The overall objective of the survey was to understand the current household sanitation situation in Juba. Through a collaborative process involving the City Council and USAID, SUWASA further refined this objective into actionable research questions that are listed in section 2.6.1.

This report presents the results of the survey. It highlights current household sanitation and hygiene practices in Juba, defines household sanitation challenges and relates the current practices and challenges to possible SUWASA interventions and identifies areas for support of Juba's municipality government.

The study is one of five studies that SUWASA is undertaking in order to fully assess the sanitation situation in Juba. The other four studies are expected to be completed by March 2015 and include:

- A survey of private exhauster businesses to determine the operation and regulatory environment;
- Assessment of the Roton Wastewater Lagoon to determine functionality and areas for improvement;
- Review of operations of public toilets to determine functionality and areas for improvement, replication and scale up;
- Mapping of institutions involved in sanitation.

Once these studies are complete, SUWASA will work with the municipal government to identify and prioritize urban sanitation investments. The prioritization process will seek to identify underserved areas where a Small Investment Project can be financially sustainable and where it would be most likely to maximize public health benefits. After the assessments are complete, SUWASA will work with the municipal government to develop an investment plan for urban sanitation. The goal of the investment plan will be to realistically expand household and public sanitation facilities in Juba given the financial resources expected to be available for the effort.

Because of a lack of population data and current city maps, the survey was divided into two phases. Phase 1 involved the creation of a map of Juba, determining its geographic boundaries and typology of settlements. Phase 1 also established a sampling frame for the household survey.

Phase 2 was the implementation of the household survey. It involved administration of a predetermined questionnaire to randomly selected households obtained from the mapping exercise. The geographic mapping and collection of data for the household survey was undertaken by SUWASA-South Sudan and consultants from the Geographic Information System (GIS) team from Tetra Tech. Data analysis for the household survey was largely undertaken by the SUWASA-South Sudan team with support from the GIS team.

The rest of the report is organized into five chapters. Chapter 2 presents the methodology used for the geographic mapping and the results of the exercise. The mapping formed the basis for determining the household survey sample in terms of its size and location within the city. Chapter 2 also presents the methodology used for the household survey.

Chapter 3 presents the findings of the household survey, highlighting sanitation and hygiene practices and behaviors. Chapter 4 draws conclusions. Chapter 5 outlines the implications of the findings for possible SUWASA interventions and Chapter 6 presents key lessons learned from this survey.

# 2.0 Methodology: Mapping and Sampling Design

## 2.1 Introduction

Juba's rapid growth has made it nearly impossible to obtain accurate population data. The 2011 census estimated that the population of Juba is close to 373,000. More recent estimates are closer to 500,000. Because it was working with unreliable population numbers, the survey design team employed an approach based on satellite imagery analysis to develop a stratified random sample for the sanitation household survey in Juba. The hypothesis for this analysis was that sanitation practices in Juba differed across urban typologies. This sampling approach allowed for in-depth analysis by urban typology and comparison of patterns across typologies. To execute this methodology, the geospatial expert obtained high-resolution satellite imagery from the USAID GeoCenter in Washington, D.C. and used it to establish the pattern of Juba's growth and to create urban typologies. Survey sample numbers resulted from area calculations by typology. This methodology is explained in detail below.

## 2.2 Satellite Image Processing

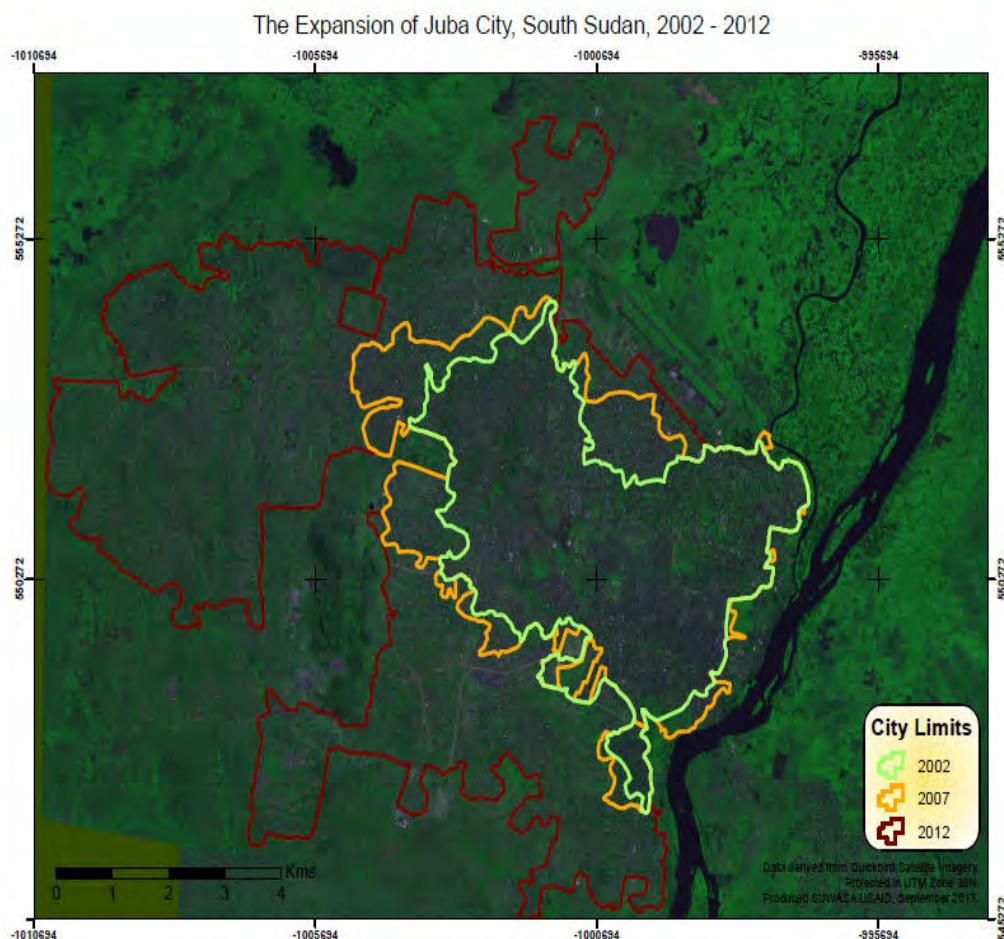
From the USAID GeoCenter, SUWASA obtained a series of high-resolution images for critical years of Juba's growth.

The panchromatic and multi-spectral imagery had a resolution of 1 meter and 2.5 meters and was obtained for 2002, 2007 and 2012. Using this multi-temporal dataset, the team determined changes to the size and layout of the city.

Originally georeferenced in a geographic coordinate system (WGS84), the team reprojected the data to the Universal Transverse Mercator (UTM) Zone 38N to allow for the capture of area-based calculations. Two of the three years (2002 and 2007) overlaid each other without any offset. The 2012 image has an offset of approximately 70 meters to the northeast. To overcome the discrepancy, digitized data was spatially adjusted using an affine transformation approach.

Though there is a general consensus that Juba has grown over the past 11 years, neither the size nor location of the growth was well documented or readily available. To ascertain the extent of growth, the team calculated the city boundaries for the three images in the time series. Visual interpretation was considered the best method to determine the growth of the city because an automated classification would not account for the fact that Juba has a large number of dwellings and road infrastructure that are made from natural materials such as soil and thatch. Because of the natural road infrastructure, the amount of spectral separation between natural areas and areas of settlement would have been harder to determine and could have resulted in errors.

Figure 2-1: Juba City Expansion between 2002 and 2013



The image interpreter created several rules for determining the city limits. They included a rule that a settlement had to be contiguous and there had to be at least two households present per hectare to be considered part of the city. Anything less than two households per hectare indicated the city periphery. Image interpretation predominantly relied upon the multispectral image for each date because of the enhanced contrast displayed between inhabited areas and natural features. The work with the images resulted in an outline of the city for 2002, 2007 and 2012.

### **2.3 Juba City Expansion**

Juba has grown rapidly between 2002 and 2012. The city had an area of 21.55 square kilometers in 2002, 27.44 square kilometers in 2007 and 71.22 square kilometers in 2012. This represents 230 percent growth in 10 years. This growth was characterized by marked changes in settlement density and significant formalization of settlement. Expansion to the west and south was the most noticeable growth trend. Growth in the eastern limit has been constricted by the White Nile. Identifying the extent and location of city growth was the first step in determining a sampling plan for the household survey.

### **2.4 Settlement Typologies**

To identify a stratified random sample, the survey team determined settlement typologies (Figure 2) based on the age of the neighborhood and its dwelling patterns. Areas were examined for whether settlement was present in 2007 and were also evaluated based on whether the settlement type

was informal or formal. Formal settlement areas displayed a pattern of gridded road network and demarcated property boundaries. This analysis produced five settlement types shown in Table 2-1.

**Table 2-1: Settlement Typologies in Juba**

Type 1	Type 1 - Established Formal Areas
Type 2	Type 2 - Transitioned Formal Areas
Type 3	Type 3 - New Formal Areas
Type 4	Type 4 - Recent Informal Areas
Type 5	Type 5 - Enclosed Open Space/Official use

Type 1 is those areas of Juba that had been formally laid out in 2007. A formalized settlement in Juba is clearly identifiable by the grid road network established by the city. Type 2 settlement areas are those parts of the city that were informally settled in 2007 but by 2012

had been formally planned. Juba underwent a large city planning exercise in 2008 and 2009 and the effects of this work were clearly visible in the satellite imagery. Type 3, new formal areas, were formally settled in 2012 but were green fields in 2007. Type 4 had areas where new informal settlements were established on green field sites after 2007. These areas did not currently have a formal land parcel system or road network in place. Type 5 areas were areas excluded from sampling. They were large open spaces designated for official use and thus not accessible to enumerators. The areas included UN compounds, government ministries, government residences and church compounds.

For the purposes of sampling design, the geographic boundaries of the five kinds of areas were measured (Table 2-2).

**Table 2-2: Juba Typology by Area**

Typology Class	Area (Hectares)
Type 1 – Established Formal Areas	1,013
Type 2 – Transitioned Formal Areas	1,443
Type 3 – New Formal Areas	1,978
Type 4 – Recent Informal Areas	2,410
Type 5 – Enclosed Open Space	527

Figure 2-4 shows different density patterns for each typology. In order to extrapolate the numbers of households from each typology, the team calculated household density per hectare. Through image interpretation, several random one-hectare areas in each typology were analyzed and all structures identified (Figure 2-2).

**Figure 2-2: Calculating Number of Households in Recent Formal Area**

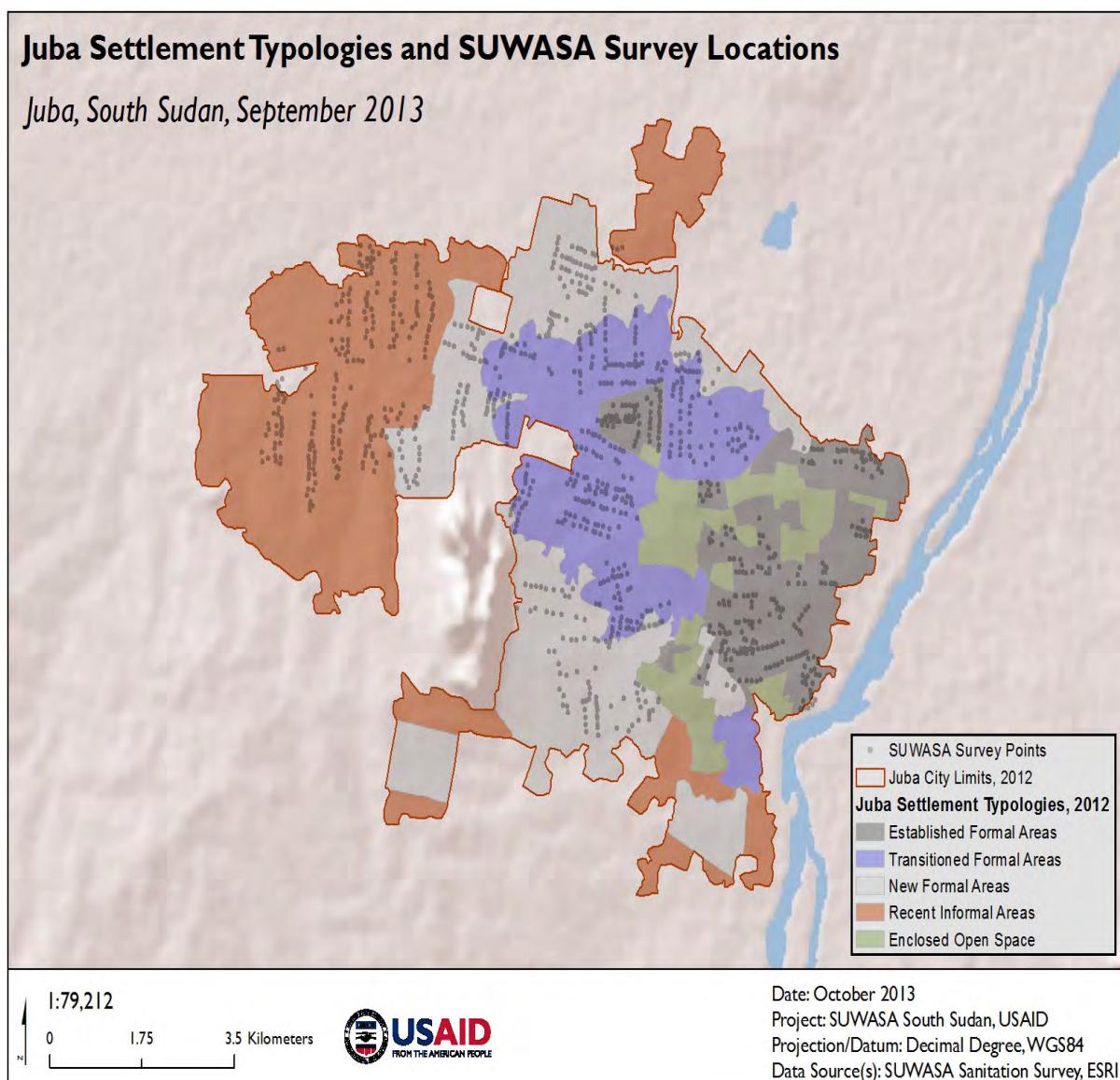


The calculations were based on the knowledge of local experts. Each household was roughly comprised of a dwelling structure, a kitchen, and an additional building. These calculations indicated that Type 1 had an average of 12 households per hectare. Type 4 had an average of four households per hectare.

## 2.5 Survey Sampling

While it is not possible to survey every household in Juba, the sampling strategy allowed the team to collect statistically representative information and use it to make projections about collective behavior. The survey design team utilized area calculations by typology and average building density per hectare to project the number of households in each typology. From this calculation, the team established a stratified random sample using proportionate allocation. In order to conduct a statistically representative sample, the team used the projected total number of households (44,671) to identify the overall sample size ( $n=1,042$ ) at a confidence level of 95 percent with a three percent margin of error. The overall sample was then proportionally stratified based on the projected number of households to produce sample numbers for each typology (Figure 2-3).

Figure 2-3: Juba Settlement Typologies



*Figure 2-4: Densities by Settlement Typologies: Established Formal Areas, Transitional Formal Areas, New Formal Areas, Recent Informal Areas*



*Table 2-3: Sample Size by Typology*

Typology	Projected Number of Households	Percent of Juba Households by Typology	Resultant Sample Numbers
Type 1	12,159	27	284
Type 2	12,983	29	303
Type 3	9,890	22	231
Type 4	9,639	22	225
Type 5	0	0	0
<b>TOTALS</b>		<b>100</b>	<b>1,042</b>

## **2.6 Household Survey Design**

### **2.6.1 Definition of Research Questions**

As stated in the introduction, the broad objective of the sanitation household survey was to understand the current state of urban sanitation in Juba. The key research questions were:

- What are the spatial patterns of access to improved sanitation services?
- Where are pit latrines and septic tanks located and what methods are used for exhaustion?
- How many households have access to and properly use hand-washing facilities?
- What are the average costs of household sanitation services? What are their sources of financing?
- How do households dispose of liquid waste? And solid waste?
- From what sources do households learn about sanitation and what is the level of knowledge?
- How do current water sources relate to sanitation practices?
- Does a prevalence of diarrhea correlate with households that have unimproved sanitation services?

### **2.6.2 Finalization of Sanitation Survey Content**

Using the research questions as a guide, the survey design team worked through a careful selection process. Prior to the consultant's arrival, SUWASA staff prepared a draft questionnaire, which served as a starting point. A rigorous review was undertaken to pare down the questionnaire to its essential elements in order to limit respondent fatigue and improve data quality. In particular, the team limited demographic information to essential elements for analysis: respondent age, sex, level of education, and length of tenure in the home and household size. The resulting survey was structured based on five components (Appendix A is the complete questionnaire):

- General information including informed consent
- Sanitation
- Water and waste management
- Hygiene and health
- Access to information

After receiving feedback from enumerators during training and after the commencement of enumeration, some questions were added and others were dropped. For example, when asking how long someone had lived at a house, enumerators had trouble converting from months to years. As a result, the survey design team added a question so enumerators could calculate exact answers. After interviews started, the survey management team noticed that several questions were not generating relevant responses. These questions were dropped from the questionnaire.

### **2.6.3 Survey Transfer to Electronic Format**

After the content was reviewed, the survey was transferred onto iPads using iForm, which was built by iFormBuilder. Survey forms were constructed online using software licensed to Tetra Tech. (Figure 2-5 shows screenshots the surveys on the mobile device.)

