PERCEPTIONS OF THE USERS OF URINE DIVERSION DRY (UDD) TOILETS IN MEDIUM DENSITY MIXED HOUSING IN HULL STREET, KIMBERLEY

BY

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A research report submitted to the Faculty of Engineering and Built Environment, the University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Masters of Science in Development Planning.

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DECLARATION

I declare that this thesis is my own unaided work. It is being submitted to the degree of Masters of Science in Development Planning to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination to any other University.

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(Signature of candidate)

05 December 2011

ABSTRACT

South Africa is a water-scarce country (Otieno and Ochieng, 2004; Wassung, 2010). The current sanitation system mostly used in South African urban areas depends on extensive use of water in a form of flush toilets. The housing sector in major cities is continuously growing and this is putting a strain on water services. The government has explored a range of sanitation technologies including waterborne, the Ventilated Improved (VIP) toilet and ecological sanitation (widely known as ecosan) in a form of a urine diversion dry (UDD) toilet. The latter provides a reasonable solution to the current sanitation challenge. This study explores the perceptions of the users of the UDD toilets installed in the medium density mixed housing development of Hull Street in Kimberley. Understanding the users' socio-cultural perceptions of the UDD toilet will contribute to future policy making, as the information can be used to improve the future roll-out of the technology in order to make it more acceptable.

The study was qualitative in nature and used a phenomenological research design. The sample size comprised 16 participants, 13 of whom were residents of the Hull Street housing project and three were employees of the Sol Plaatje Housing Company (SPHC). The sample was selected by a purposive sampling method. Semi-structured interviews were conducted to collect data for the study. The data was analysed by means of content analysis, which enabled the researcher to identify important themes for the study.

The findings of the study revealed dissatisfaction regarding the use of the UDD toilet, which emanates from poor design of the toilet facility. The research was successful in identifying, inter alia, odour, uncomfortable sitting position on the toilet mainly by female users and high cost of operating and maintaining the sanitation system. Recommendations emphasise the importance of involving users in future UDD sanitation projects and educating the public at large about sustainability aspects of this sanitation technology (UDD). One of the key lessons drawn from the study is that challenges experienced by the users should be used to improve future UDD toilets.

Key words: *Ecological sanitation (ecosan), UDD sanitation system, medium density mixed housing, socio-cultural perceptions, users and Hull Street.*

DEDICATION

I dedicate this research to my loving husband, Kgame Matsebe and our sons, Thato and Lebohang for their continued support, understanding and tolerance. You have provided necessary motivation through thick and thin of this course.

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ABBREVIATIONS AND ACRONYMS

du/ha	Dwelling unit per hectare
BNG	Breaking New Ground
CSIR	Council for Scientific and Industrial Research
CUP	Comprehensive Urban Planning
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
ECOSAN	Ecological Sanitation
EcoSanRes	Ecological Sanitation Research
EETP	Erdos Eco-town Project
IDP	Integrated Development Plan
JMP	Joint Monitoring Programme
LASF	Letrina Abonera Seca Familiar
MDGs	Millennium Development Goals
MDMH	Medium Density Mixed Housing
OECD	Organisation for Economic Co-operation and Development
SIDA	Swedish International Development Co-operation
SPHC	Sol Plaatje Housing Company
SPM	Sol Plaatje Municipality
UD	Urine Diversion
UDD	Urine Diversion Dry/Dehydration
UN	United Nations

UNEP	United Nations Environmental Programme
UNICEF	United Nations Children's Emergency Fund
WCED	World Commission on Environment and Development
WHO	World Health Organization

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CHAPTER 1: INTRODUCTION TO "THE TOILET PROBLEM"

1.1 Background to the study

It is estimated that the world's population will reach 8 billion in the next 25 years, with 5 billion people living in urban areas (UN-Habitat, 2003 cited in Winblad and Simpson-Hébert, 2004). An urban population of such magnitude will put a strain on basic services (Mara, 1996) such as sanitation, water and housing. Already it is also estimated that more than 50% of the world's population will experience water shortages, while 40% may live in slums (UN-Habitat, 2003 cited by Winblad and Simpson-Hébert, 2004). Presently, approximately 2.6 billion of the world's population lack access to basic sanitation (WHO and UNICEF, 2006; EcoSanRes, 2008 and Bhagwan *et al.,* 2008). Approximately 2.8 billion people have access to some type of sanitation system such as pit toilets, most of which are unhealthy and contaminate human and natural environments (EcoSanRes, 2008). Of this 2.8 billion, around 1.1 billion people have access to waterborne systems (*ibid*).

Sanitation promotes health and safety, which are socially, economically, environmentally and technically sustainable (United Nations, 2002). The term sanitation refers "to the process of disposing of human excreta in a manner that protects public and environmental health" (Van Vliet *et al*., 2010:106). This was affirmed by the WHO/UNICEF Joint Monitoring Programme (JMP), which stresses improved sanitation as systems in which excreta are disposed of in such a way as to reduce the risk of faecal-oral transmission to users, while ensuring a clean and healthy environment (WHO & UNICEF, 2006b). Drangert (2004) has highlighted that a sanitation system extends beyond a "toilet" to incorporate aspects of management issues, disposal and potential reuse of treated faeces, greywater discharges, comfort, affordability and health.

The South African government upholds the WHO/UNICEF JMP vision with regards to sanitation and this responsibility was mandated to the then Department of Water Affairs and Forestry (DWAF). The sanitation portfolio has been integrated within the Department of Human Settlements (previously the Department of Housing), since 2010. DWAF's National Sanitation policy defined sanitation as "principles and practices

relating to the collection, removal or disposal of human excreta and waste water as they impact upon users, operators and the environment" (DWAF, 1996:3).

To address this challenge, the South African government needs to implement "sustainable sanitation" solutions. The concept of sustainability is having an impact on all disciplines and its definition depends on the context in use. The Brundtland report, also known as the World Commission on Environment and Development (WCED), refers to sustainability in terms of sustainable development, which "is not a fixed state of harmony, but rather a process of change in which the exploitation of resources, the direction of investments, the concentration of technological development and institutional change are made consistent with future as well as present needs" (WCED, 1987:9). The Organisation for Economic Co-operation and Development's (OECD's) second commission of inquiry - "Protection of Mankind and the Environment" developed a broad definition of sustainability that focuses on environmental, social and economic perspective of sustainable development (OECD, 2002). In addition, sustainability is defined as "a vision of the future that provides us with a road map and helps us to focus our attention on a set of values and ethical and moral principles by which to guide our actions" (Viederman, 1995:37). Sustainability can only be achieved by taking into account the manner in which people relate to resources, environment and development. Such relationships constitute the fundamental principles of sustainability, which are social, economic, and environment (UN, 2002).