Use of electronic data collection software eliminates many of the issues of paper surveys, including data transfer errors. It also speeds up the time between data collection and analysis. In addition, electronic data collection improves data quality. For example, if a respondent answers that he or she has a septic tank, questions about tank exhaustion automatically appear on the iPad. In addition, the electronic survey has input controls, allowing for only four digits to be entered for a year. It also has mandatory questions that must be answered in order to save the data, ensuring that enumerators ask all required questions. The software features multiple question types and can log a respondent's signature and photograph and the date and time. The software also has drop-down menus for rapid selection of questions.

*Figure 2-5: Example Screenshots of Survey Appearance on Mobile Device*

The screenshot shows an iPad displaying a survey application. The title bar reads "SUWASA Juba - Water and Waste Management". The main content area contains the following questions:

- W1. What is the main source of domestic water in your household? (Domestic water includes water for drinking, cooking and washing) \***
  - Water vendors - Tanker
- W2. Do you have water storage facilities in your household? \***
  - Yes
  - No
- W2a. Is your water storage facility covered? \***
  - Yes
  - No
- W2b. Do you clean your water storage facility? \***
  - Yes
  - No
- W2c. How frequently do you clean your water storage facility? \***
  - At least once a week
- W3. Do you treat your DRINKING water? \***
  - Yes
  - No
- W3b. Do you drink primarily bottled water? \***
  - Yes
  - No
- W4. What are the main challenges you face in obtaining domestic water? (Select all that apply) \***
  - Unreliable supply/regular shortage, High cost /price is too high

Electronic data collection allowed for tracking quality assurance with daily data transfers. Data were stored on tablet devices. When connected to Wi-Fi or a cellular network, data were seamlessly uploaded to an Internet-based database using a secure username and password. The data were accessible from an online portal that allowed real-time assessment of survey progress. For example, GPS coordinates captured for each interview could easily be viewed in a GIS, allowing the survey management team to assess whether an enumerator was sampling accurately and to determine coverage of a sampling area.

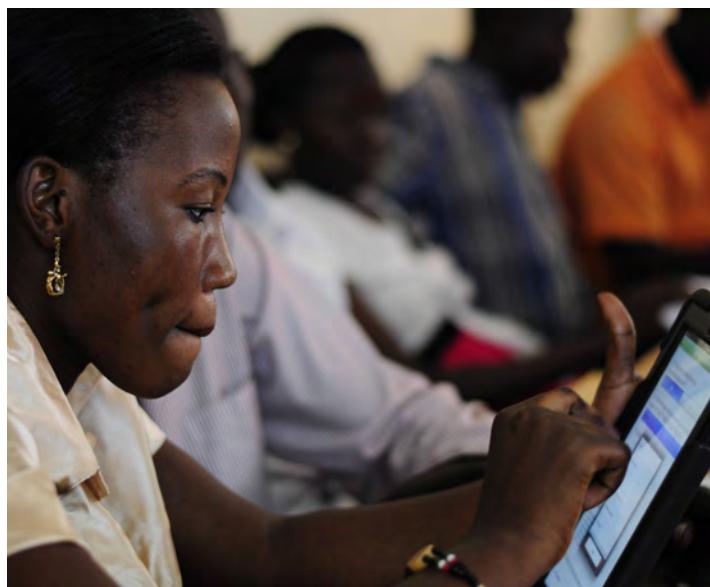
## 2.7 Enumeration: Training and Implementation

Upon completion of the survey design process and creation of the stratified sampling plan, the survey management team conducted enumerator training before deploying enumeration teams.

### 2.7.1 Enumerator Selection and Training

SUWASA staff identified enumerators, most of whom were current students or graduates of the information technology, physics, education and communication departments at the University of Juba. This survey offered enumerators hands-on field practice and an opportunity for professional capacity building. The survey management team provided 2 ½ days of training to 24 potential enumerators.

Figure 2-6: Enumerator iPad Training



The training included the following components:

- Introduction to the SUWASA project;
- Familiarization with sanitation survey objectives;
- Introduction to survey content using paper forms;
- Round robin practice conducted in both English and Juba Arabic to familiarize enumerators with technical question content and translation;

- Familiarization with the iPad;
- Introduction to the iForm application for data collection including how to input data and properly save (Figure 2-6);
- Overview of sampling patterns;
- Group practice in teams.

### 2.7.2 Enumeration Team Deployment

From the initial field of 24 candidates, 16 enumerators were selected for survey work. Teams of two were assembled based on their abilities in English, Juba Arabic, their expression, and speed and accuracy with an iPad. Based on these criteria, the survey management team assembled eight enumeration teams, the majority of which included a man and a woman. Enumerators arrived at the SUWASA office at 8 a.m. daily for a briefing on the work for the day (Figure 2-7).

Figure 2-7: Morning Briefing using Google Earth



Teams were then transported to random starting points. They conducted interviews until pick up at 4 p.m. The survey management team assigned a daily target of ten interviews for each team, a target which, after eight days, most teams were able to meet.

### 2.7.3 Enumeration Team Oversight

Enumerator training did not end after the initial 2-½ day intensive training (Figure 2-8).

Figure 2-8: Sanitation Survey Enumerators



The survey management team checked enumerator performance in the field daily. After observing an enumerator team's interview, supervisors provided feedback on techniques, pacing, and keeping the respondent engaged. Teams that did not meet their interview quotas or had personality challenges were visited more frequently than teams functioning well. As a result, supervisors saw an improvement in interviewing skills and a reduction in average interview time.

## 2.8 Data Transfer and Progress Monitoring

The survey management team seamlessly transferred interview data from iPads to a cloud-based database daily. A secure login and password ensured that information management was timely and secure. Data were also backed-up daily on a local computer.

In order to track daily progress toward sample targets, basic GIS analysis was utilized to monitor how many interviews had been conducted across typologies. This daily updating allowed the survey management team to efficiently plan enumeration. In addition, enumeration teams recorded skips (empty households or households with no respondent over age 18) and interview refusals to determine whether results in certain areas would contribute to bias in the survey.

Survey enumeration finished October 10, 2013 after 14 days. The total sample size for analysis consisted of 1,054 interviews. Table 2-4 shows the final interview count by typology.

Table 2-4: Survey Interviews by Typology

Typology	Number of interviews
Type 1 - Established Formal Areas	284
Type 2 - Transitioned Formal Areas	309
Type 3 - New Formal Areas	233
Type 4 - Recent Informal Areas	228
Type 5 - Enclosed Open Space	0
<b>TOTAL</b>	<b>1,054</b>

For the analysis, all non-relatives who were interviewed were not included because they were not considered part of the household for research purposes. The results presented therefore were only for 1,032 respondents.

# 3.0 Findings of the Household Survey

## 3.1 Demographic information

The majority of respondents were from Munuki Payam (57.3 percent) and the least (0.9 percent) from Rejaf Payam (Table 3-1). A *payam* is an autonomous municipal region within Juba city limits.

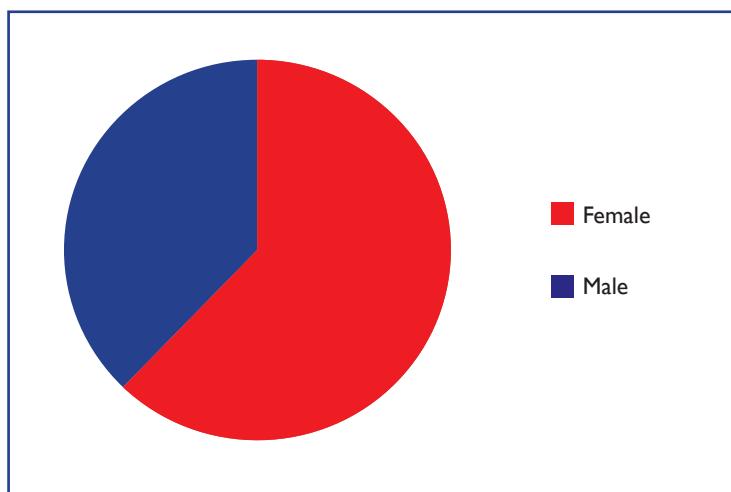
Table 3-1: Respondents by payam

Payams	Frequency	Percent
Juba	146	14.1
Kator	222	21.5
Munuki	591	57.3
Northern Bari	64	6.2
Rejaf	9	.9
Total	1,032	100.0

The number of respondents per payam represented their population densities. The survey targeted only single-story detached houses and not apartment blocks. In each compound, only one household was interviewed. The survey therefore was more targeted to local communities. This makes sense because these communities will most probably require direct government intervention. Populations in apartment blocks will mostly be able to take care of themselves.

As shown in Figure 3-1, the majority of respondents, 62 percent, were female. This was mainly due to the fact that the survey took place during the day when most males were out of the home.

Figure 3-1: Gender of Respondents



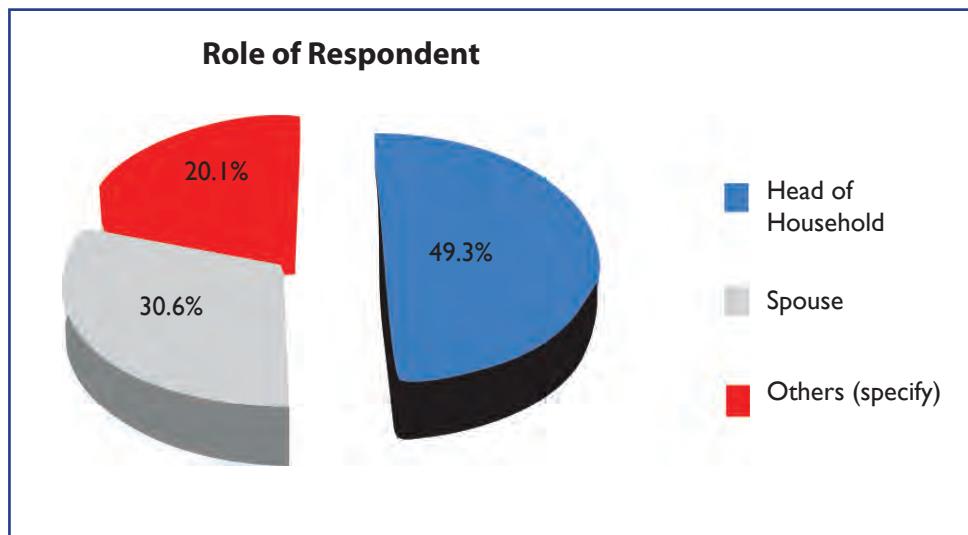
The average age for respondents was 34.12. The minimum age was 18 and the maximum, 90. The average age for women, 32.64, was less than the age for men, 36.12. The average age is representative of the relative youth of South Sudan's population. Indeed, 58 percent of South Sudan's population is under the age of 20, according to government estimates from 2012.

### 3.1.1 Role of Respondent

The respondents included (see Figure 3-2):

- 49.3 percent, heads of households;
- 30.6 percent spouses;
- 20.1 percent other adult relatives at least 18-years-old who had lived at the premises for a year or more.

Figure 3-2: Role of Respondent



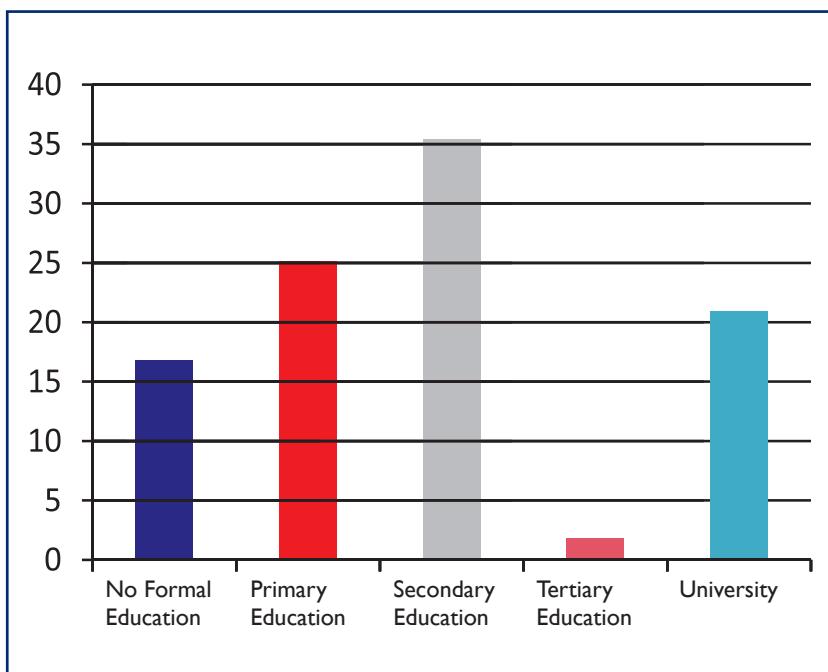
Other relatives were included in the survey because the questions were deemed simple enough to be answered by any adult member living in the household.

A discrepancy existed between the percent of female interviewees and the percent of heads of households. The high number of females should lead to more spouses than heads of households. The result suggested that most female respondents considered “head of household” to mean the person who was answering the questionnaire. As a result, the heads of households in the sample should be slightly lower than indicated in the study. National statistics, which placed the percentage of female heads of households at 46 percent in 2011, confirmed that the survey sample was high. The distinction is important because of the implications for interventions.

### 3.1.2 Education Level of Household Head

The survey also sought to establish the education level of the head of household because the head of household will be the target for most sanitation interventions. As Figure 3-3 shows, 35 percent of household heads were reported to have had secondary education, 25 percent, a primary education, 23 percent a tertiary and university education and 17 percent had no formal education. This corresponds with government statistics that reported secondary school attendance in South Sudan’s Central Equatoria State at 37 percent in 2009. The national figure for secondary school attendance was 22 percent.

*Figure 3-3: Education Level of Household Head from the Study*



### 3.1.3 Household Characteristics

On average, households had 5.38 adults, 2.35 children between 6 and 18, and 1.63 children under the 5 (Table 3-2).

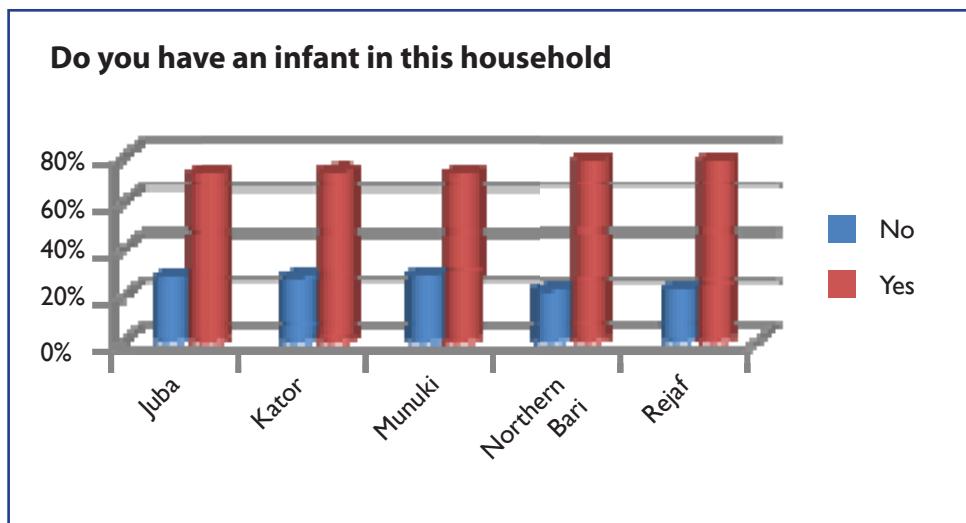
*Table 3-2: Household Size Characteristics*

In the household	Number	Minimum	Maximum	Mean	Standard deviation
Adults	999 <sup>1</sup>	1	30	5.38	3.483
Age 6 to 18	999	0	13	2.35	2.113
Under 5	999	0	9	1.63	1.509
Total	999	1	42	9.36	5.197

The average household size was 9.36 people, slightly higher than the reported national urban household size of 7.1 (NBS 2012:13). There were more adults than children in the households in keeping with the cultural practice in which those with the financial capacity house relatives from the extended family. The practice also explains the large household sizes. For instance, out of the 1,032 respondents, 4 percent had more than 20 people in a household. The highest household size was 42. Nationally, 3 percent of urban households were reported to have more than 15 in 2009 (NBS 2012:13). A survey of annual needs and livelihoods from 2011 found that the national average household size was 8.8 with a range of 3 to 24 household members (GOSS 2011:64).

Despite the high number of adults in households, it is also worth noting the high presence of children under-five in payams, where more than 72 percent of households are located (Figure 3-4).