Sustainable sanitation is thus understood as a system that protects and promotes human health, does not contribute to environmental degradation or depletion of the natural resource base, and is technically and institutionally appropriate, economically viable and socially acceptable (Bracken *et al.,*2005; SuSanA, 2008). Several studies have demonstrated that South Africa is among the world's most water-scarce countries (Otieno and Ochieng, 2004 and Wassung, 2010). In a water-scarce country like South Africa, ecological sanitation options are necessary to decrease the demand on water resources (Schutte and Pretorius, 1997). The South African government has already explored a range of sanitation technologies, including waterborne and ecological sanitation (widely known as "ecosan") in the form of urine diversion dry (UDD) toilets. As part of the South African government's sanitation policy and water scarcity challenge, ecosan should be promoted and implemented on a scale large enough to have

an impact on the environment. Currently, the implementation of UDD toilets is mostly restricted to rural areas, rather than urban areas.

Ecosan is a sanitation approach that is considered to be a more sustainable option resulting in less damage to the environment. The aim of ecosan is to close the nutrient and water cycles in a safe way while wasting few resources (EcoSanRes, 2008).

The ecosan approach uses less water and has been implemented widely in rural, peri-urban and urban settings, inside and outside the house in both the developed and developing world (Duncker *et al.,* 2007; Drangert *et al.,* 2002; Esrey *et al.,* 1998 and Peasey, 2000). Ecosan systems are neither widely known nor well understood in South Africa (Austin *et al.,* 2005). This is due to the fact that they have some unfamiliar descriptions, such as urine-diversion pedestals or squatting plates (Esrey *et al*., 1998), which raise socio-cultural concerns. Moreover, ecosan systems require more promotion, support, education and training compared to other sanitation systems, such as VIP toilets (*ibid)*. Nonetheless, ecosan seems to be economically feasible and environmentally sustainable for the South African context, but socio-cultural factors affecting the choice of such sanitation solutions have not been sufficiently investigated to date.

There are numerous examples of ecosan such as composting toilets, enviro-loo, vacuum toilets and urine diversion (UD) toilets, both UD flush toilet and UD dehydrating/dry (UDD) toilet. The latter (UDD toilet), which separates faeces and urine in particular, is considered appropriate for some regions of South Africa (Austin *et al.,* 2005), and therefore has been implemented widely in rural areas, especially in residential settings. According to Kvarnström *et al.* (2006), the UDD sanitation system separates collection of human excreta, whereby the faecal matter is collected dry and does not require water for flushing (See Figures 1, 2 and3). Only a small quantity of water can be used to clean the urine receptacle and urinal, either automatically through a flush mechanism, or by hand.

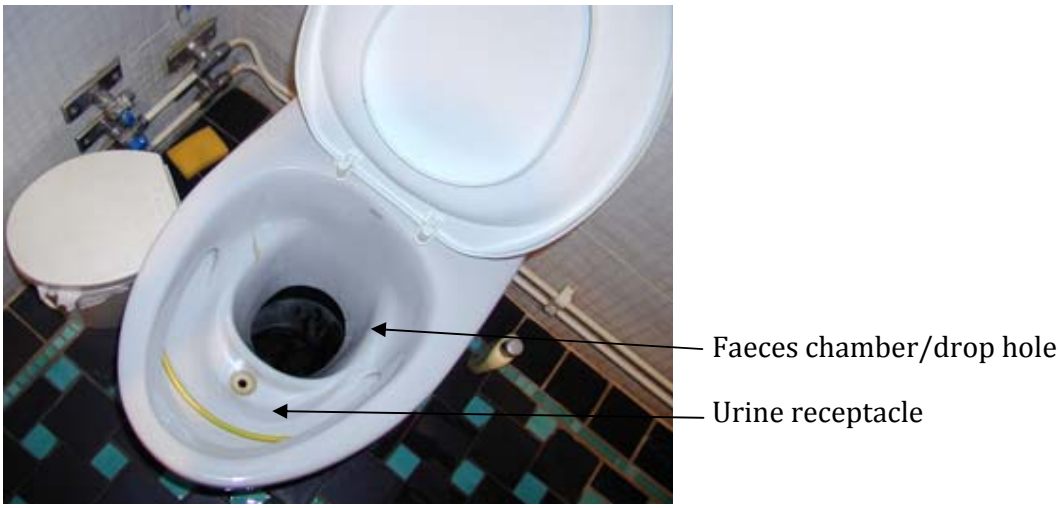

Figure 1: UDD toilet (Source: EcoSanRes, 2008)

Figure 2: Example of UDD toilet in Hull Street (Source: CSIR, 2011)

Figure 3: Example of UDD toilet with a kiddie seat in Hull Street (Source: CSIR, 2011).

A UDD toilet is generally associated with larger plots and lower densities. It is therefore necessary to explore the integration of UDD toilets in Medium Density Mixed Housing (MDMH) developments since sanitation forms part of sustainable human settlements (See Figures 4 and 5). MDMH refers to housing developments with a minimum of 50 dwelling units per hectare (du/ha) and a maximum of 125 du/ha (Landman *et al*., 2007 and Osman, 2010). This housing typology is characterised by ground level entry, private external space for each dwelling unit and close proximity to secure parking, with such developments ranging from single to four storeys. All these characteristics promote integration and facilitate some social and spatial mix within a housing development

(*ibid*). Such housing developments are advocated in the South African Department of Human Settlement's plan known as "Breaking New Ground" (BNG). The objective of this comprehensive plan is to ensure that these new housing developments have a greater mix, as well as a higher density, than is currently the case (Dept. of Housing, 2004).

Figure 4: MDMH development with UDD toilets, China-Sweden Erdos Eco-town Project (EETP), China (Source: McConville and Rosemarin, 2011).

Figure 5: MDMD development with UDD toilets in Moshoeshoe Eco-village, Kimberley, South Africa (Source: CSIR, 2011).

This study focuses on the perceptions of the users of the UDD toilets in the Hull Street Housing Project, which is a MDMH in Kimberley, Northern Cape province of South Africa, and the extent to which UDD toilets have been accepted or rejected by users. This will then inform whether UDD toilets are sustainable sanitation systems or not in this particular context, from a user's perspective. Lessons, success factors and challenges

will be drawn with regards to the relevance, application and sustainability of this technology.

1.2 Problem Statement

Sanitation backlogs are international challenges affecting many countries and South Africa is no exception (WIN-SA, 2009). In an attempt to address this challenge, South Africa has committed itself towards employing programmes that would enhance and fast-track the eradication of the sanitation backlog by 2015 (*ibid*). From 2007 to 2008, an estimated 31% of the citizens of South African and 19% of the population of the Northern Cape province had no access to adequate sanitation facilities[1] (Department of Cooperative Governance and Traditional Affairs: COGTA, 2009). According to the DWA's Water Services National Information System (2011), the sanitation backlog for the Sol Plaatje local municipality[2] is estimated at 11.03%, which is closer to the provincial figure. These figures indicate a need for improvement to eradicate the backlog.

In response to this challenge, the Swedish International Development Agency (SIDA) in collaboration with the Northern Cape Department of Housing and the Sol Plaatje municipality (SPM) implemented the UDD sanitation projects in the Moshoeshoe Eco-village and Hull Street housing developments in Kimberley, Northern Cape. SIDA is an administrative division of the Department of Foreign Affairs in Sweden, aimed at assisting poor people to achieve better livelihoods (Jonah, 2007).

However, this UDD sanitation system seems to not have been accepted by the users and it does not have institutional support from the politicians and officials at the local municipality (Schoeman, 2011; Dliwayo and Swiegers, 2011; personal communication). This is also reflected in local newspaper reports (*The Diamond Field Advertiser*: DFA, 28 February 2011) that have highlighted the dissatisfaction of the Hull Street Housing complex's residents regarding the UDD toilets (See Appendix A). The complainant (a disappointed resident of Hull Street in the DFA's newspaper article) referred to this

[1] This means that this population may be using some inadequate sanitation facilities such as unimproved pit toilets or chemical, bucket and communal toilets (DWAF, 2002).

[2] Hull Street falls under the Sol Plaatje municipality.

sanitation system as a bucket system and cited that it has contributed to the ill health of the children in Hull Street (*ibid*). Due to political influence and public complaints from some residents, both the Moshoeshoe Eco-village and Hull Street projects (both projects were implemented by SIDA and Northern Cape Department of Housing) will be re-fitted with waterborne systems (Schoeman, 2011; personal communication).

1.3 Significance of the study

The study is important because it addresses the user-technology interface in a setting where a potentially useful (enviro-friendly) technology has been rejected by the users and has been ejected by socio-political and economic dynamics. This presents an opportunity to learn about the factors that contribute to the apparent rejection of UDD technology.

It is important to note that MDMH is one of the housing typologies promoted by the Department of Human Settlement's comprehensive plan called "Breaking New Ground" to address the spatial restructuring of South African cities (Department of Housing, 2004). In addition, there is also a general perception that this housing typology is more viable, socially and economically, when compared to high-rise developments. Part of the significant aspect of MDMH is its ability to accommodate a large number of people in a small space, with easy access to services and facilities. The suitable location of MDMH developments tries to resolve, among other, transport challenges in order to reduce travelling costs (*ibid*). The above statements demonstrate the desired sustainable human settlements scenario the South African government intends to achieve. The South African government has restructured various portfolios, for instance, sanitation (previously with the then Department of Water Affairs and Forestry) has been integrated within the Department of Human Settlements.

The researcher has not been able to find a similar study conducted in a similar urban setting of MDMH in South Africa. This is significant in terms of sustainability, as it relates to the issue of growing urbanisation, which requires innovative sanitation solutions that are appropriate for the targeted users. In a broader sense, the study will contribute to the growing body of knowledge regarding the challenges of service provision in urban areas. Moreover, the study will provide an understanding regarding users' perceptions of UDD toilets, which could be used to redesign a future UDD

sanitation system. Information from the study could also be used to improve the future roll-out of this technology, in order to make it more acceptable to the users.

1.4 Aim of the study

The study sought to understand the socio-cultural perceptions and practices of the users of the UDD toilets in Hull Street, Kimberley, with an intention to measure the degree of acceptance of this sanitation technology in a MDMH context.

1.5 Objectives of the study

The study was guided by the following objectives:

- To discuss/critique the nature of and rationale for UDD toilet technology.
- To determine the level of acceptance of the UDD toilets in Hull Street, Kimberley by the users.
- To contribute to the extension (body) of knowledge on the perceptions of the users of the UDD toilets in urban MDMH contexts.
- To develop guiding principles for acceptance of the UDD toilets in other MDMH projects, as informed by the analysis of the case study.
- To provide comprehensive guidelines for future implementation of the UDD toilets in MDMH contexts, as informed by the analysis of the case study.

1.6 Research questions

The main question is formulated as follows:

- What are the perceptions of the users of UDD toilets in Hull Street, Kimberley?

  This main question is linked to the following sub-questions:

  - What lessons may be drawn from the use of UDD toilets in Hull Street, Kimberley?
  - What are the benefits and challenges of using UDD toilets in Hull Street, Kimberley?

- Is it possible to enhance the level of acceptance for the use of UDD toilets in Hull Street? If so, how?
- What does this mean for planners and those involved in the management of this housing development?
- And finally, if an approach to achieving better socio-cultural acceptance can be obtained in the case study situation, would it be possible to use the results of this study to develop guiding principles for acceptance of UDD toilets in other MDMH projects?

1.7 Delimitations of the study

According to the Sol Plaatje Municipality (undated), the Hull Street housing development is situated in the periphery of the town of Kimberley (also known as the Diamond City) in the Northern Cape Province of South Africa (See Figure 6 for the project site map). It falls within the Sol Plaatje Municipality, which is the provincial capital of the Northern Cape, located in the eastern part of the province, close to the border of the Free State Province. Hull Street is near the De Beers mining property, closer to the CBD and the industrial area (*ibid*).