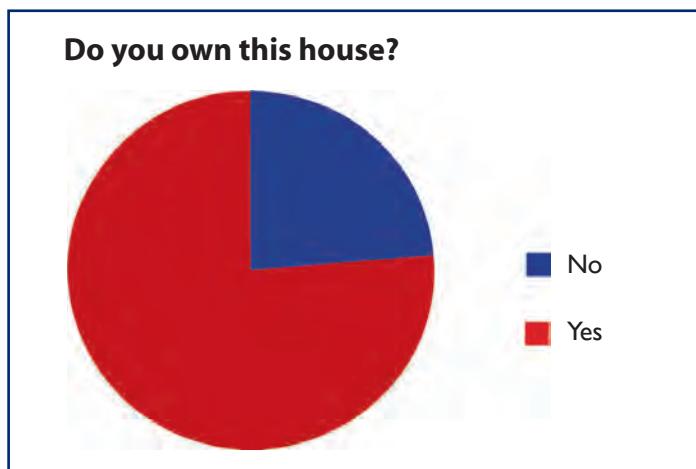
*Figure 3-4: Infant in Household*



### 3.1.4 Land Tenure

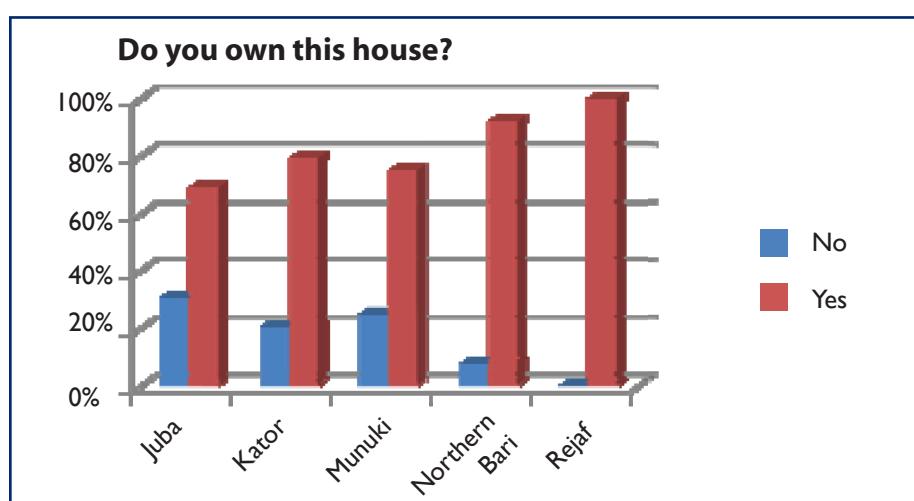
The majority of respondents in all three categories, 76 percent, indicated that the house they were living in was owned by the household. Only 24 percent indicated that they did not own the house.

*Figure 3-5: Ownership of House*



Of those who did not own the house, only 25 percent were tenants. Of respondents who did not own the house, 3 percent were not renting the premises – people most likely staying in a family home or looking after the property for a relative. Home ownership was high across all payams, averaging above 69 percent (Figure 3-6).

*Figure 3-6: Ownership of House by Payam*



### 3.2 Sanitation

As shown in Table 3-3, 81.4 percent of respondents indicated that they had a working toilet.

Table 3-3: Do You Have a Working Toilet?

Description	Frequency	Percent
No	192	18.6
Yes	840	81.4
Total	1,032	100.0

Reported access to toilets was high across all payams as shown in Figure 3-8. However further analysis suggests that respondents were not necessarily reporting the toilets in their homes, but were also reporting toilets they were sharing with other households and neighbors.

Figure 3-7: Geographic Distribution of Toilets in Juba

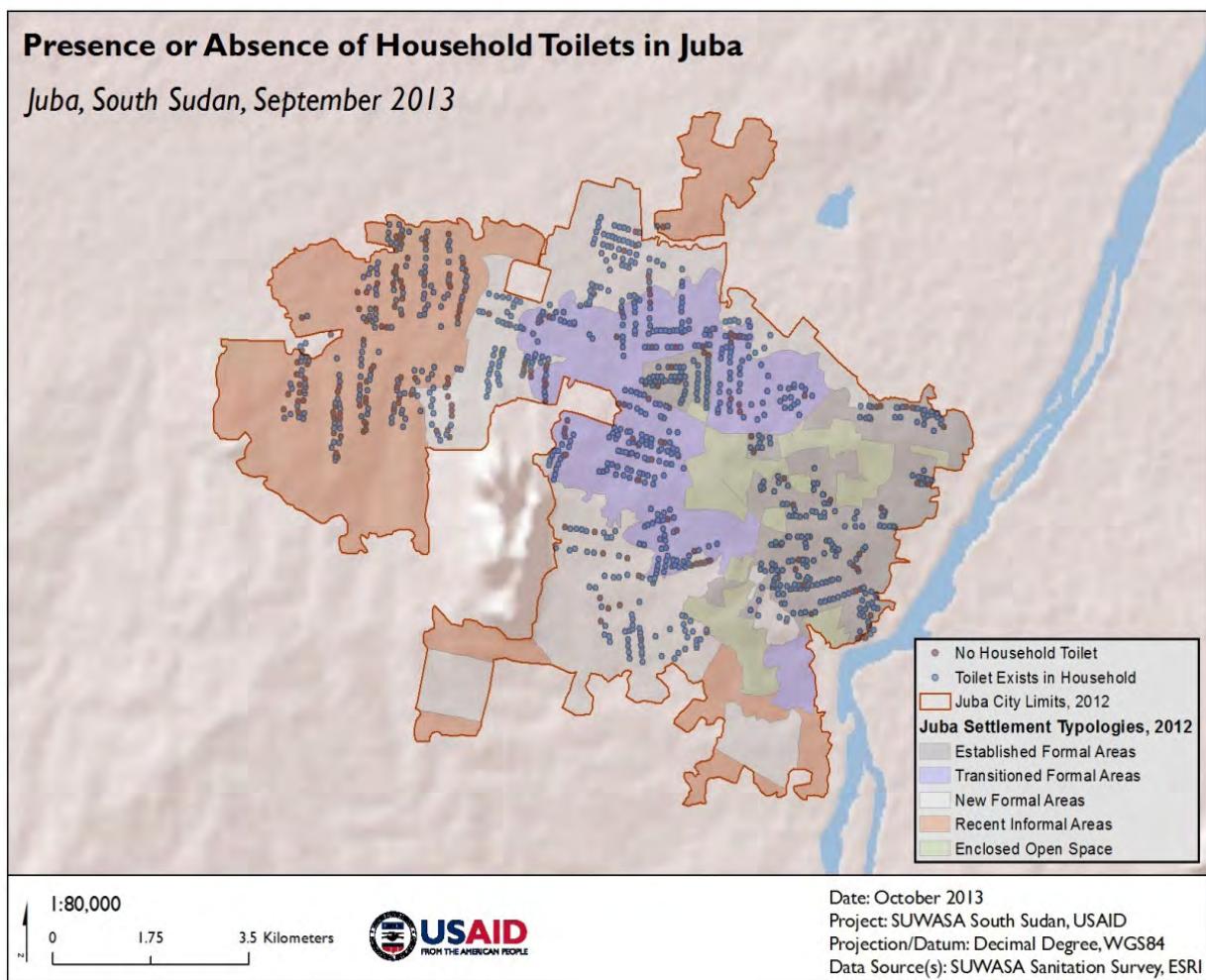
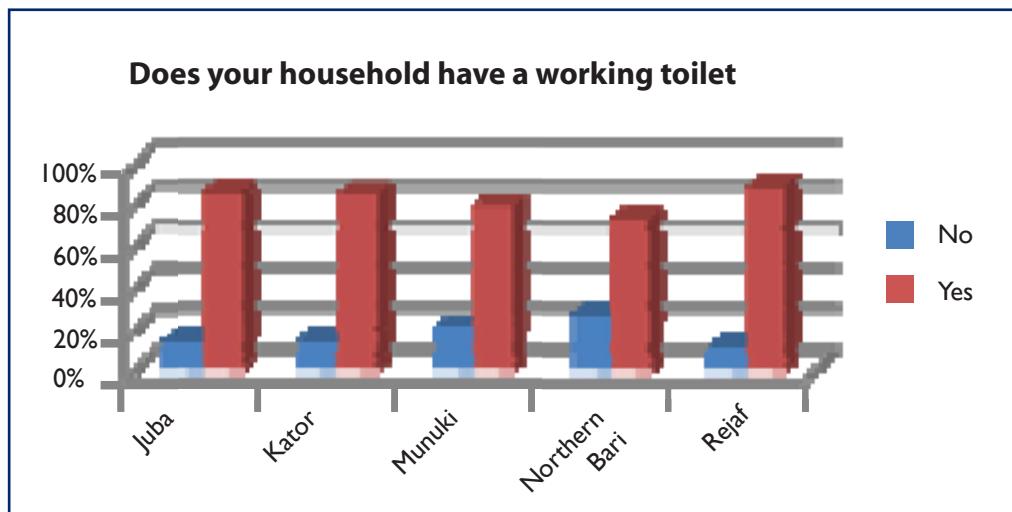


Figure 3-8: Presence of Household Toilet by Payam



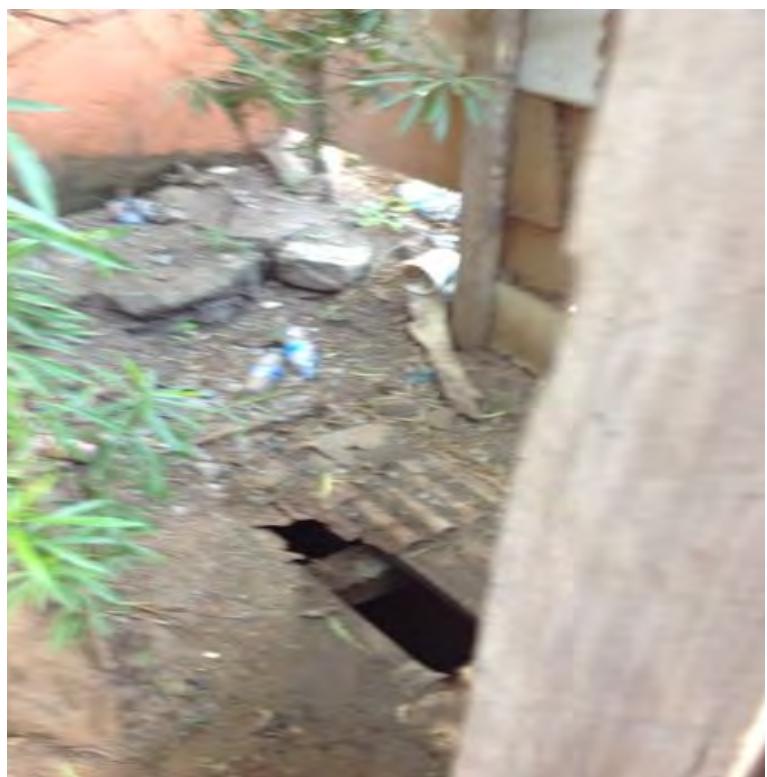
For instance, when asked whether respondents shared their toilets, only 55.8 percent said they did not share a toilet (Table 3-4).

Table 3-4: Do You Share Your Toilet with Other Households

	Do you share this toilet with other households?			Total
Type of toilet facility	No toilet facility	No	Yes	
No toilets facility	192	0	0	192
	100.0%	.0%	.0%	100.0%
Latrine	0	499	254	753
	.0%	66.3%	33.7%	100.0%
Bucket	0	1	0	1
	.0%	100.0%	.0%	100.0%
Compost toilet	0	7	1	8
	.0%	87.5%	12.5%	100.0%
Flush/pour flush	0	64	13	77
	.0%	83.1%	16.9%	100.0%
Hanging toilet or hanging latrine	0	0	1	1
	.0%	.0%	100.0%	100.0%
Total	192	571	269	1032
	18.6%	55.3%	26.1%	100.0%

Further analysis of those who said they had no toilet shows that the majority (151) were using their neighbors' toilet. This brings the number of those sharing toilets to 732 rather than the reported 571. It can therefore be concluded that 55.3% of households have access to an individual toilet, 40% share a toilet facility, whilst the remaining 4.7% have no access to a toilet. In addition, physical observation of toilets indicated that many toilets did not meet minimum required standards of cleanliness, privacy and safety (see Figure 3-9).

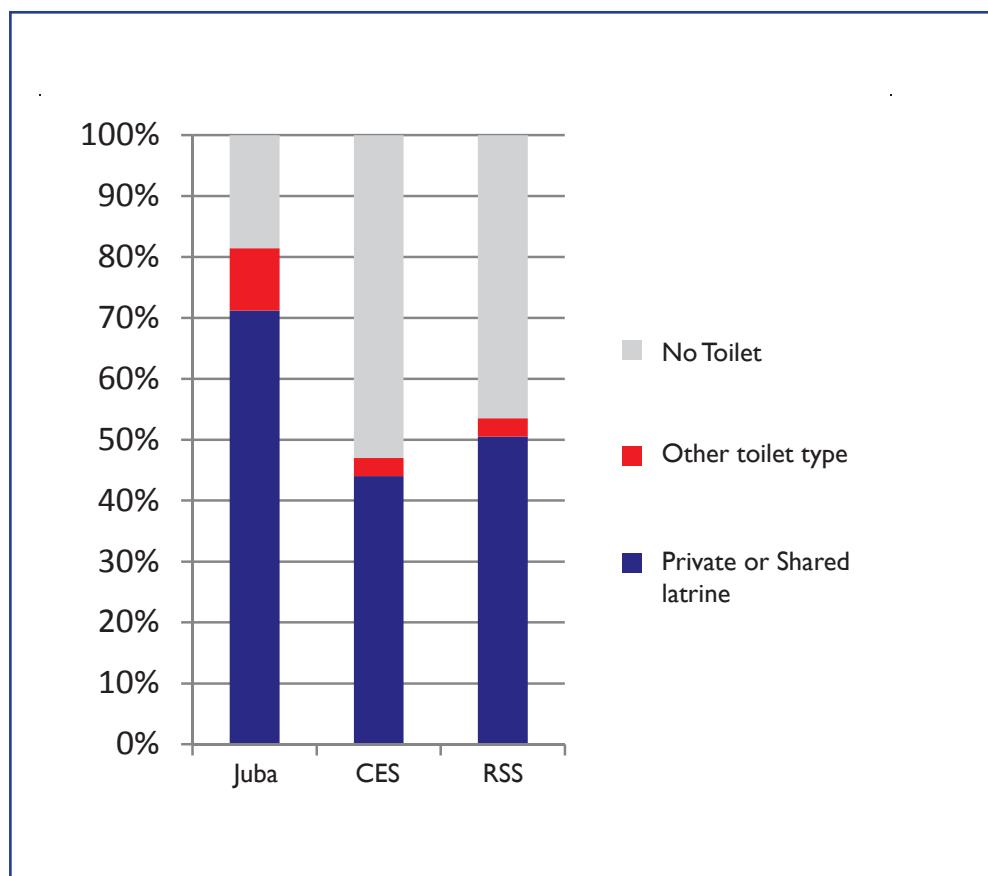
Figure 3-9: Unhygienic Toilet



Taking into consideration the variables, it can be concluded that only 55.8 percent of households have access to a toilet; 26 percent shared a toilet, and the remaining 18 percent have no access to a toilet. Of the households sharing a toilet, an average of 4 households were sharing one toilet. With an average household size of 9.3, this means that a toilet serves 37 people, a figure far above the accepted standards.

Despite high levels of toilet sharing, the survey still seems to suggest that residents of Juba had slightly better access to a toilet than residents of South Sudan and Central Equatoria in 2009 (Figure 3-10 below).

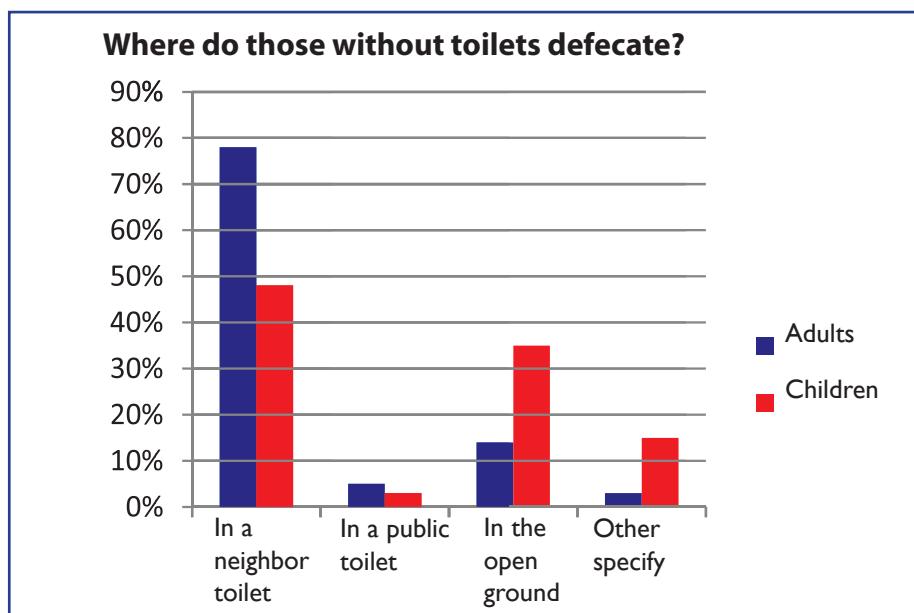
Figure 3-10: Comparison of Access to Toilets in Juba, Central Equatoria and Urban South Sudan



### 3.2.1 Lack of Toilets and Open Defecation

Of the 4.7% who indicated that they did not have a toilet, the majority of both adults and children used the open ground (65%), 21% used public toilets and 14% used other means (Figure 3-11). It is therefore noteworthy that open defecation is still an issue in Juba, despite the rapid transformation of the city into an urbanized area.