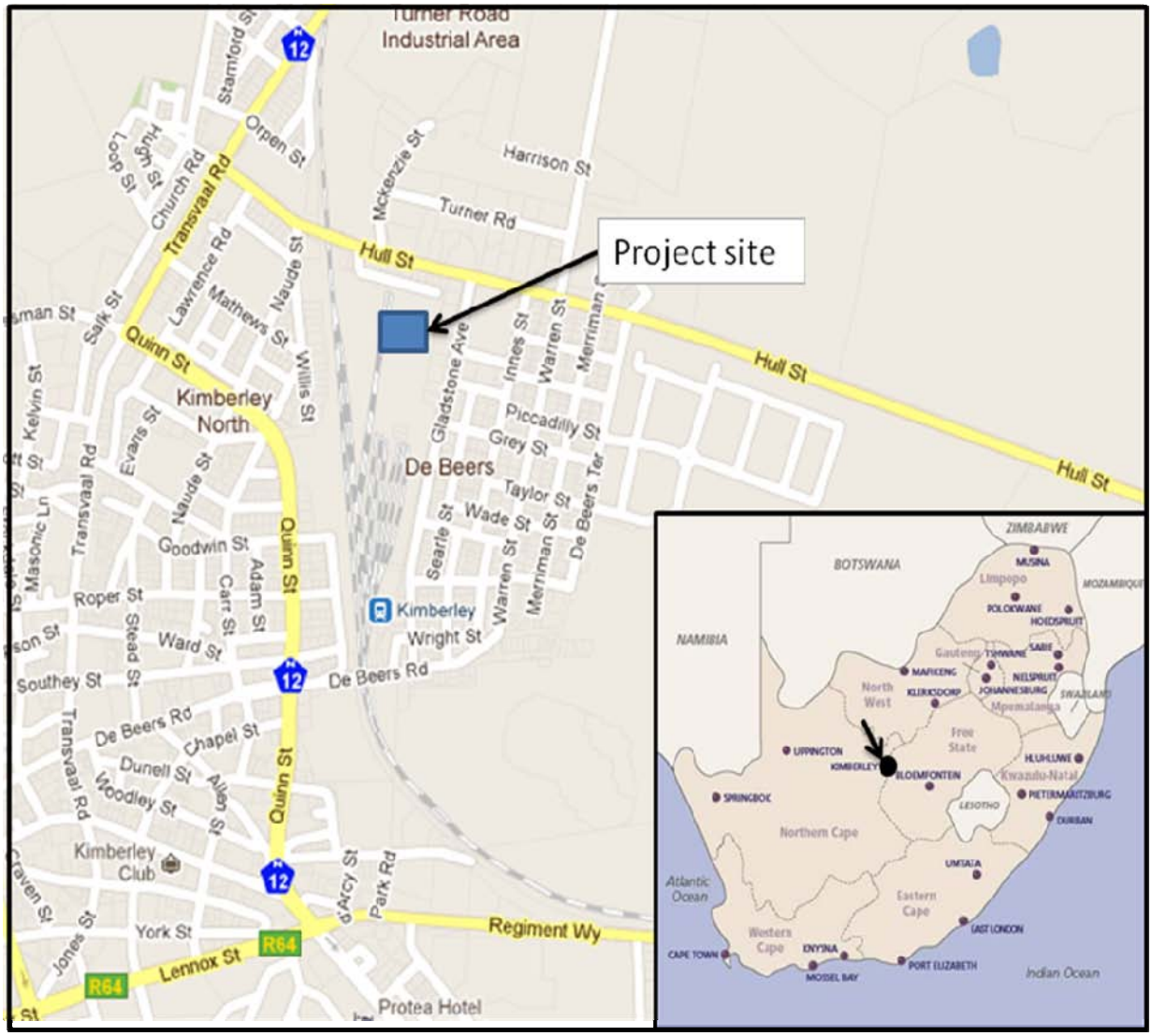

Figure 6: Map of Hull Street, Kimberley in South Africa (source: Google maps).

The selection of this case study was influenced by several factors. Firstly, the Council for Scientific and Industrial Research (CSIR) has previously shown interest in and has been involved at this site, as the Hull Street project is one of the few MDMH developments with UDD toilets in the country and was deemed worthy of intensive investigation. The users of Hull Street have been using the UDD system for eight years. Therefore, they have experienced both positive and negative effects of using this sanitation system. The study was qualitative, where the researcher used a questionnaire to elicit users' pros and cons of using the UDD toilets.

The researcher/author has been involved in CSIR-led UDD sanitation technology and MDMH projects to date[3]. With the recent restructuring of the Department of Housing and its renaming (from Housing to Human Settlements) as well as the combination of portfolios (sanitation moved from the then Department of Water Affairs and Forestry to Human Settlements), the researcher views it as essential to combine these research fields (UDD sanitation and MDMH) by exploring how they operate in practice. In order to achieve sustainable human settlements, it is also anticipated that other government portfolios might be combined, such as water being integrated with human settlements.

Finally, the purpose of this housing development project has taken into account social, environmental and economic aspects in order to be a sustainable residential entity (Landman *et al*., 2009). The vision for this project was to promote Local Agenda 21 by putting in practice ecological and sustainable development principles (*ibid*). It is therefore important that the project be closely monitored and assessed at various stages of its lifetime and that lessons be extracted for future developments.

1.8 Definitions of key terms

Ecological sanitation (ecosan) is "an approach to sanitation which focuses on options for reuse of nutrients and organic matter contained in excreta and wastewater, and emphasizes sustainability in all aspects" (GTZ, 2009:8). It is a sustainable "closed-loop" or circular system that treats human excreta as a resource (Esrey *et al*., 1998; Langergrabber and Muellegger, 2004). The nutrients found in human excreta are then reused as fertilisers in agriculture (*ibid*).

Medium Density Mixed Housing (MDMH) refers to housing developments that are generally not more than four storeys high, and well located close to social amenities and public facilities (Landman *et al*., 2007 and Osman, 2010). The building typologies are varied and may include stand alone houses. This housing typology is characterized by

[3] The UDD sanitation technology project the researcher was involved in was called Ecological Sanitation, Urban Agriculture and Gender in Periurban Settlements. Its aim was "to gain an insight and knowledge about how residents perceive and understand ecological sanitation and reticulation of nutrients" (Drangert *et al.*, 2002:4). On the other hand, the aim of the MDMH project was to "investigate and understand its relevance and suitability for the establishment of quality housing and neighbourhoods in South Africa, as well as to determine the key factors that are likely to hinder or contribute to its success" (Landman *et al.*, 2007:4).

ground level entry, private external space for each dwelling unit, and close proximity to secure parking. Mixed housing should have most of the following characteristics: mix of building or unit types, mix of tenure forms (e.g. ownership, rent-to-buy and rental units); mix of income groups facilitated by affordable housing and market-rate housing in the same development; and a mix of land uses such as residential, commercial, public open space and business (*ibid*).

Perception is defined as a way one views something without full knowledge or understanding (*The Free Dictionary*, undated). These perceptions are common across societies. However, they are further modified by cultural beliefs and practices, economy, urban/rural population pattern and gender (Drangert, 2004), which in turn influence, guide, motivate or demotivate behaviour and determine the future success of technologies and/or products (Duncker, *et al*., 2007).

A **urine diversion (UD)** toilet collects urine separately from faeces and from water /minimal flush water (GTZ, 2009). It has been designed with two outlets with two collection systems: the front part for urine and rear one for faeces (and possibly a third one for anal wash water) in order to keep these two (or three) excreta or wastewater fractions separate. UD toilets may, or may not, mix water and faeces, or some water and urine but never combine urine and faeces. There are two types of UD toilets: one that does not use flush water, called urine diversion dehydration (UDD) toilet and another one that uses flush water, and is known as a UD flush toilet (*ibid*).

A urine diversion dry (UDD) toilet refers to a sanitation system or toilet that does not use water to flush, and separates human faeces and urine (separate collection and storage). Only a small quantity of water can be used to clean the urine receptacle and urinal - either automatically through a flush mechanism or by hand. This toilet pedestal has two outlets with two collection systems: one in the front for urine and the rear part for faeces.

This chapter has introduced and highlighted different main elements of the research study. This includes background to the study, which identifies one example of an ecosan technology in a form of UDD toilets as a sustainable response to water scarcity challenges particularly in South Africa. However, this UDD sanitation system has highlighted challenges related to socio-cultural perceptions in accepting it.

Nevertheless, it is of great significance to consider this sanitation system as an innovative solution, because it treats human excreta as a valuable resource in a form of a soil conditioner. Therefore, the study aimed to establish the perceptions of users regarding the use of UDD toilets in Hull Street, Kimberley.

This research report comprises six chapters – the introduction, literature review, research methods, case study description, presentation of findings and data analysis as well as conclusion and recommendations.

CHAPTER 2: A REVIEW OF SOCIO-CULTURAL ASPECTS OF THE UD TOILET

2.1 Introduction

This chapter reviews the body of knowledge in terms of the following areas: UD (and UDD) sanitation, its acceptance issues and ecosan as a component of sustainable housing, including medium density mixed housing (MDMH). There are some criteria that need to be taken into account for a sanitation system to be sustainable and these include: health and hygiene training/awareness, the environment and natural resources, technology and operation, financial and economic issues, as well as socio-cultural and institutional aspects (SuSanA, 2008). The focus of this research study is on socio-cultural aspects. However, emphasis will be placed on individual values and societal norms in countries with different socio-economic status and varying ethnic backgrounds, including gender conditions.

The history of sanitation can be traced back as far as 7 000 years to the Babylonians, Egyptians, Greeks and Romans (PB Gast, undated). The ancient Romans were pioneers of sanitation, they built aqueducts for fresh water, sewer systems and public baths (PHLUSH, 2009; PB Gast, undated). During earlier times, sanitation was not considered an issue of concern (PB Gast, undated) in that people could defecate and urinate anywhere, be it by the roadside, open space or relieve themselves in the river (Pathak, 1995).

Prior to the invention of the first sewer toilet in London in 1853, inhabitants were using chamber pots, which were dumped in the streets (PHLUSH, 2009). Such deplorable living conditions resulted in considerable health risks in terms of widespread epidemics. People contracted diseases ranging from cholera, tuberculosis, diphtheria, smallpox and yellow fever (PB Gast, undated). Consequently, about 60 million people died between 1438 and 1441 mainly due to the Black Death epidemic (*ibid*).

By the mid-19th century, most great cities and towns were dirty, crowded, smelly and water sources were contaminated (PHLUSH, 2009; PB Gast, undated). Industrialisation added to cities and towns becoming overcrowded, with the resulting dirt and smell due to lack of proper sanitation practices (PB Gast, undated).

As cities grew, the wastewater treatment plants could not be managed to meet the demands of the growing population. Flush toilets may not be environmentally sustainable in some areas, mostly in cities of developing countries because of increased usage of plants that are not coping with high volumes of waste water as a result of urbanisation. Based on the above, there was a strong need to explore alternatives such as ecological sanitation technology (PHLUSH, 2009).

Urban sanitation has been largely characterised by flush toilets connected to sewers that carry excreta away from areas of habitation (see Figure 7). This sanitation system has become an established standard of which its suitability and sustainability are generally unquestioned (Schütze *et al.*, 2011).

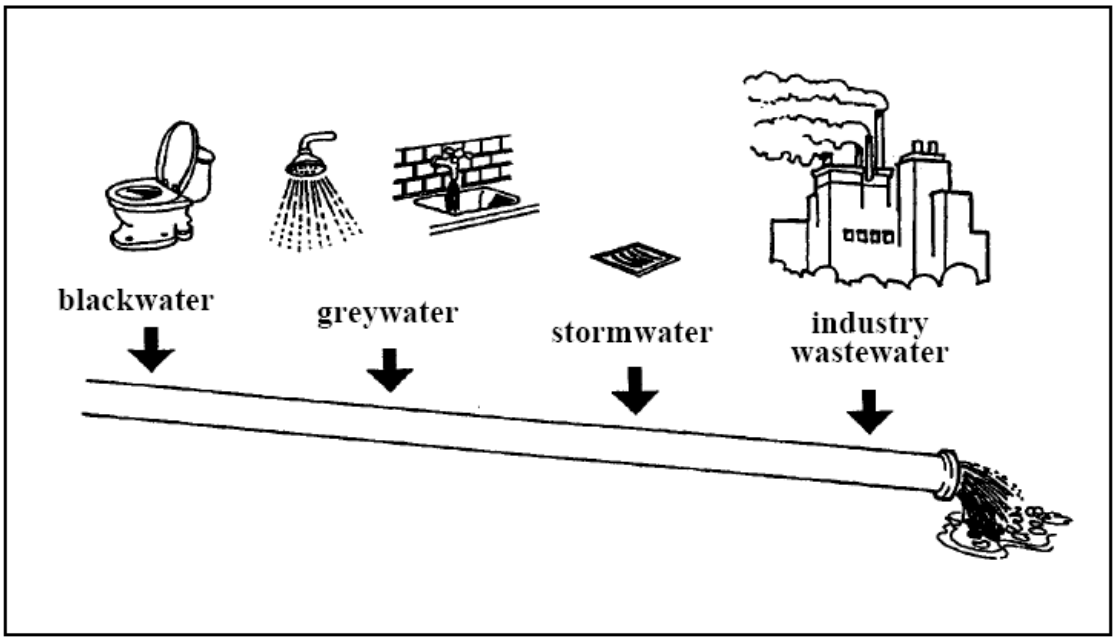

Figure 7: Linear flow system (Source: Esrey *et al.*, 2001)

However, the challenges of a paradigm shift to ecological sanitation are determined partly by how government authorities buy into the concept of sustainable sanitation systems, such as the ecological sanitation (ecosan) approach (See Figure 8).

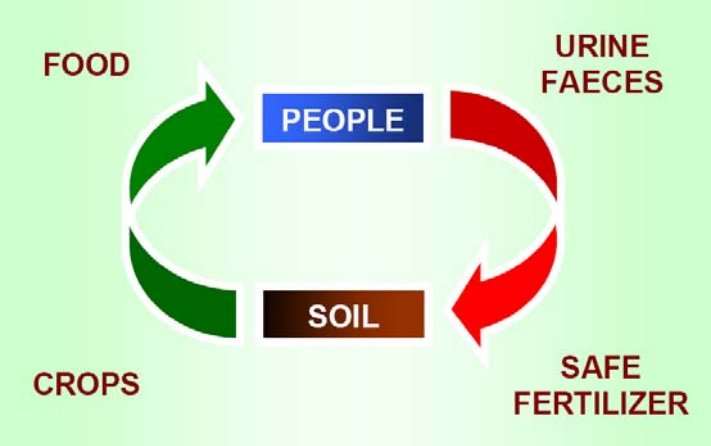

Figure 8: Closing the loop on sanitation (Source: EcoSanRes, 2008)

Introducing and operating ecosan installations in urban areas requires a thoughtful combination of technical and managerial aspects fitting the prevailing socio-cultural context (Drangert, 2004). Various kinds of toilets were used in both urban and rural areas in both developed and developing countries to collect excreta for reuse, where the type of toilet was designed in accordance with the conditions of each location (Lee, 2000).