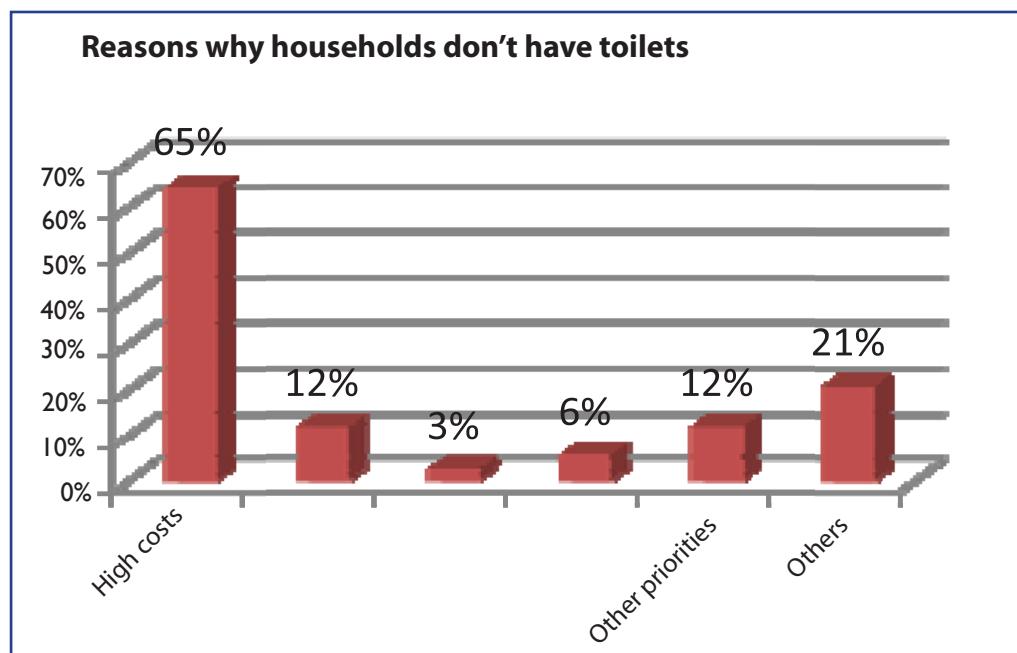
Figure 3-11: Where do those without Toilets Defecate?



### 3.2.2 Reasons for Not Having a Toilet

Those who did not have a toilet reported six reasons. To analyze the most frequent reasons, each reason has been analyzed as a percentage of the total number of respondents who answered this question, n=192. Figure 3-12 shows responses.

Figure 3-12: Reasons for Not Having a Toilet



The majority of respondents, 65 percent, indicated high costs as the main reason; 21 percent had other reasons; and 6 percent indicated that they did not know how to purchase a toilet. More than 27 percent of respondents either had other priorities, had access to other toilets or were satisfied with current practices such as sharing a toilet with other households – a cause for concern. This finding suggests that significant effort will be required to change attitudes about the value hygienic sanitary facilities.

### 3.2.3 Type of Toilet Facilities

Results of the survey suggest that 89.6 percent of respondents used a pit latrine, 9.2 percent used either a flush or pour flush toilet, 1 percent used double vault latrines, which are referred to as composting toilets, and 0.2 percent used a bucket latrine or a hanging toilet. Figure 3-13 shows three different types of toilets found in the survey.

*Figure 3-13:Toilet Types in Juba (Clockwise from top left: pour flush, flushing, cement-floored pit latrine, pit latrine)*



Table 3-5: Toilet Type by Payam

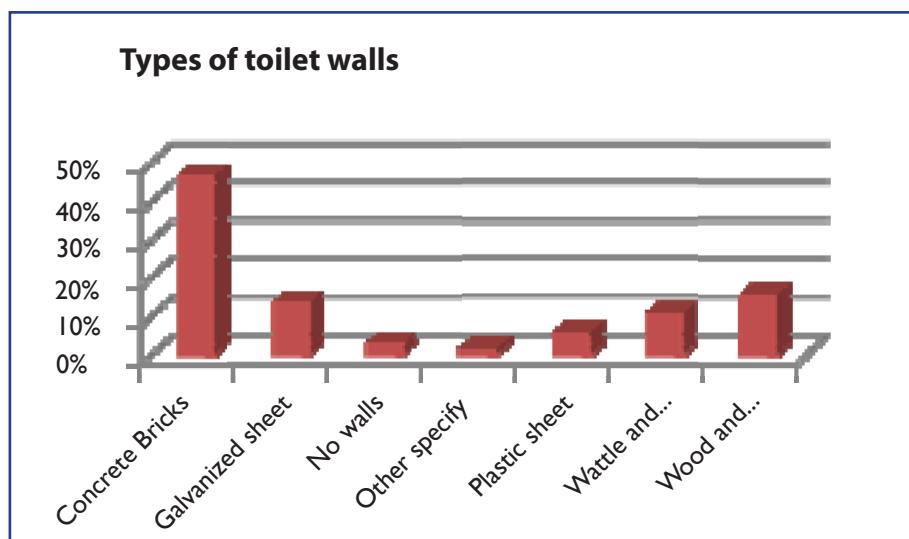
	Toilet type				Total
Payams	Latrine	Composting toilet	Flush/pour flush	Hanging toilet/hanging latrine	
Juba	105	3	14	0	122
	86.1%	2.5%	11.5%	.0%	100.0%
Kator	156	3	24	0	183
	85.2%	1.6%	13.1%	.0%	100.0%
Munuki	414	2	39	1	456
	90.8%	.4%	8.6%	.2%	100.0%
Northern Bari	47	0	0	0	47
	100.0%	.0%	.0%	.0%	100.0%
Rejaf	8	0	0	0	8
	100.0%	.0%	.0%	.0%	100.0%
Total	730	8	77	1	816
	89.5%	1.0%	9.4%	.1%	100.0%

Kator, Juba and Munuki payams recorded the largest number of flush toilets – 13.1 percent, 11.5 percent and 8.6 percent respectively. Even in these payams, only 4 properties had a piped sewerage connection. The low rate of sewerage access was recorded, in part, because the survey did not include ministerial and government compounds, which have sewer service. Pit latrines were the most common kind of toilet throughout the payams, accounting for over 85 percent toilets. Double vault pit latrines were often used as composting toilets, suggesting that ecological toilets could potentially provide a sanitation option in the area.

### 3.2.4 Toilet Construction Materials

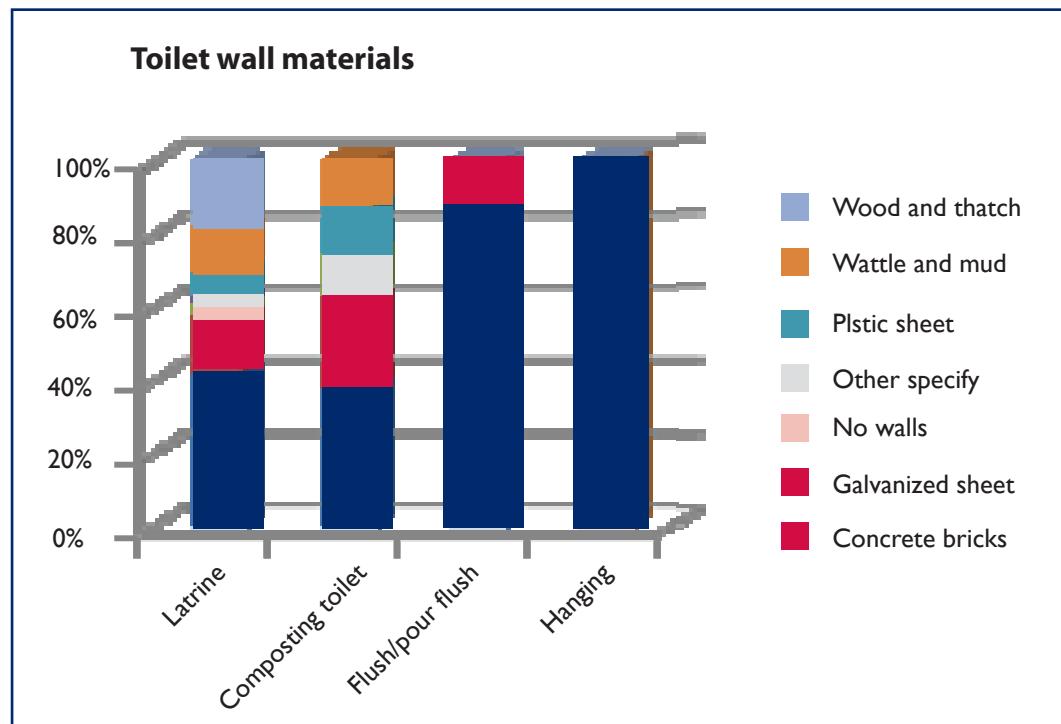
The survey found that households use a wide range of materials for toilet construction. The majority of toilet walls, 47 percent, were constructed with concrete blocks; 16 percent used wood and thatch; 14 percent used galvanized iron sheets; 11 percent used wattle and mud; and 6 percent used plastic.

Figure 3-14: Materials Used for Toilet Walls



In general, pit latrines were constructed of multiple materials. Flush toilets were usually more permanent and mostly constructed with concrete blocks (Figure 3-15).

Figure 3-15: Materials Used for Toilet Walls by Toilet Type



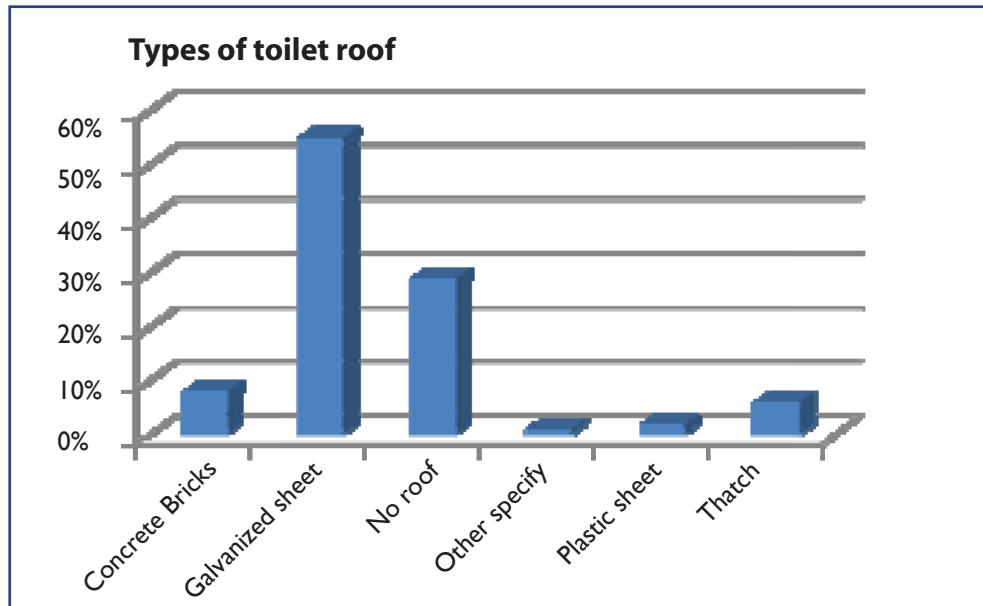
The majority of toilets, 55 percent, used galvanized iron sheet roofing: 54.1 percent of latrines used galvanized iron sheet roofing, 57.1 percent of flush toilets, and 62.5 percent of composting toilets (Figure 3-16; Figure 3-17).

Figure 3-16: Concrete Block Toilet with Iron Roofing Sheet



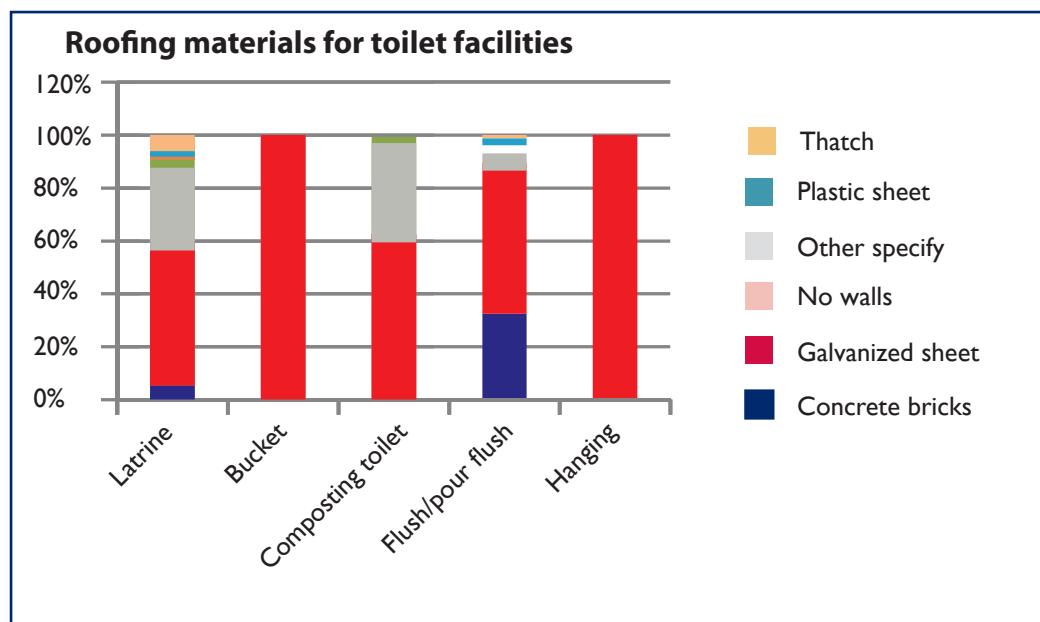
Only 7.7 percent of toilets had a concrete roof: 32.5 percent of them were flush toilets and 5.3 percent were pit latrines (Figure 3-17). Thatch roofs accounted for 5.7 percent of toilets, 6.2 percent of them were for pit latrines.

Figure 3-17: Materials Used for Toilet Roofs



It should be noted that almost a third of toilets, 29 percent, had no roofs: 6.5 percent of these toilets were flush toilets and 31.3 percent were latrines (see Figure 3-18). The lack of roofs and variety of materials suggests that toilets may not yet be regarded as an important, permanent structure.

Figure 3-18: Materials Used for Toilet Roofs by Toilet Type



The lack of roofing and permanence also indicated that the toilets were neither private nor secure, a concern particularly for women and children.

Figure 3-19: Roofless Iron Sheet Toilet



### 3.2.5 Septic Management

Only four properties in the survey had a sewer connection and only 5 percent of households had a septic tank (Table 3-6).

Table 3-6: Septic Management by Toilet Type

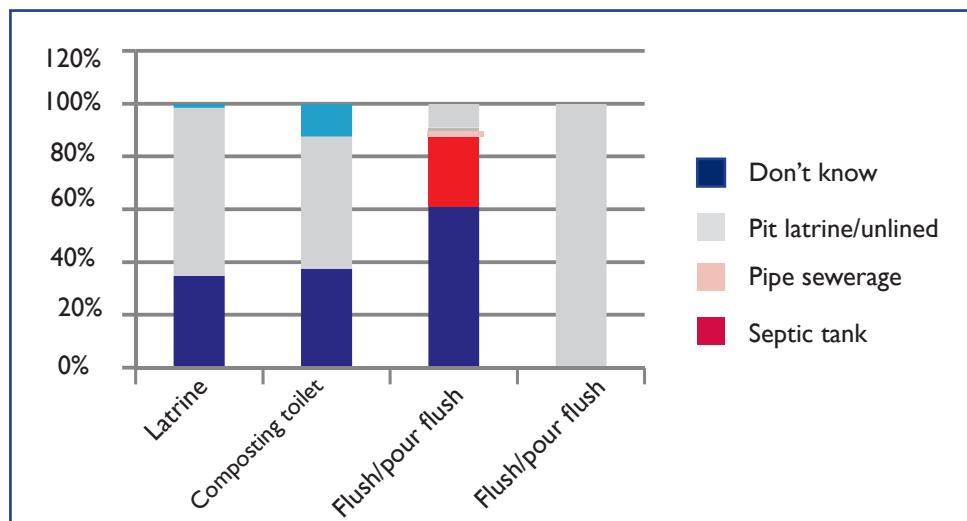
Description	Frequency	Percent
Piped sewerage	4	0.5%
Septic tank	22	2.7%
Concrete or other lining	304	37.3%
Pit latrine/unlined pit	477	58.5%
Don't know	12	1.5%
Total	816	100

*Figure 3-20: Flush Toilet with Manhole Leading to Septic Tank*



Of flush toilets, 28.6 percent had a septic tank. The majority of toilets, 61 percent, had some kind of lined underground structure, which may or may not have been a septic tank. Almost a tenth, 9.1 percent, of pour flush toilets were reported to be running their sewage straight into the environment through unlined pits. Even more worrisome, 63.7 percent of pit latrines were unlined. Of the 34 percent that were lined, it was not clear what materials were used (Figure 3-21).