2.2 Acceptance of UD toilets

Acceptance is an "act of accepting, receiving what is offered, with approbation, satisfaction or acquiescence, especially, favourable reception, approval, as the acceptance of a gift, office, doctrine, etc" (*Websters Dictionary*, undated). The acceptability of UD toilets entails technical, socio-cultural and economic factors that include a diversity of cultural and societal norms, individual values, people's beliefs, attitudes and practices, religious conventions, user preferences and established practices that determine whether a novel approach will be accepted or rejected by its users (Drangert, 2004). User interface is the key consideration for the success of a UD toilet (McConville and Rosemarin, 2011). Henceforth, the UD toilets must be of the right design and convenient to use, as people might be cautious and take time to understand the systems well before they adopt them (*ibid*).

It may be said that people's behaviour is not always motivated by rational needs, but rather by what they feel or perceive their needs to be (Drangert, 2004). Their choice of sanitation system to satisfy their needs is influenced by their feelings, perceptions of the

sanitation system and its ability to satisfy those needs (Duncker *et al.,* 2006). People's attitude towards the handling of human excreta is strongly influenced by perceptions and practices. These perceptions are common across societies. However, they are further modified by cultural beliefs and practices, economy, urban/rural population pattern and gender (Drangert, 2004), which in turn influence, guide, motivate or demotivate behaviour and determine the future success of technologies and/or products (Duncker *et al.,* 2007).

Perception is defined as "a process of becoming aware of the world around you through your senses" (Positive thinking principles, undated). For the purpose of this study, perception is defined as a way one views something without full knowledge or understanding, while practice is defined as "a habitual or customary action or way of doing things" (*The Free Dictionary*, undated). Perceptions are seen as influencing and guiding behaviour, motivating or demotivating all actions and determining the future success of technologies and/or products (Duncker *et al.,* 2007). To manage the future of a technology or a product, perceptions have to be managed and applied to adapt the strategy of technology implementation and transfer to the tasks of creating, shifting, changing and managing perceptions (*ibid*).

The functionality and the ease with which the entire sanitation system (including the collection, transport, treatment and reuse and/or final disposal) is constructed, operated and monitored are important aspects, which need to be taken into account to enhance the acceptance of the UDD system (Schütze *et al.,* 2011:63). The benefit of a UDD toilet is that it uses little or no water for flushing (Esrey *et al.,* 1998; Drangert, 2004; Austin *et al.,* 2005 and GTZ, 2009) while a flush toilet uses 8 to 12 litres per flush (GTZ, 2009). This results in a cost saving for both users and the service provider (municipality). Furthermore, the UD toilet recycles phosphorus from the urine and has less odour as a result of separating faeces and urine compared to other on-site sanitation technologies, such as the Ventilated Improved Pit (VIP) latrine. Another advantage is that it may also create business opportunities through the sale of UD toilets and the fertilizer generated. In addition, it can be installed indoors and above ground, which minimises toilet-related groundwater pollution with nitrates and pathogens (*ibid*).

Several research studies and the experiences of different authors reveal that this sanitation system functions well in different contexts (rural, peri-urban and urban), provided that it is properly installed, operated and maintained (Kvarnström *et al*., 2006). However, socio-cultural perceptions and practice, technical and environmental factors play a major role towards acceptance of this sanitation system (Winblad and Kilama 1980). For instance, it is common practice in Muslim cultures to keep water in the toilet for anal cleansing. The Islamic religion requires cleaning of all body openings, including anal cleansing, as a common practice for purification rituals prior to praying. In addition, Machaki villagers in the North West Frontier Province, Pakistan preferred the squatting commode to be installed in a north-south direction to avoid facing Mecca. The reason behind preferring a squatting commode was mainly due to the fact that it was considered to be ideal for anal cleansing, which is difficult to do when using urine diversion toilets or common sitting commodes (*ibid*).

The success of a given sanitation technology depends on how well it is embedded into an existing context. Adapting a sanitation system to meet the diverse needs and cultural norms of users seems to be a formidable challenge. However, UDD toilets have been successfully integrated into various urban settings, including MDMH developments in several countries, South Africa included (Austin and Duncker, 2002; Winblad and Simpson-Hébert, 2004).

The acceptance of UDD toilets by the users in Hull Street in Kimberley poses challenges partly because of socio-cultural perceptions of handling human excreta (Drangert *et al*., 2002). These challenges are mainly evident from the design of the UDD toilet, which is considered to be sub-standard by poor people (*ibid*). The socio-cultural acceptance of UD toilets here refers also to the appropriateness of the sanitation system, the perceptions of users regarding the quality of this sanitation technology (inferior quality) and the common practices whereby a father-in-law is not supposed to use (access) the same toilet facility used by his daughter-in-law. It has demonstrated that culturally, sons and daughters-in-law have their own toilet separate from that of the parents-in-law (Drangert, 2004). This is mainly applied in rural areas. When people move to urban areas, lack of space for toilets constraints them to use and share the same toilets without any cultural separation (*ibid*).

Inferior or incorrect design of UD toilets was highlighted as a barrier to acceptance of the technology (Drangert, 2002). Research conducted in four South African provinces, namely North West, KwaZulu-Natal and the Northern and Eastern Cape indicated that the design of a UD toilet can influence its acceptance (Matsebe and Duncker, 2005 and Duncker *et al.*, 2006). The study showed that the users liked UD toilets because they were convenient, safe and comfortable; reduced the spread of diseases, did not use water and were properly built (*Duncker et al.,* 2006). However, the level of maintenance and operation of this type of ecosan technology can lessen its acceptance. Respondents indicated that they liked the UD toilet as a toilet but handling of the excreta remained a major challenge (*ibid*).

Poor design of UD toilets can cause health and hygiene risks of exposure to pathogens and hazardous substances by the application of this specific sanitation system (McConville and Rosemarin, 2011). Aesthetic aspects, such as smell and appearance of human excreta, play a pivotal role in acceptance or rejection or avoidance of a sanitation system (Drangert, 2004). It is therefore necessary to design and construct toilets that are appealing to users and to develop national sanitation policies and strategies supporting their implementation (*ibid*).

Without proper consultation, users may not buy into the UD toilet if they are not fully involved in the project from the conception phase throughout the implementation process - including consultation, consensus and participation. It should be acknowledged that the community as the beneficiary is the main stakeholder throughout the process (CSIR, 2006). It is proper practice to implement projects in consultation with the users and not for them. This will result in achieving buy-in from the community members as they will be able to operate and maintain the UD sanitation system effectively. In addition, users will gain better understanding of the technology and be able to express their views.

Several authors have highlighted the importance of first establishing if there is a real demand for human excreta for fertilizer from a sanitation system and then design the sanitation system around this demand (UNESCO, 2006; SuSanA, 2008; Murray, 2009).