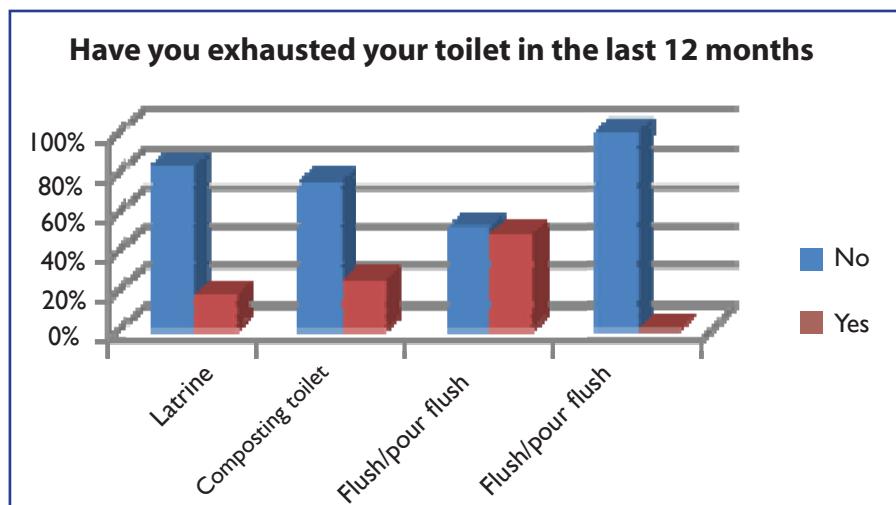
*Figure 3-21: Septic Management by Toilet Type*



### **3.2.6 Exhausting of Toilets**

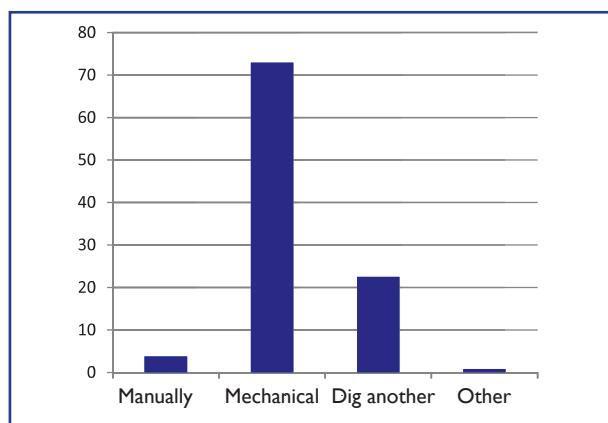
Only 20 percent of respondents had exhausted their toilets in the past 12 months: 17.7 percent of respondents with pit latrines, 25 percent of respondents with composting toilets and 48.1 percent of respondents with pour-flush toilets (Figure 3-22).

Figure 3-22: Exhaustion by Toilet Type



Of those who answered the question on exhausting the toilet, 72.9 percent had used a mechanical exhauster. Only 3.75 percent exhausted manually.

Figure 3-23: Methods of Toilet Exhaustion

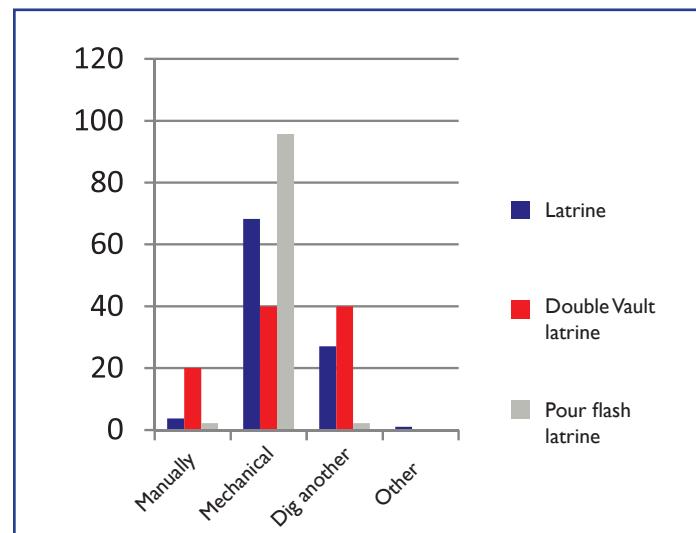


Over a fifth of respondents, 22.5 percent, did not exhaust their toilet but dug another pit and 0.8 percent used other means including chemicals to reduce the fecal matter in the pit. For respondents with pour flush toilets, 95.6 percent used mechanical exhausters (Figure 3-25).

Figure 3-24: Private Exhauster at Work in Juba

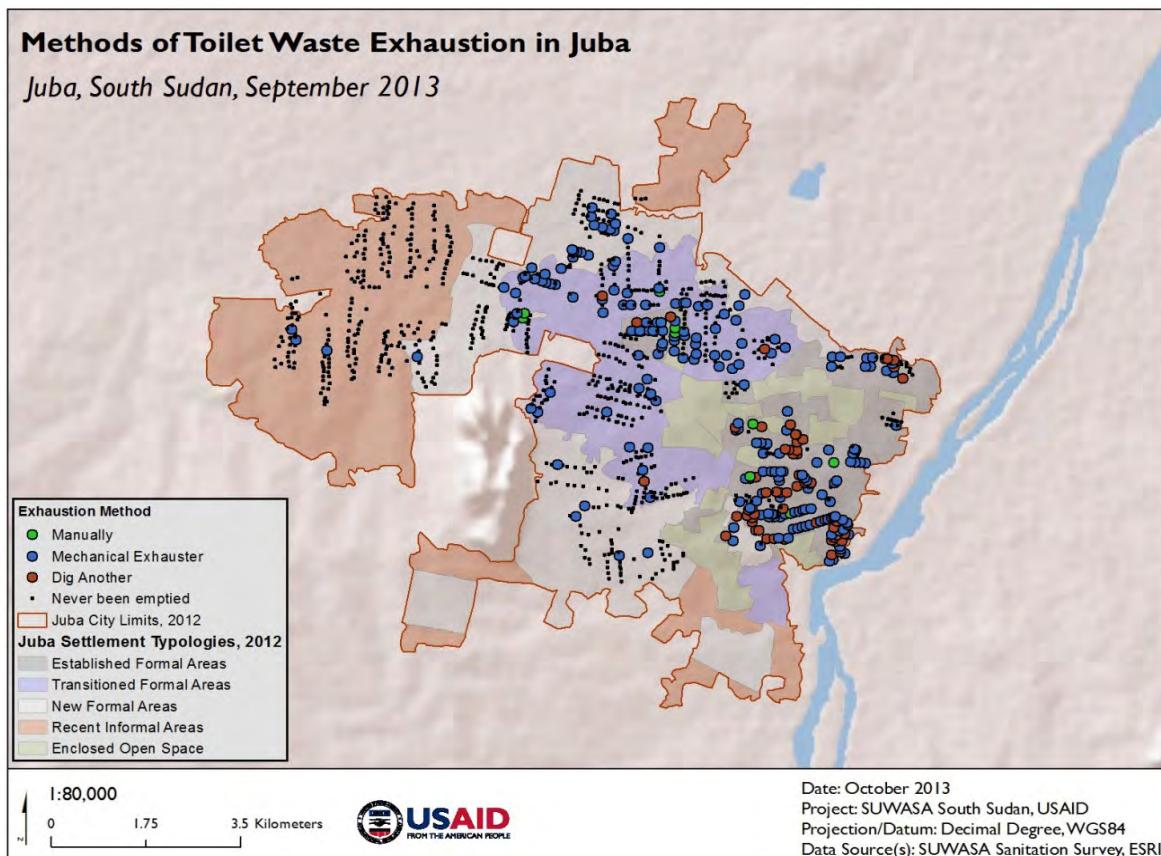


Figure 3-25: Method of Exhaustion by Toilet Type



The percent of respondents with pit latrines who used mechanical exhaustion was 68. However a quarter of respondents with pit latrines reported digging a new pit. However it should also be noted that mechanical exhausting is practiced more in some parts of the city than in others.

*Figure 3-26: Geographic Distribution of Mechanical and Manual Exhausting*

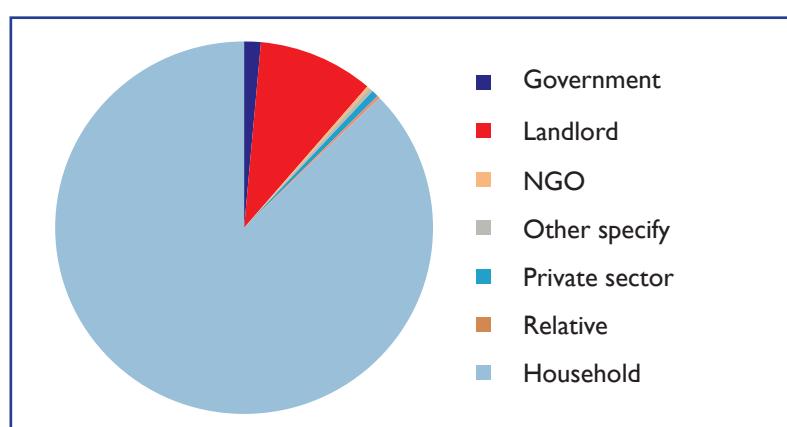


The average cost of exhausting is SSP299.49, approximately US\$51, and on average, households reported exhausting their toilet 2.45 times a year.

### 3.2.7 Financing of Toilets

The majority of respondents, 87.5 percent, reported that their toilet was paid for by the household and 9.9 percent indicated that the toilet was financed by the landlord. That means that 99 percent of toilets were financed by the owner of the property. Financing by the government, NGOs or the private sector was rare, indicating that a culture exists in which the cost of a toilet is the responsibility of the household.

*3-27: Financing of Toilets*

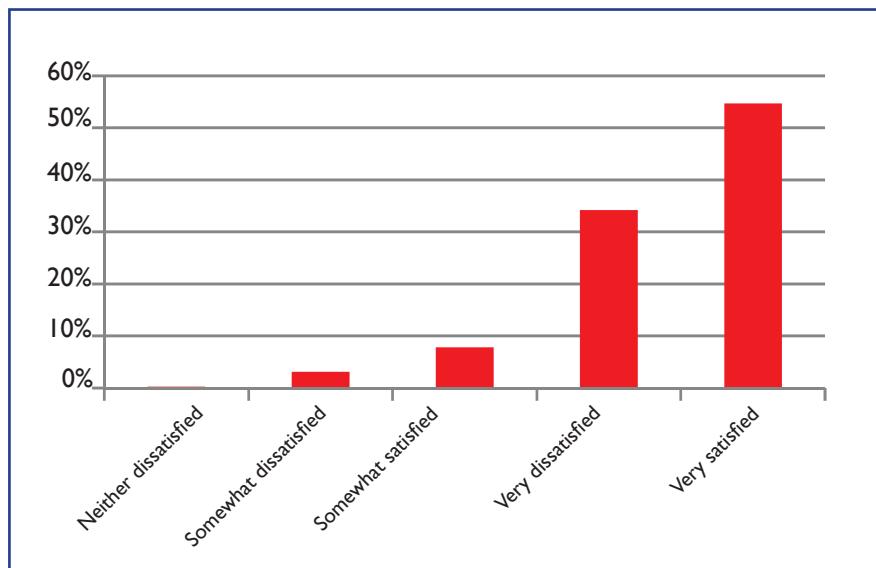


The result may also indicate that neither governments nor donors have been active in the household sanitation sector. Regardless, interventions should be demand driven.

### 3.2.8 Satisfaction with Toilet Facilities

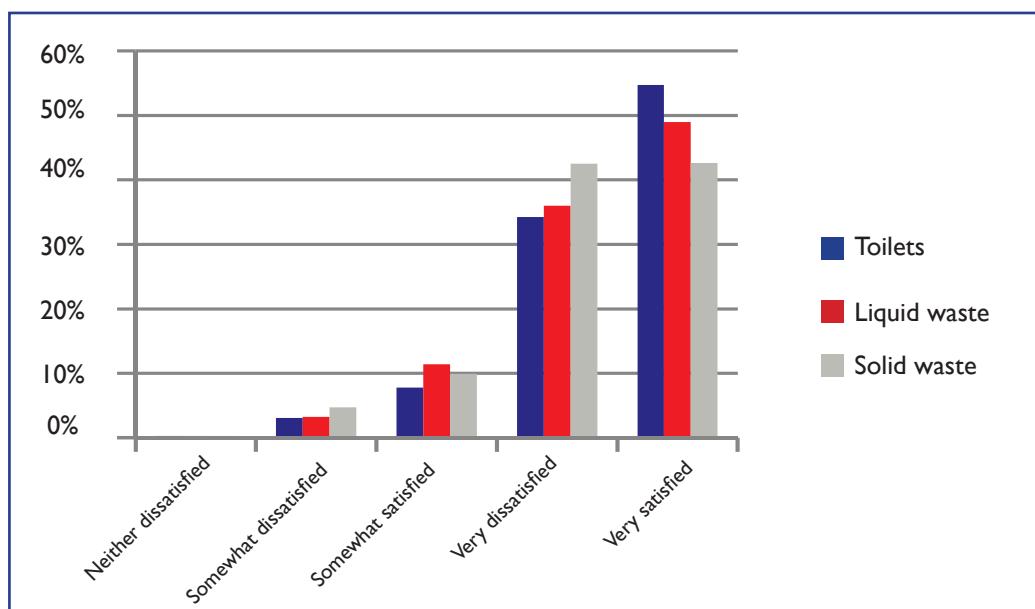
Despite low access numbers, 54.7 percent of respondents indicated that they were very satisfied with their sanitation facilities and services. The percentage included 63.5 percent of those who had toilets and 16.1 percent of those who did not have a working toilet (Figure 3-28).

Figure 3-28: Satisfaction with Toilet Facilities



Respondents were more satisfied with their toilets than they were with solid and liquid waste management services (Figure 3-29).

Figure 3-29: Comparison of Satisfaction with Other Municipal Services



The high level of satisfaction was surprising because of high rates of toilet sharing, the lack of privacy and the inadequacy of most toilets (Figure 3-30).

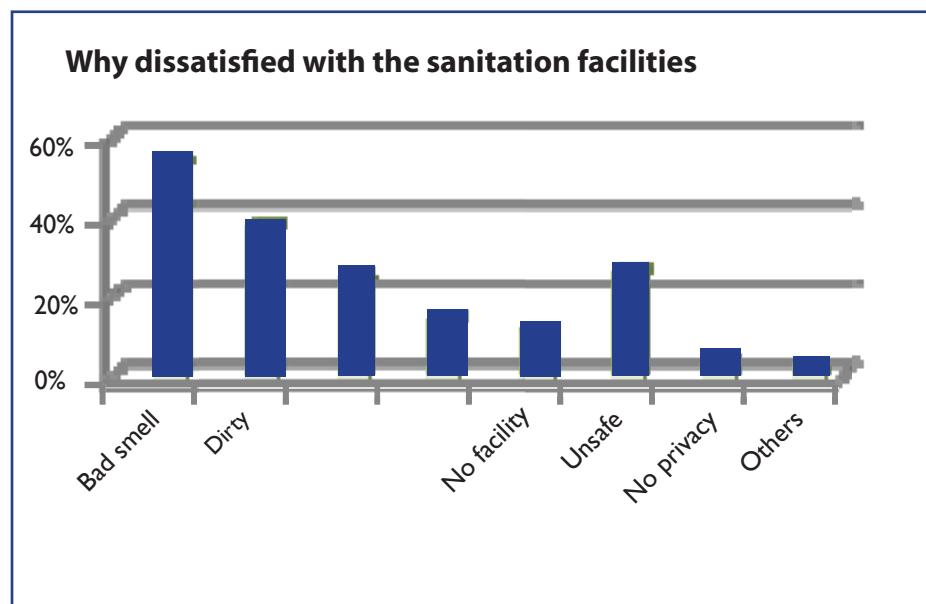
Figure 3-30: Toilet with Limited Privacy and Security



The Juba City Council has been engaged in an ongoing solid waste management improvement project financed by the Japan International Cooperation Agency (JICA). As a result, much less satisfaction with toilets and much higher satisfaction with solid waste services was expected. However, the high level of satisfaction with toilets could be attributed to low levels of expectation.

Despite the high level of satisfaction with toilets, 34.2 percent of respondents were dissatisfied with the facilities. Most dissatisfied, 65.6 percent, were those who had no toilets. Over a quarter of those who had a toilet, 27 percent, were also dissatisfied with the facilities.

Figure 3-31: Reasons for Dissatisfaction with Sanitation Facilities



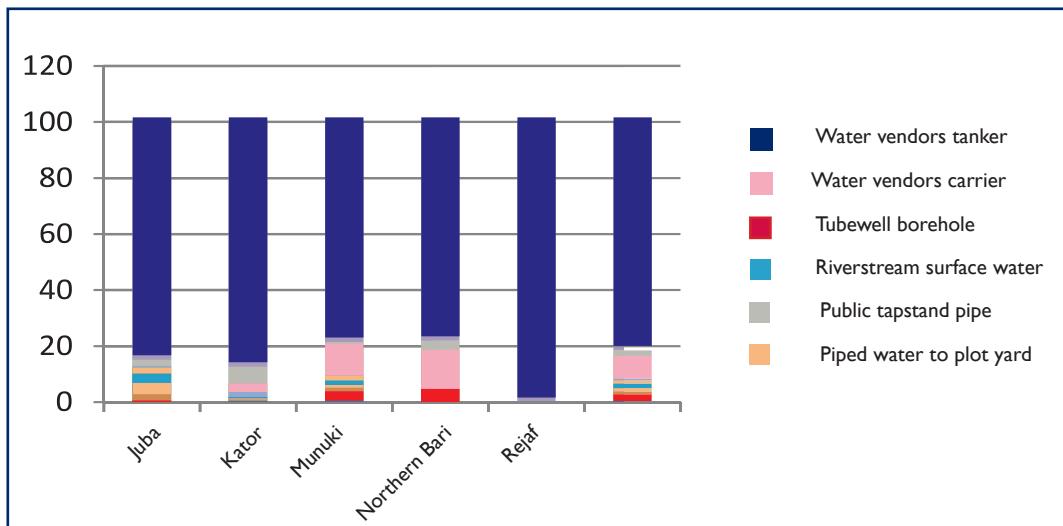
The most common reason for dissatisfaction was bad smells, 54.2 percent. Other reasons were dirty facilities, 38.18 percent, unsafe facilities, 26.49 percent, far away facilities, 24.94 percent, and long waits, 14.8 percent.

Overall, the survey indicated that toilet facilities do not offer the desired sanitary, safety and privacy. Despite the necessity of sharing and the poor construction, only 4.16 percent of respondents said privacy was a concern, despite the fact that 62 percent of respondents were female.

### 3.3 Sources of Domestic Water

The majority of households in all payams, 81 percent, obtained drinking water from water vendors, mostly from tankers. The low percent of water from tankers was 78 percent in Northern Bari and Munuki and the high was 100 percent in Rejaf.

Figure 3-32: Sources of Drinking Water



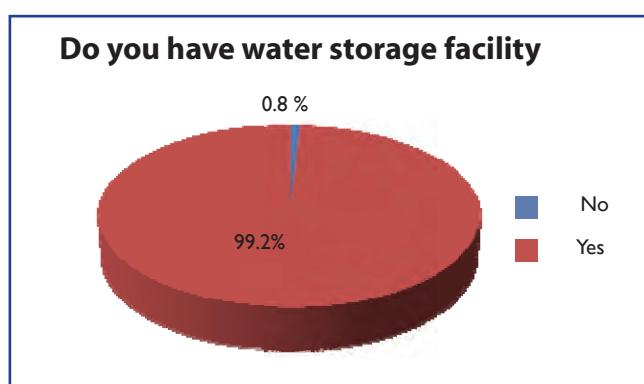
Tube wells were the second most common source, 8 percent. Piped water to the plot was extremely low, 1.5 percent, as was access from public stands, 1.1 percent. Water access from hand-dug wells and rivers and streams was very low, 2.3 percent and 0.5 percent respectively.

Because of the low rate of water access from hand-dug wells and rivers and streams, it is easier to control water-related diseases. However, strict regulation of the water tanker operations is needed to ensure the safety of the water being delivered. The survey also indicates the potential for positive attitudes towards paying for water services since the community is already used to purchasing water from tankers. In the long term, any plans to expand access through the public water network also needs to look at the economic impact on the water vendors.

#### 3.3.1 Safe Water Practices

Because of high reliance on tanker or carried water, almost every household had a water storage facility (Figure 3-33).

Figure 3-33: Presence of Water Storage Facility

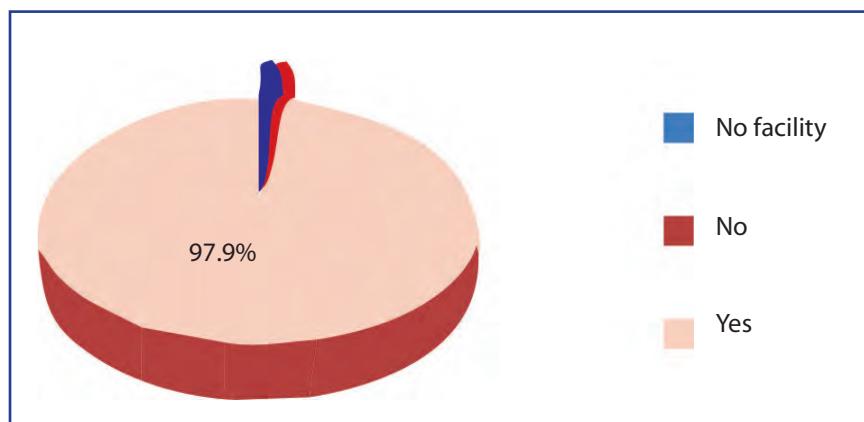


*Figure 3-34: A Typical Water Storage Tank next to a Toilet Block*



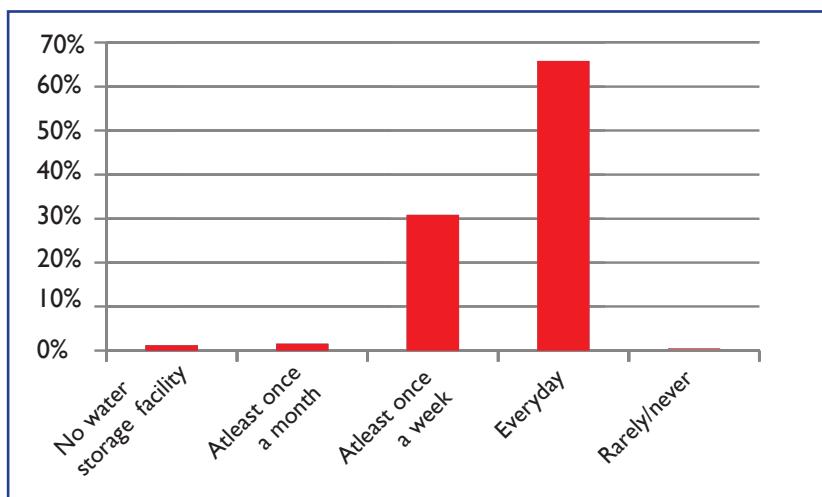
Almost all water storage facilities were reported to be covered – a good sign for hygiene and water safety (Figure 3-35).

*Figure 3-35: Covering of Water Storage Facility*



Over 98 percent of respondents indicated that they cleaned their water storage facilities: 65.8 percent indicated that they cleaned the water storage facility daily, 30.9 percent, at least once a week, and 1.6 percent, at least once a month (Figure 3-36). These findings are also good news for hygiene and water safety.

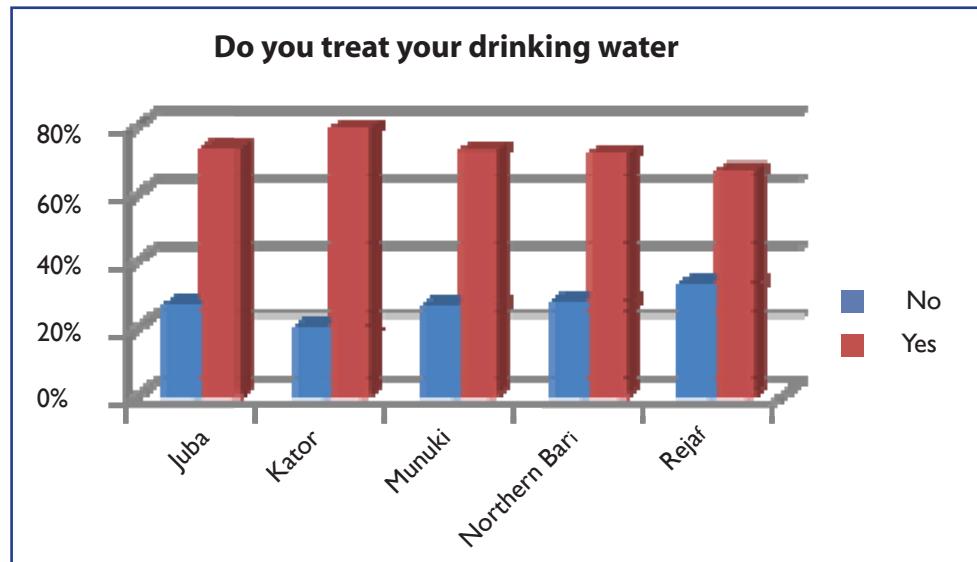
*Figure 3-36: Frequency of Cleaning Water Storage Facility*



### 3.3.2 Treating Drinking Water

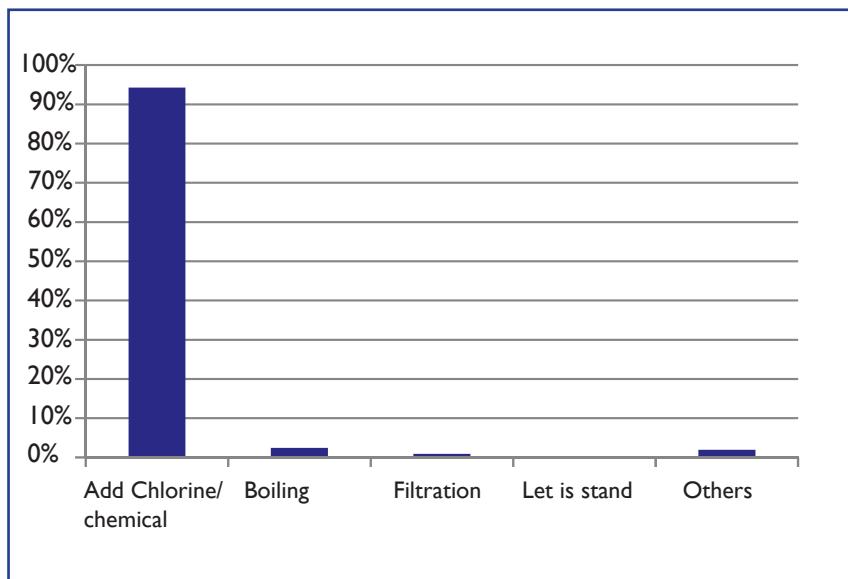
More than 74 percent of respondents indicated that they treat their drinking water and 25.8 indicated that they did not. The latter finding is a concern because almost everyone gets their water from a vendor and over 72 percent indicated that they had an infant in the household.

Figure 3-37:Treating Drinking Water



Adding chlorine or another chemical was the method used by 94 percent of respondents. Other methods included boiling, filtration and letting the water settle (Figure 3-38).

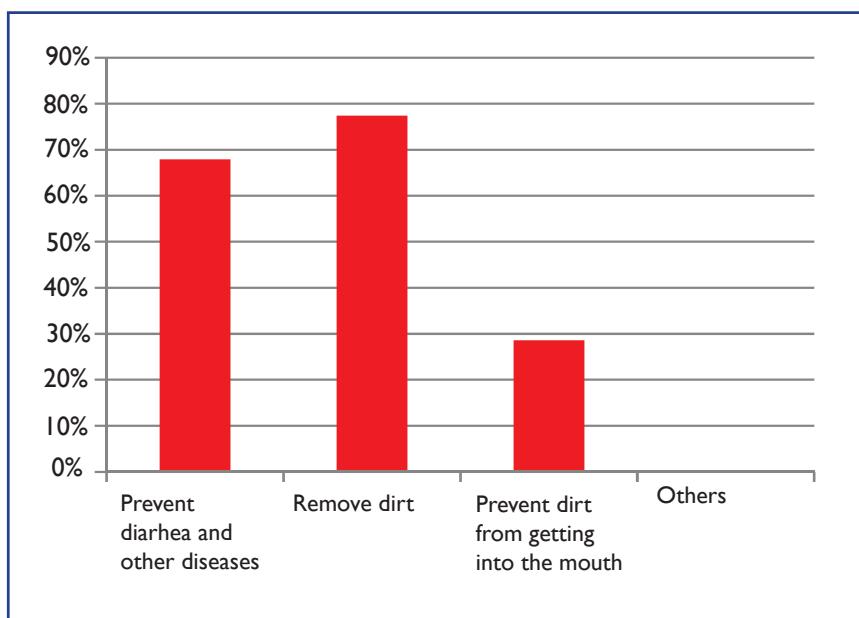
Figure 3-38: Methods of Treating Water



## 3.4 Hygiene and Health

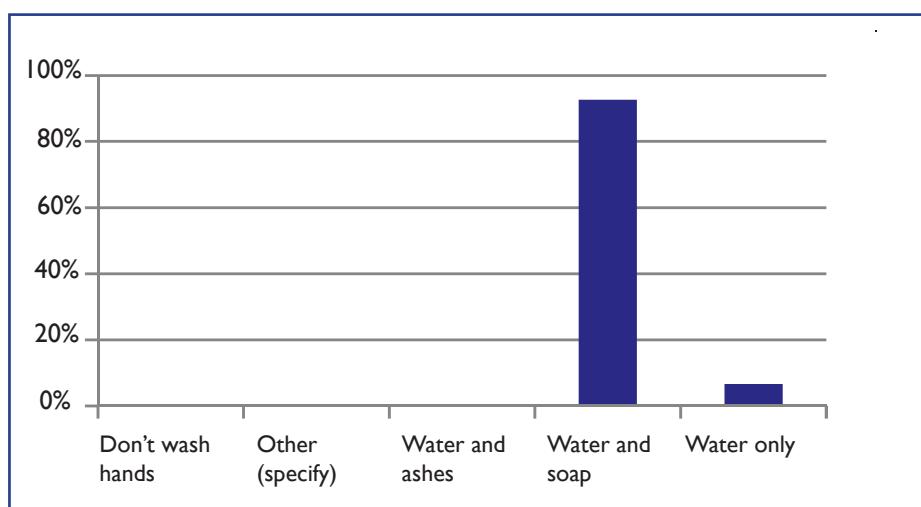
When asked about the importance of washing hands, 99.8 percent of respondents indicated that washing their hands was important: 77.4 percent indicated that removing dirt was the most important reason, 67.9 percent indicated preventing diarrhea and 28.6 percent said preventing dirt from getting into the mouth (Figure 3-39).

*Figure 3-39: Importance of Washing Hands*



A very high number of respondents, 92.7 percent, reported that they washed their hands with soap and water and only 6.6 percent said they washed their hands with water only (Figure 3-40).

*Figure 3-40: What Do You Use to Wash Your Hands*



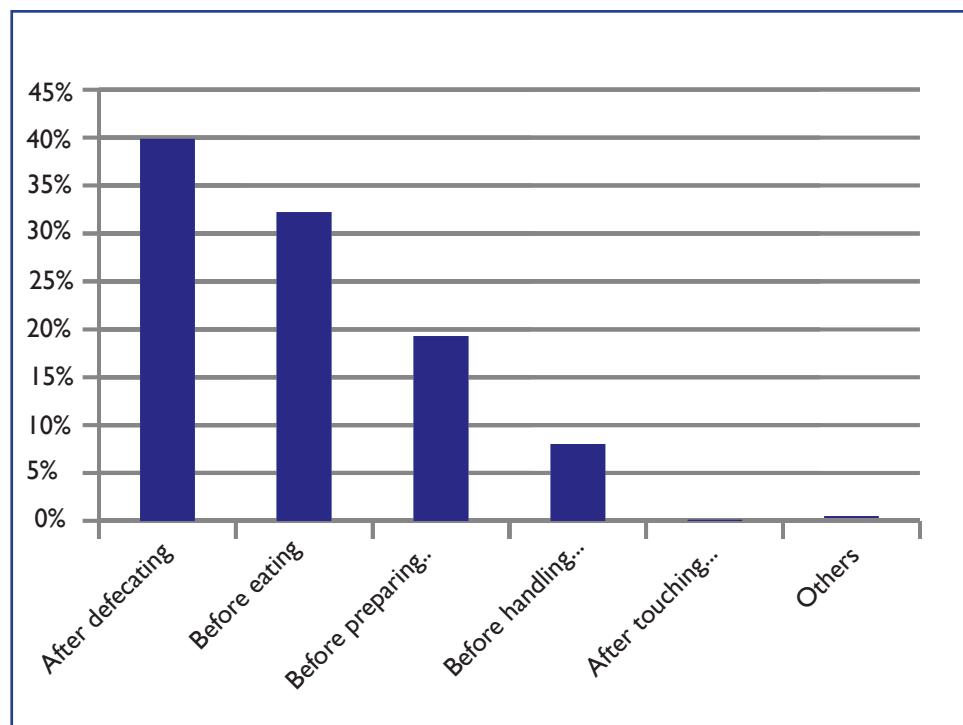
Despite the high level of reported hand washing, 46.4 percent reported that they had no hand-washing facility, 26 percent reported that the hand-washing facility was inside the yard or compound, 21.6 percent reported that the facility was inside or next to the latrine, and only 5.1 percent that it was inside the house or bathroom.

Figure 3-41: Hand-washing Basin Outside a Toilet Block



Despite the reported high level of hand washing, only 39.9 percent indicated that they wash their hands after defecating, 32.2 percent before eating, 19.3 percent before preparing food and only 8 percent after handling a child's feces.

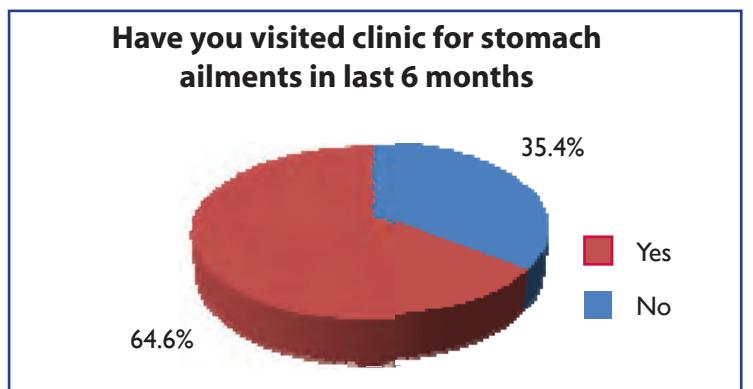
Figure 3-42: When Do You Wash Your Hands?



The hand-washing findings are worrisome given that the majority of respondents were female and would therefore be handling water, food and children younger than five. There is a great need for hygiene promotion within the city.