There is a wide range of institutional issues that can influence the success of sanitation services, including organizational competencies, human resources, knowledge and skills

on how to operate and monitor human excreta. Awareness-raising campaigns for behavioural change can be necessary in areas with low levels of hygiene and sanitation practices (McConville and Rosemarin, 2011), especially with regard to the handling of human excreta.

2.3 Handling of human excreta

According to Duncker *et al.*, (2006), the UD toilet can be accepted as a toilet but its major barrier to acceptance may be the emptying of the vault and the reluctance of users to use the products (excreta) from the toilet (see Figure 9). The users may see it as an unpleasant and unhealthy way to handle human faeces because of offensive odours (*ibid*).

Figure 9: Maintenance team member empties a faecal drum of the outdoor toilet at SPHC (Source: CSIR, 2011).

Field research studies conducted revealed that there is a general norm that discourages touching or physical handling of human excreta (Drangert, 1998 and 2004; Drangert *et al*., 2002; Duncker *et al.*, 2006 and Duncker *et al.*, 2007), which impacts on human perceptions. For example, handling of human excreta in South Africa remains a general challenge since faeces are perceived as waste products, unhealthy, unhygienic and detrimental to humans (Duncker *et al*, 2007). Therefore, human excreta are supposed to be privately kept because of their associated diseases, intolerable odour and related cultural beliefs like witchcraft (Drangert, 2004). As part of the tradition of the Luo people in Southeast Asia, they "believed that faeces was a waste and should be disposed

in a safe place particularly that of a child, since an evil person could pick it up and use it to bewitch the owner". The same belief is applicable in the Tanzanian lake regions "where faeces have been associated with evil when found at the door front or any other place of the house". Similarly in Kabale, "what people know (and it is true) is that faeces or urine can be used by witch doctors to harm (even kill) people. Sometimes they will use your excreta to harm you or use any human excreta." (*ibid*: 14).

The manner in which excreta is perceived differs in that there is a general view that the smell from faeces is stronger than that of urine (Drangert, 2004). However, smell is unacceptable, since bad smells can cause ill health generally, such as nausea and vomiting (*ibid*). This emphasises the importance of a toilet design that will promote minimal exposure of human excreta. For the acceptability of UD toilets, the aforementioned factors should be strongly considered during the design phase. Poor sanitation practices negatively impact the health and productivity of the population and degrade the natural resource base needed for economic growth (SuSanA, 2011).

A UD sanitation system should consider a wider range of options that take into account the health, hygiene and socio-cultural factors in emptying the vault, which involves the handling of human faeces (Kalbermatten, 1982; SuSanA, 2008a). In his study, Drangert (2004) revealed that adult faeces are viewed as repulsive, to such a degree that no one would like to handle them unless forced by circumstances - for example in cases of sickness.

This is confirmed by research about Korean traditional societies, where it was found that faeces had to be handled in a safe way as they could cause illness (Schütze *et al.*, 2011). A report by Duncker *et al*., (2006) indicates that users pointed out that disposal of excreta should be the responsibility of the local municipality and not the household. This is to say that even advocacy and training on UD toilets would not be sufficient to change the perceptions of the users regarding the handling of human faeces and therefore ownership of this particular sanitation system (*ibid*).

There is general unease on the part of UD toilets' users regarding eating food grown using human faeces (Duncker *et al*., 2006). This indicates that careful planning is essential for effective communication and advocacy concerning UDD toilets in South

Africa It is also essential that correct information on the operation and maintenance of the system be well transferred (*ibid*).

However, perceptions seem to change when handling a baby's faecal matter and further exception can refer to the handling of faeces of an incapacitated adult (Drangert, 1998; 2004). Women are reported to have accepted this task, as babies' faeces are considered to be harmless when compared to those of adults (Drangert, 2004).

2.4 Use of human excreta

Generally, ecosan toilets such as UD are sustainable "closed loop" or circle systems that treat human excreta as a valuable resource (Esrey *et al*., 1998; Duncker *et al*, 2007). A UD toilet system is a technique applied across the globe and designed in such a manner that it separates and stores urine and faeces for the reuse of nutrients. Human excreta can be turned into something useful and valuable, with minimum risk of environmental pollution and threat to human health (Esrey *et al*., 1998; Duncker *et al*, 2007). The nutrients found in human excreta are then reused as a soil conditioner or fertilizers in agricultural activities (*ibid*) – see Figure 10, therefore adding an economic value to human excreta.

Figure 10: Experiment of human excreta reuse in corn field (Source: McConville and Rosemarin, 2011).

Since larger human populations have been relocated to settle in certain locations, communities are now faced with a problem of excreta disposal (Schütze *et al*., 2011). Many agricultural societies have approached this problem in a pragmatic way, recognising the value of human waste for soil fertility. They therefore practised the collection and reuse of excreta (*ibid*: 36). The most renowned example of the organised collection and use of human excreta to support food production is that of China (Brown, 2003). Excreta reuse was also popular in ancient Arab cultures, where the collection and use of excreta was incorporated into agricultural systems (Schütze *et al*., 2011). This shows that the "use of human excreta is not new; it has been, and continues to be, practised by many cultures, especially for agricultural purposes" (*ibid*: 37).

Perceptions regarding smell are usually interpreted differently. In Manyatta (Kenya), people felt that tomatoes fertilised by human excreta have a faecal odour and taste like urine (Drangert, 2004:11). To counter the odour in the UD toilets, several measures were proposed, such as maintenance of the toilet, installation of ventilation pipes, use of air freshener and application of ash onto faecal deposit. However, there is a more relaxed view towards children's faeces. Cultural values do not have any negative connotations relating to the odour and handling of children's faecal matter. It is

perceived to be clean. Therefore, water from washing nappies could be poured into the garden or into the toilet (*ibid*).

2.4.1 Use of faeces

Faeces have been used in various countries from ancient time for various purposes (to be elaborated on further in this section). It is crucial for faeces to be processed in several steps before use as a fertilizer in order to destroy most of the pathogenic organisms (Winblad, 1997; Jönsson *et al*., 2004; Duncker *et al*., 2007).

The following examples outline case studies where faeces have been used. In the Hermosa Provincia of El Salvador, dehydrated faeces from Letrina abonera seca familiar (LASF) toilets were used to reclaim wasteland and a nursery garden (Winblad and Simpson-Hébert, 2004). In Sweden, household garbage was mixed with dehydrated faeces and composted for eight months before used as a soil conditioner in the small gardens of residents (Drangert, 1998). The use of fresh faeces for vegetable farming in a city of Bhaktapur in Nepal, (Asia) has been common since ancient times (Pokharel & Gajurel, 2003).

In Harare, Zimbabwe, faeces have been used as fertiliser for sweet potatoes (Guzha, 2001). The planting of bananas in old, full, pit latrines was commonly practised in Malawi in rural, peri-urban and urban areas (Morgan, 2001). Some farmers successfully grew other produce such as paw-paws, granadillas, tomatoes, pumpkins and a range of leafy vegetables. Other farmers were practising urban agriculture in Lilongwe and Blantyre, they collected sewage from the disposal site for fertilisation of their plants or gardens (*ibid*).