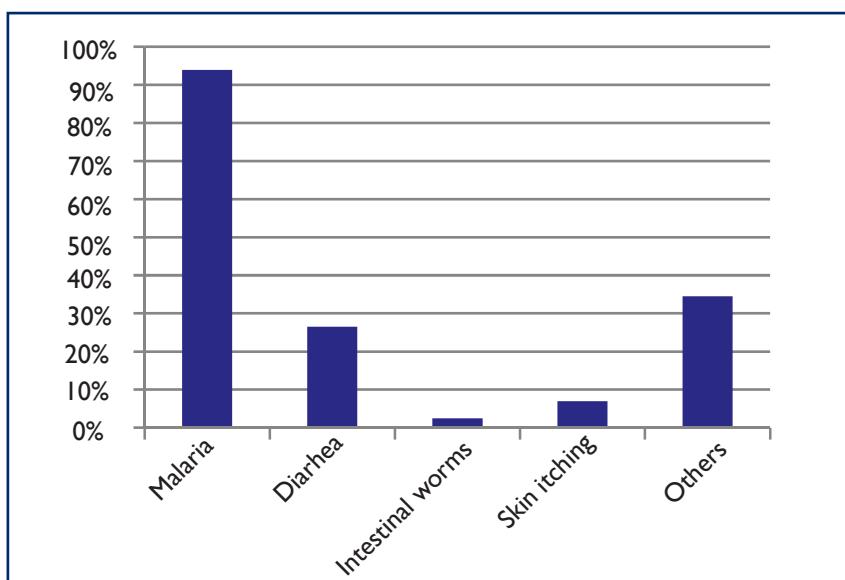
The survey may, however, also explain the high frequency of household visits to clinics for stomach ailments. As shown below, 64.4 percent of respondents indicated that a member of the household had visited the clinic in the last six months. Average number of clinic visits was 5.74 times per year.

*Figure 3-43: Visits to the Clinic for Stomach Ailments*



When asked what common diseases are experienced in the household, the majority, 93.9 percent indicated malaria. Diarrhea was reported in only 26.5 percent of cases (Figure 3-44).

*Figure 3-44: Common Diseases Experienced in Household*



### 3.5 Communication Channels

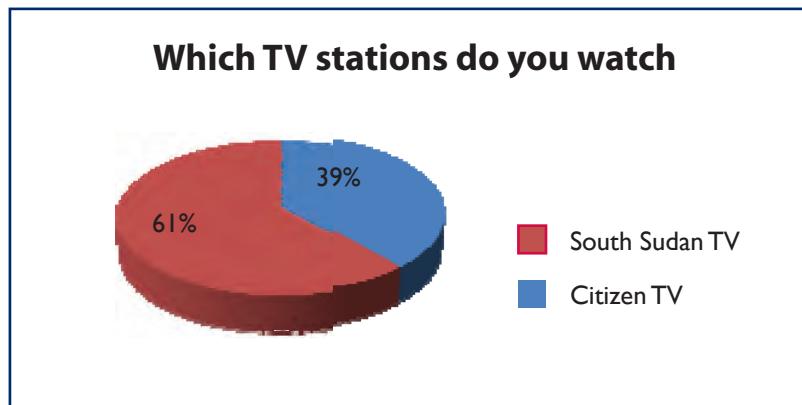
The survey found that very few respondents, 4.2 percent, watched television (Table 3-7).

*Table 3-7: Do You Watch TV?*

Stations	Frequency	Percent
Don't watch TV	896	86.8
Citizen Television	17	1.6
South Sudan TV	27	2.6
Total	1,032	100.0

Of respondents who watched television, the majority, 61 percent, watched South Sudan TV and the remainder watched Citizen Television (Figure 3-45).

Figure 3-45: Most Watched TV Stations



Slightly more respondents, 19.1 percent, read newspapers, the majority reading The Citizen (Table 3-8).

Table 3-8: Do You Read a Newspaper

	Responses	
	N	Percent
The Citizen	141	71.2%
The Juba Post	6	3.0%
The Juba Monitor	12	6.1%
Gurtong	3	1.5%
Other	36	18.2%
Total	198	100.0%

An even greater number of respondents, 58% percent, reported that they listened to the radio. The majority, 51.8% percent, listened to Radio Miraya and almost a quarter listened to Bakhita Radio (Table 3-9). The nongovernmental radio stations were more popular than the government station.

Table 3-9: What Radio Station Do You Listen to?

Radio Stations	Responses	
	N	Percent
Radio Miraya	315	51.8%
Bakhita Radio	149	24.5%
South Sudan Radio	70	11.5%
Others	74	12.2%
Totals	608	100.0%

# 4.0 Discussion of main findings

## 4.1 Sanitation Facilities

The survey shows that the most common form of toilet is a pit latrine, some of which have lined sub structures. Most toilets that use water were pour flush toilets that used septic tanks. The study also shows that the practice of exhausting toilets by mechanical means (vacuum tankers) is widely adopted for septic tanks and pit latrines.

Exhausters are expected to empty their tanks at the Roton Wastewater Lagoon in Northern Bari Payam. Government agencies including the Ministry of Lands, Housing and Physical Planning, Juba County and the Juba City Council are active in liquid waste management. It can therefore be concluded that there are sufficient blocks on which to build a fecal sludge management system in Juba. This base is remarkable given that central water and sewerage networks are almost non-existent.

The study, however, also indicates that the existing elements of the fecal sludge management system still need to be understood and strengthened. A large number of households have toilets that cannot be exhausted. For instance, the study indicated that over 58 percent of pit latrines were not lined. The lack of lining in pit latrines is less prevalent in some areas of the city. (See Figure 4-2).

In addition, many toilets are not built of permanent materials and do not qualify as adequate or improved sanitation because they lack privacy, safety and cleanliness. Furthermore, many households have no toilets and 26 percent of households share toilets. As per the WHO/UNICEF Joint Monitoring Programme (JMP) definition of access, each household must have a latrine. Actual access to a toilet, without taking into account quality, could be only 55.8 percent, but perhaps much less.

Therefore, it is safe to say that Juba's sanitation infrastructure, including toilets and the buildings in which they exist, is problematic. Providing design and construction improvements for toilets remains a crucial part of sanitation interventions. Improving toilets is necessary as a matter of sanitation and environmental protection. However, interventions involving toilets must be undertaken with a better understanding of the cost of constructing latrines. Many building materials must be imported into South Sudan, which adds to the cost.

Exhaustion of household toilets raised concerns. In particular, it is troubling that about 40 percent of households dig a new pit, rather than clean the pit, which should not happen with toilets designed to be reused. Manual exhausting of toilets, reported by 20 percent, also demands investigation with an eye to introducing more ecological alternatives.

Finally, the poor construction of most toilets requires capacity building on design and supervision of toilet construction.

The Roton Wastewater Lagoon also requires investigation to establish whether it is technically and environmentally sound. The lagoon is currently the main disposal point for fecal matter in the city. Additionally, exhauster trucks that operate in the city should be examined to determine if they are technically sufficient. In particular, it is necessary to investigate and establish the financial viability of the private exhauster business and whether regulations are in place to govern operation and the environmental safety.

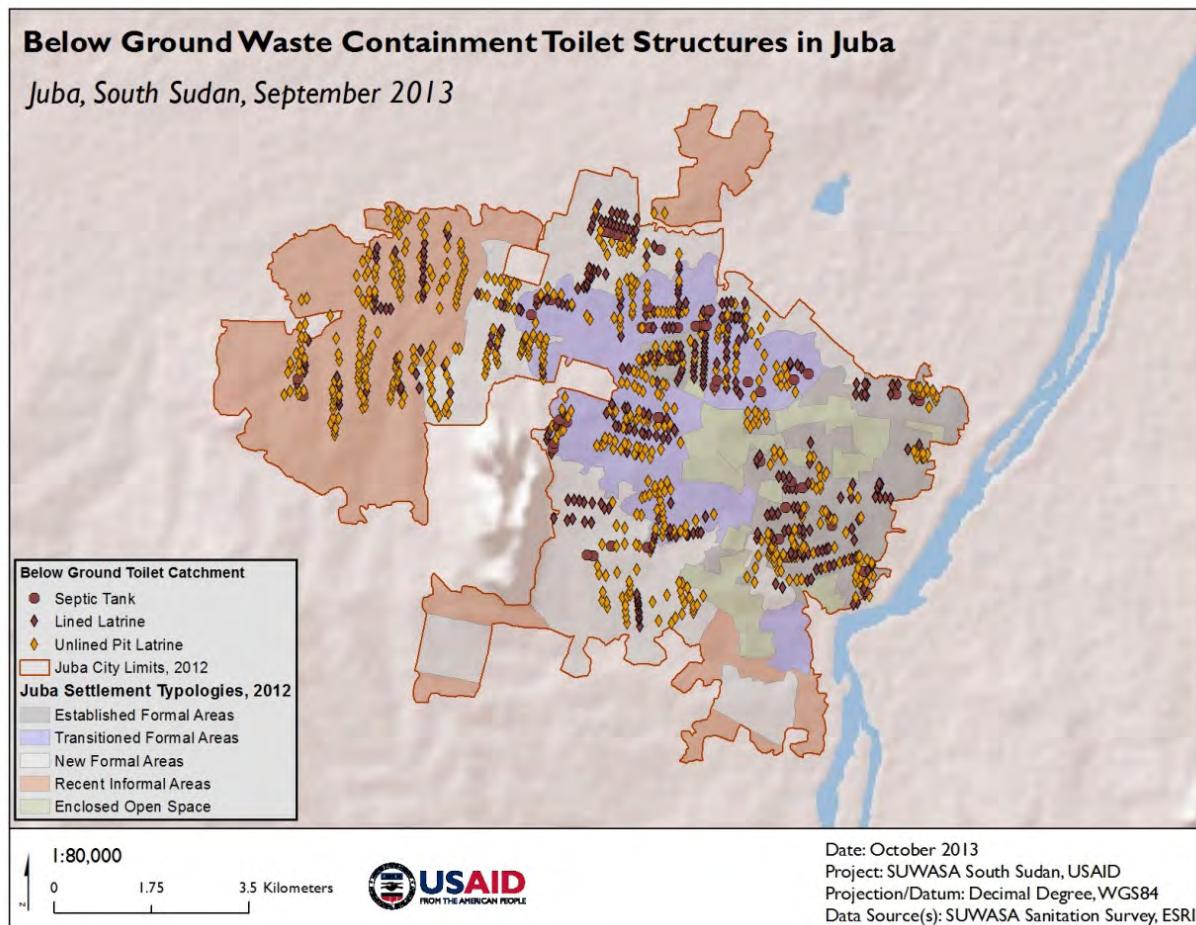
The government agencies tasked with providing and regulating household and municipal sanitary services also need to be examined. Are there sufficient bylaws and regulations in place? Can the agencies tasked with managing sanitary services handle the job? What needs to change and improve in order for these agencies to create an enabling environment for both household and private sector participation in the sanitation system?

The household survey has provided information on household fecal sludge management, just one of the building blocks that make a sound fecal sludge management system. The survey has also highlighted the need for a better understanding of the other elements of the system in order to better provide support to the city as it expands its municipal services.

Figure 4-1: Building Blocks of Fecal Sludge Management



Figure 4-2: Geographic Distribution of Toilet Substructures



## 4.2 Building Blocks for Engaging Households

Most properties are occupied by landlords or property owners, requiring interventions to focus on property decision makers. This target allows for relatively easy interventions, especially since the survey shows that education levels allow for understanding.

Additionally, the community is used to paying for sanitation services. For example, more than 97 percent paid for construction of their current toilet and over 97 percent of respondents pay tankers and carriers for drinking water. Since there has been little government engagement in the sanitation sector, the community has not grown used to subsidized services and is primed to be receptive to demand-driven approaches.

Because 81 percent of survey respondents say they obtain their drinking water from a tanker or carrier, there is less reliance on unsafe and shallow wells and less exposure to waterborne diseases. The widespread reliance on water from suppliers also suggests that Juba residents may be willing to pay for water and sanitation services.

The common use of tankers also underscores the absence of a city water system and indicates that this is a sector that requires intervention. In the meantime, the use of tankers also demands strict supervision and regulation to ensure that only safe water is provided. Failure to provide a regulatory framework for tankers would result in an inability to fully obtain the gains of any potential sanitation intervention.

Expanding the central water network will also need to take into account political and economic fallout from the current water vendors at work in the city.

Despite the existence of the building blocks on which Juba can build a fecal sludge management system, there are still big hygiene challenges. The study showed that attitudes toward sanitation and hygiene are poor.

First, with 35 percent of respondents without a toilet, the level of open defecation is high for an urban area.

Second, toilets are not considered a priority for households. In addition, over 50 percent of respondents were very satisfied with shared toilets that lacked privacy. Indeed, respondents expressed more satisfaction with toilets than with other services including solid waste. However, solid waste is highly visible and, perhaps, more offensive (Figure 4-3 ).

*Figure 4-3: Uncollected Solid Waste in Front of a Public Toilet*



One of the city's sanitation challenges is helping households understand the unseen dangers of poorly constructed, poorly maintained and poorly used toilets (Figure 4-4).

Third, although many respondents reported that they washed their hands, the veracity of their statements is in question since 46.6 percent had no hand-washing facility. Furthermore, only 39.9 percent washed their hands after defecating, 32.2 percent before eating and only 8 percent after handling a baby's feces.

*Figure 4-4:A Poorly Maintained and Unhygienic Toilet*



Finally, only 74.2 percent of respondents treated their drinking water. A combination of these four hygiene behaviors might partially explain why over 64 percent of respondents had visited a clinic for stomach ailments.

In Juba, low-income housing *tukuls*<sup>1</sup> are sandwiched between modern buildings.

*Figure 4-5: Mixed land Use in Juba City*



At the same time, there is rapid gentrification in the city and modern construction is replacing the tukuls. (Figure 4-6).

*Figure 4-6: Signs of Gentrification in Juba*



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<sup>1</sup> A *tukul* is a traditional small hut made of either grass or mud

Gentrification presents two issues: new modern buildings include new toilets but they displace occupants of the turkels.

The city must consider how to ensure that toilets in gentrified neighborhoods are properly built and contribute to an effective fecal sludge management system rather than creating an environmental pollutant. In addition, city planners must consider how much sewerage can be managed onsite and whether there are parts of the city that may be suited to the task and others that are not. In general, city planners need to consider Juba's long-term plans for comprehensively addressing onsite and off-site sanitation services.

As modern buildings displace residents, the poor and landless are being moved, which was noted by UKAID in 2011 (HPG 2011:5-6). If displaced inhabitants are moving to informal urban settlements, it is necessary to examine sanitation in the settlements and to address those problems.

# 5.0 Implications for SUWASA

## 5.1 Possible SUWASA Interventions

There are two potential areas for SUWASA intervention in household sanitation in Juba.

### 5.1.1 Promotion of Good Sanitary Facilities

It could be possible to promote and provide support to households about appropriate construction of toilets. Depending on the type of settlement, all toilet types – pit latrines, ventilated improved pit latrines, pour flush and flushing toilets – could be promoted since they are all already in use in the city. Though ecological toilets were not included in the study, some households described their toilets as composting toilets, suggesting that use of ecological toilets could be explored. Ecological toilets, particularly for promoting decentralized wastewater management systems outside of wastewater lagoons such as decentralized biogas systems, is attractive given that a centralized wastewater collection system does not exist. Any attempt to introduce ecological toilets must, however, be accompanied by analyses of the acceptability and feasibility of the technology. The German development organization GIZ is introducing ecological toilets for biogas production in Yei. SUWASA will be able to observe the project and learn from it.

SUWASA could promote good sanitation by:

- Constructing and promoting demonstration toilets;
- Developing manuals on different toilet types and providing support to the municipality for a program to promote household use;
- Provide help with the development of bylaws and guidelines for the Juba City Council on household toilet construction;
- Capacity building on proper toilet construction for city council staff, local builders and masons.

### 5.1.2 Hygiene Promotion

SUWASA could also provide support for a program that promotes good hygiene practices. The program could include:

- Proper use and maintenance of toilet facilities;
- Installation of hand-washing facilities and proper methods and times for hand washing with soap;
- Safe water handling and use.

Final decision on potential SUWASA intervention depends on the outcomes of ongoing studies including the Private Exhausters and Lagoon Management Study, a study of public toilets and a study of institutions involved in sanitation. Decisions must also depend on the outcomes of discussions between SUWASA, USAID and other cooperating partners and the priorities of the South Sudan government and local authorities in Juba.

# 6.0 Challenges and Lessons Learned

## 6.1 Data collection

Local university curricula do not include hands-on learning and critical thinking skills, which created challenges during enumerator training. Though enumerators quickly learned the basics of data collection on iPads, they struggled with alternating between English and Juba Arabic. They also struggled with mechanical aspects of interviews. These difficulties could have been handled by enumerator training that included listening skills, best practices for conducting interviews as a team, guidance on challenges encountered in the field and in-depth practice with technical aspects of the survey.

Enumeration management in Juba proved challenging. Issues from logistics to life skills presented obstacles.

One of the logistical challenges was setting drop off and pick up points for the enumerator teams. Drivers dropped teams off at points across the survey area. At the end of the day, teams were supposed to gather at a central location for pick up. It became necessary to obtain enumerator buy in for the end-of-day pick up.

Setting targets for the number of interviews conducted was another challenge. In order to improve enumeration team performance, the management team established a target of ten interviews a day for each team.

Enumeration teams reported many challenges with the interviews. In areas where households were not clearly demarcated and in areas where commercial and residential land use intermixed, teams struggled to meet interview targets. Some teams reported being chased from compounds. Many teams reported survey fatigue with respondents indicating that, "People come for interviews, but nobody ever does anything."

The survey management team also worked with enumerators to build life skills, including arriving at work on time and dressing appropriately. Most enumerators had no experience working in a professional environment and were unprepared for the responsibilities of the job.

## 6.2 Data Management and Analysis

English to Arabic translation and lack of clarity from the enumerators and respondents created confusion about key terms. For instance, the Arabic word for septic tank is also used in Juba to mean any toilet with a lined pit. As a result, some respondents who reported that they had a septic tank were actually reporting a lined pit latrine. This confusion explained the reason a significant number of respondents with pit latrines also reported having septic tanks. The confusion was compounded by the fact that the enumerators were not students of engineering or public health and were therefore not familiar with the different toilet technologies. A key lesson learned is that if students are used as enumerators, training must be provided so they appreciate key technical concepts, or students must be chosen who are enrolled in academic programs in the field being studied.

Though the use of the iPad made data storage and transfer easier, it limited the team's ability to conduct verification during data analysis. For example, if the database shows a missing entry, it is normally possible with paper questionnaires to go back to the questionnaire and check whether this was a data-entry or data-collection error. With the iPad, if an entry is missing, there is no way of checking. This means that in order to effectively use iPads, good data entry training must be provided and elaborate quality assurance procedures also need to be done daily.

For questions that respondents could not answer, such as age in some cases, the iPad automatically registered a zero. For non-numeric questions the iPad registered question marks. During analysis, the team had to eliminate many respondents. For future exercises, it will be important to ensure that data collection does not leave any blanks for non-responses.

Data analysis took a little bit longer because the database was set up in such a way that answers questions with multiple answers were recorded under one variable. To analyze these responses, the team first had to remove all but one answer and then create new variables for the remaining answers. In the future, similar studies should ensure that the database is set up to enable entry of multiple answers separately, saving time during analysis.

On a very positive note, the combination of the Tetra Tech GIS team and the technical sanitation team from SUWASA-South Sudan produced a very useful report that provides geographic and sanitation information unavailable before the study took place. The report helped the Juba City Council move from not knowing how to determine a random sampling frame to having significant information about the city's household sanitation situation. The process used in this study should be replicated wherever possible. With the completion of this report, the city now has:

- Maps chronologically detailing the physical expansion of the city;
- Information about the spread and extent of the different typologies of human settlement in the city including densities;
- Access to a database – based on simple but sound scientific principles with a little innovation from the SUWASA team – and a report on the sanitation situation in the city.

The Juba City Council benefitted from the study. But the young student enumerators also benefited. They learned new ICT, research and social skills, and earned income.

Furthermore the SUWASA team has passed on new skills to the staff of the directorate and created a productive relationship between the project and its client partner.

Finally, the entire SUWASA team learned how to deal with data gaps with a process that can be replicated relatively easily by SUWASA and officials throughout South Sudan and beyond.

# References

1. Government of South Sudan, "National Baseline Household Survey 2009, Report for South Sudan," National Bureau of Statistics, 2012.
2. Government of South Sudan, "Annual Needs and Livelihoods Assessment 2010/2011," (PROVIDE PUBLISHER OR SPONSOR, South Sudan, PROVIDE DATE of Publication).
3. Humanitarian Policy Group, "City Limits: Urbanisation and Vulnerability in Sudan, Juba Case Study," (report sponsored by UKaid and the Overseas Development Institute, 2011).

# Appendix A:

## SANITATION SURVEY QUESTIONNAIRE

<b>Complete before entering household</b>	
<b>Enumerator Name</b>	[Enter your name]
<b>Interview Date</b>	[Enter date]
<b>Payam</b>	[Select payam]
<b>Boma</b>	[Enter Boma name]
<b>GPS Coordinates</b>	[Record GPS coordinates]
<b>Start Time</b>	[Enter start time]
<b>Greeting</b>	Hello, my name is [NAME] and I am conducting a survey on behalf of the Juba City Council to collect baseline information on water and sanitation issues to inform upcoming projects. We will be visiting many households in different parts of Juba. We would like to ask some questions about waste, sanitation and hygiene practices and needs. This will take less than 30 minutes. Information collected will be kept anonymous.
<b>Informed Consent: May I ask you a few questions?</b>	
Yes (Continue to signature)	
No (Thank respondent and end survey)	
<b>Informed Consent - Signature of respondent</b>	
[Record respondent's signature]	
<b>What is the respondent's role in the household?</b>	
Head of Household	
Spouse	
Child	
Other Relative (Specify)	
No Relation (Specify)	
<b>Enter respondent's age (years)</b>	
[Enter age]	

<b>Sanitation</b>		
S1	<b>Do you have a working toilet in your household/yard/compound?</b>	
	Yes	Skip to S4
	No	
S2	<b>Where do adult members of this household go to defecate when at home?</b>	
	In the open ground	
	In a nearby water body	
	In a neighbor's toilet	
	In a public toilet	
	Other (specify)	
S3	<b>Where do children members of this household go to defecate when at home?</b>	
	In the open ground	
	In a nearby water body	
	In a neighbor's toilet	
	In a public toilet	
	Other (specify)	
S4	<b>What kind of toilet facility do members of your household usually USE? [ASK TO OBSERVE TOILET FACILITY]</b>	
	Flush/pour flush	
	Latrine	
	Composting toilet	
	Bucket	
	Hanging toilet/hanging latrine	
	No facilities (bush or field)	
	Other (specify)	
S4a	<b>Ask permission to take a photo of the toilet.</b>	
	[Take photo]	
S4b	<b>Take GPS coordinates of toilet</b>	
	[Record GPS coordinates]	
S4c	<b>What kind of below ground structure does the toilet have?</b>	
	Pit latrine - unlined pit	
	Pit latrine - concrete or other lining	
	Septic tank	
	Piped sewer system	

	Don't know/Not sure	
S4d	<b>What kind of shelter walls does the toilet have? (If more than one material, choose material that covers the largest area)</b>	
	Concrete/ bricks	
	Galvanized Steel	
	Wattle and Mud	
	Wood and Thatch	
	Plastic Sheet	
	No Walls	
	Other Specify	
S4e	<b>What kind of shelter roof does the toilet have?</b>	
	Concrete	
	Galvanized Sheet	
	Thatch	
	Plastic Sheet	
	No roof	
	Other Specify	
S5	<b>Do you share this facility with other households?</b>	
	Yes	
	No	Skip to S6
S5a	<b>How many other households use this toilet facility?</b>	
	[Enter number]	
S5b	<b>Can any member of the public use this toilet?</b>	
	Yes	
	No	
S5c	<b>How much does it cost to use this toilet facility per day? (SSP)</b>	
	[Enter number]	
S6	<b>Who financed the construction of the toilet for your household?</b>	
	The household	
	Landlord	
	NGO	
	Government	
	Private sector	
	Relative	

	Neighbor	
	Other (Specify)	
S7	<b>What are the advantages of owning your own toilet? (Select all that apply)</b>	
	Cleanliness	
	Health/hygiene	
	Privacy	
	Comfort	
	Convenience	
	Time saved	
	Status/prestige	
	Safety	
	None	
	Don't know	
	Other (Specify)	
S8	<b>What do you think would be the advantages of owning your own toilet? (Select all that apply)</b>	
	Cleanliness	
	Health/hygiene	
	Privacy	
	Comfort	
	Convenience	
	Time saved	
	Status/prestige	
	Safety	
	None	
	Don't know	
	Other (Specify)	
S9	<b>What are the disadvantages of owning your own toilet? (Select all that apply)</b>	
	High costs	
	Other people come to use it	
	Contamination of water	
	No disadvantages	
	Don't Know	
	Other (Specify)	
S11	<b>What are the reasons why you do not own a toilet? (Select all that apply)</b>	

	Cost	
	Have access to other toilet	
	Satisfied with current practice	
	Do no know how to purchase or construct	
	Other priorities	
	Don't know	
	Other (specify)	
<b>S12</b>	<b>Have you emptied your septic tank/toilet in the last 12 months?</b>	
	Yes	Answer if S4c = Pit latrine or Septic Tank
	No	
<b>S12a</b>	<b>How many times have you emptied your septic tank/pit latrine in the last 12 months?</b>	
	[Enter number]	
<b>S12b</b>	<b>How is the septic tank/pit latrine emptied when full?</b>	
	Never emptied/Dig another	
	Manually	
	Mechanical exhauster	
	Other (specify)	
<b>S12c</b>	<b>Who pays for the exhaustion of the septic tank/pit latrine?</b>	
	Myself	
	Landlord	
	Don't know	
<b>S12d</b>	<b>How much does it cost each time you empty the septic tank/pit latrine? (SSP)</b>	
	[Enter number]	
<b>S13</b>	<b>How satisfied are you with your current sanitation facilities/services?</b>	
	Very dissatisfied	
	Somewhat dissatisfied	
	Neither dissatisfied nor satisfied	
	Somewhat satisfied	
	Very satisfied	
<b>S13a</b>	<b>What are the main reasons you are dissatisfied with your sanitation facilities/services? (Select all that apply)</b>	
	Long distance to facility	
	Bad smell	
	Long waiting time at facility	
	Dirty	

	Unsafe	
	No privacy	
	No facility (lack of access)	
	Other (Specify)	
	<b>Water and Waste Management</b>	
W1	<b>What is the main source of domestic water in your household? (Domestic water includes water for drinking, cooking and washing)</b>	
	Piped water into dwelling	
	Piped water into plot/yard	
	Public tap/standpipe	
	Tubewell/borehole	
	Dug well	
	Spring	
	Rain water harvesting	
	Tanker - truck	
	Cart with small tank/drum	
	Bottled water	
	River/stream/ponds (surface water)	
	Other (specify)	
W2	<b>Do you have water storage facilities in your household?</b>	
	Yes	
	No	
W2a	<b>Is your water storage facility covered?</b>	Answer if W2 = Yes
	Yes	
	No	
W2b	<b>Do you clean your water storage facility?</b>	Answer if W2 = Yes
	Yes	
	No	
W2c	<b>How frequently do you clean your water storage facility?</b>	
	Every day	
	At least once a week	
	At least once a month	
	Rarely/never	

W3	<b>Do you treat your DRINKING water?</b>	
	Yes	
	No	
W3a	<b>How do you treat your drinking water?</b>	Answer if W3 = Yes
	Boiling	
	Add Chlorine/Chemical	
	Filtration	
	Leave in the sun (SODIS)	
	Let it stand and settle	
	Other (specify)	
W3b	<b>Do you drink primarily bottled water?</b>	Answer if W3 = No
	Yes	
	No	
W4	<b>What are the main challenges you face in obtaining domestic water? (Select all that apply)</b>	
	Long distance to obtain water	
	Unreliable supply/regular shortage	
	Low pressure	
	High cost/price is too high	
	Poor quality	
	Other (specify)	
W5	<b>How do you dispose of your solid waste? (Rubbish, garbage, food waste, animal waste. NOT human waste) (Select all that apply)</b>	
	Burn	
	Bury outside the yard	
	Bury inside the yard	
	Dump outside the yard	
	Private operator comes to collect it	
	The City Administration collects it	
	Other (specify)	
W5a	<b>How frequently is your solid waste collected?</b>	
	Daily	Answer if W5 = Private operator or city administration collects
	Once a week	
	Twice a week	
	Once a month	

	Rarely/never	
	Don't know	
W5b	<b>How much does it cost for collection of solid waste? (per collection) (SSP)</b>	
	[Enter number]	Answer if W5 = Collection (private or city)
W6	<b>Is there an infant in the household?</b>	
	Yes	
	No	
W6a	<b>The last time he/she defecated, where did you dispose of the feces?</b>	
	In own latrine	
	In the open ground	
	In a nearby water body	
	In a neighbor's toilet	
	In a public toilet	
	Other (specify)	
W7	<b>How do you dispose of the liquid waste from your kitchen and from bathing? (Select all that apply)</b>	
	Throw in the compound	
	Drain it away from the compound through a furrow/trench	
	Nothing - let it stagnant in the compound	
	Put in containers and dispose away from compound	
	Don't know	
	Other (specify)	
W8	<b>How satisfied are you with your current solid waste disposal?</b>	
	Very dissatisfied	
	Somewhat dissatisfied	
	Neither dissatisfied nor satisfied	
	Somewhat satisfied	
	Very satisfied	
W8a	<b>What are the main reasons for your dissatisfaction with solid waste disposal? (Select all that apply)</b>	
	Heaps of garbage bring flies and bad smells	
	Lack of removal by city administration	
	High cost of service	
	Neighbors dump garbage in our compound	
	Other (specify)	
W9	<b>How satisfied are you with your current liquid waste disposal?</b>	

	Very dissatisfied	
	Somewhat dissatisfied	
	Neither dissatisfied nor satisfied	
	Somewhat satisfied	
	Very satisfied	
W9a	<b>What are the main reasons for your dissatisfaction with liquid waste disposal? (Select all that apply)</b>	
	Smell	
	Causes disease	
	Brings flies	
	Causes discomfort	
	Other (specify)	
	<b>Hygiene and Health</b>	
H1	<b>What hygiene advice have you heard before? (Select all that apply)</b>	
	Drink clean water	
	Use a latrine	
	Wash your hands with soap	
	Food hygiene (cover your food, etc)	
	Other (specify)	
H2a	<b>When do you wash your hands? (Select all that apply)</b>	
	After defecating/Visiting the toilet	
	After handling a child's feces	
	Before eating	
	Before preparing food	
	After touching animals	
	Other (specify)	
H2b	<b>What do you use to wash your hands?</b>	
	Water only	
	Water and soap	
	Water and ashes	
	Other (specify)	
H2c	<b>Where is the handwashing facility located within the household?</b>	
	Inside or next to the latrine	
	Inside the house/bathroom	

	Inside yard/compound	
	No handwashing facility	
	Other (specify)	
H3	<b>Do you think washing your hands is important?</b>	
	Yes	
	No	
H3a	<b>Why do you think washing your hands is important? (Select all that apply)</b>	
	Removes dirt	
	Prevents diarrhea and other diseases	
	Prevents dirt from getting into mouth/food	
	Don't know	
	Other (specify)	
H4	<b>In your view, what are the threats brought about by poor sanitation and hygiene to you and your family? (Select all that apply)</b>	
	Causes disease	
	Smell	
	Flies	
	Makes people uncomfortable	
	Other (specify)	
H5	<b>What are the main diseases that have faced your household in the last six months? (Select all that apply)</b>	
	Diarrhea	
	Malaria	
	Intestinal worms	
	Itching/Skin problems	
	Other (specify)	
H6	<b>Have you or has any member of your household visited a clinic in the last six months for stomach ailments?</b>	
	Yes	
	No	
H6a	<b>How many times have you or any member of your household visited the clinic in the last six months?</b>	
	[Enter number] [Total number of visits for the household]	
H7	<b>What information do you have on how diarrhea could be prevented? (Select all that apply)</b>	
	Wash hands with soap	
	Use safe water sources and/or treat your drinking water	
	Wash, peel or cook your food/fruits before eating	

	Cover your water/food to protect from contact with flies	
	Give only breast milk to children under six months	
	Other (specify)	
<b>I2</b>	<b>Access to Information</b>	
I2	<b>How often do you listen to the radio?</b>	
	Daily	
	Weekly	
	Less than once a week	
	Rarely/Never	
I2a	<b>What radio stations do you usually listen to?</b>	
	Miraya FM	
	Bakhira Radio	
	South Sudan Radio	
	Capital FM	
	City FM	
I3	<b>How often do you watch TV?</b>	
	Daily	
	Weekly	
	Less than once a week	
	Rarely/Never	
I3a	<b>What TV stations do you usually watch?</b>	
	South Sudan TV	
	Citizen TV	
I4	<b>How often do you read newspapers?</b>	
	Daily	
	Weekly	
	Less than once a week	
	Rarely/Never	
I4a	<b>What newspaper do you usually read?</b>	
	Citizen Newspaper	
	Juba Post	
	Gurtong	
	The Monitor	
	The Advertiser	

I5	<b>Have you ever been exposed to hygiene and/or sanitation information or outreach campaigns in your community?</b>	
	Yes	
	No	
I5a	<b>Who conducted the campaign?</b>	Answer if I5 = Yes
	[Enter name of organization]	
	<b>Observe gender of respondent</b>	
	Female	
	Male	
	<b>Highest education level completed by head of household</b>	
	No formal education	
	Primary education	
	Secondary education	
	Tertiary Education	
	University	
	<b>Size of household - Number of people living in the household (people who eat together)</b>	
	<b>Number of adults above 18 years</b>	
	[Enter number]	
	<b>Number of children aged 6 - 18 years</b>	
	[Enter number]	
	<b>Number of children 5 years old and below</b>	
	[Enter number]	
	<b>Total household members</b>	
	[Automatic total]	
	<b>Do you own this house?</b>	
	Yes	
	No	
	<b>Do you rent this house?</b>	
	Yes	
	No	
	<b>How long have you lived at this house? (years and months)</b>	
	[Enter number]	
	<b>Are there any other comments you would like to make as we come to the close of this interview?</b>	

	Yes	
	No	
	<b>Enter respondent comments</b>	
	<b>Thank the respondent for his/her time and participation.</b>	
	<b>End Time</b>	
	[Enter end time of interview]	
	<b>Is this interview complete?</b>	
	Yes	
	No	
	<b>Why isn't it complete?</b>	Answer if interview is not complete
	[Enter comments]	

**U.S Agency for International Development  
1300 Pennsylvania Avenue, NW  
Washington, DC 20523  
Tel: (202) 712-0000  
Fax: (202) 216-3524  
[www.usaid.gov](http://www.usaid.gov)**