However, in contrast to the above statements, there is a general norm in South Africa that views faeces as offensive and unsuitable to handle (Drangert, 1998). Human faeces are generally perceived to have a stronger smell than urine, which is attributed to the type of food eaten (Drangert, 2004; Drangert *et al*., 2002). It was indicated that faeces from red meat eaters have a very bad smell (Drangert, 2004). In addition, the author highlights that people in a given society are inclined to acclimatize to a particular odour, including an unpleasant one (*ibid*).

Ash is applied on top of faeces after defecation to counter the smell and accelerate dehydration (Drangert *et al.,* 2002 and Drangert, 2004). Tallensi[4] farmers use a combination of human faeces and animal manure as fertiliser (*ibid*). A study conducted in Dzivarasekwa extension in Zimbabwe has shown that the use of human excreta for the fertilisation of vegetables was not well received, where people knew that the vegetables had been grown using human excreta (Guzha, 2001). The use of faeces is still practised in Asia as a natural medicine and for traditional healing (Bracken *et al*., 2006). However, socio-cultural perceptions on the use of faeces are directly related to fear that faeces may contain pathogens and hazardous substances that could affect public health at all points of the sanitation system: from the toilet, via the collection and treatment system, to the point of reuse or disposal and to downstream populations (*ibid*, 2011:63).

In most societies it is common to assess a person's health (including that of babies) from their faeces (Drangert, 1998). At the same time there is an expressed view that prohibits the handling of faeces, as it is perceived to be a medium for revenge and to heal thunder-stricken persons. In some cultures, the use of faeces is problematic since an evil person uses them to bewitch the owner (Drangert, 1998; 2004). There are witchdoctors who use human excreta (faeces or urine) to cause harm and even to kill people. Such a belief is likely to challenge the acceptance or rejection of UD toilets. However, if the faecal matter is treated by UD toilet or composting, it then resembles soil or humus, which could be easily handled (*ibid*).

Even though South Africans generally do not regard human excreta as a valuable resource, biophysical concerns, such as land degradation, declining soil fertility and limited phosphorus reserves could compel users of UD toilets to change their perceptions (Rosemarin, 2005). The respondents said that they would in future use human excreta in their gardens and eat the produce, although it remains to be seen whether they will in actual fact do so (Duncker *et al.,* 2007). Nowadays, human faeces are seldom used for medical purposes (Drangert *et al*., 2004). In cases where they are still used, the ingredients in medicines administered by local/traditional healers are unknown to the buyer. In Kabale, faeces are used to treat thunder-stricken persons, and in Addis Ababa they are used to treat a serious wound called chife (*ibid*).

[4] Tallensi, also spelled Talensi are people of northern Ghana who speak a language of the Gur branch of the Niger-Congo language family (http://www.britannica.com/EBchecked/topic/581597/Tallensi).

People perceive cow dung as safe and less offensive, with little or no reservation as to touching it (Drangert, 1998; Drangert *et al*., 2002). However, pigs are considered dirty for religious reasons, as well as their scavenging habits. Chickens and dogs are also scavengers, but only dogs are usually unacceptable as human food. Generally, human faeces are perceived to be disgusting (*ibid*).

2.4.2 Use of urine

This section discusses the views, attitudes and perceptions of people across the globe on the use of human urine. Different authors have demonstrated that urine contains more nutrients than faeces.

People perceive urine to be harmless and inoffensive (Drangert, 1998 and Drangert *et al.*, 2002). This is mainly attributed to the fact that when water and urine are on the ground, one cannot tell the difference. Like faeces, urine is perceived to be smelly and occasionally there is a flow back that keeps the urine smell for a while (Drangert, 2004:11). Furthermore, urine smells if a person is on medication. Similarly, urine becomes more offensive as urea is converted to offensive ammonia gas. It was also highlighted that the smell "can be so strong as to make a person feel odd" when using it in the garden (*ibid*).

Moreover, urine has antiseptic properties and is used to clean or smear wounds as well as an antiseptic drug (Drangert, 2004). A range of studies have shown that urine is used to treat ailments, such as eye disease, athlete's foot, for persons intoxicated by alcohol and as poison neutraliser. In Cuernavaca (Mexico), a known but not widespread practice is to dilute and drink human urine to cure allergic reactions. In other cases, most families do not use the urine, but rather channel it into the ground or soak away (*ibid*).

There are also contradicting perceptions as to whether urine attracts flies or not. Farmers hold positive attitudes towards the use of urine on their farms (Drangert, 2004). This could be attributed to the fact that urine is rich in nitrogen (*ibid*). Other studies revealed that urine is often used to treat minor ailments, such as small wounds and as an insecticide to kill banana weevils in the Kagera area in Tanzania (Chaggu & John, 2002; Drangert, 2004). Furthermore, it has been given as a fresh drink to someone who has inhaled or ingested poison (Drangert, 2004). Urine therapy represents a

natural medicine that not only eliminates symptoms but also treats the cause of illness (Universal Healing TAO, undated).

During the 19th century, urine was stored and used as a detergent for washing clothes and to make dye in Denmark (Drangert, 1998). In Nigeria, strangers are not allowed to collect urine for fear that it may be used against the people through "black magic" or "evil spirits" (Sridhar *et al*., 2005). In South West Nigeria, urine has been used for growing edible crops, such as fruit-yielding Okro (Hibiscus esculentus), Amaranthussp (a leafy vegetable) and maize. However, urine-grown crops are generally unacceptable as they are perceived to may have pathogens and therefore should be disposed of (*ibid*).

Fermented urine is used as a fertiliser in Mexico and users often add a handful of soil as a catalyst for the fermentation process, prior to sealing the container to avoid the loss of nitrogen (Ceballos, 1997). Experimentation with fermented urine to grow food has yielded good results for leafy vegetables (Esrey & Andersson, 2001). On the other hand, unfermented urine can be used as a fungicide (Clark, 2003). Furthermore, it was used in Europe in older times for household cleaning, softening wool, hardening steel, tanning leather and dyeing clothes. Similarly, it was used by the Greeks and Romans to dye their hair (*ibid*).

According to Esrey and Andersson (2001), as is the case with faeces, the Chinese have been using urine in the pharmaceutical industry to make blood coagulants. The authors further pointed to anecdotal evidence from several locations that indicated that people preferred vegetables fertilised with urine, and that the Chinese were willing to pay more for vegetables grown with urine (*ibid*).

In Thailand, people found it difficult to accept the application of human urine as a fertilizer. This was attributed to the general belief that human excreta are dirty and a pathway for disease transmission (Pinsem & Vinnerås, 2003). In Paje, Botswana, some families used urine for fertilising purposes. Conversely, experience has shown that generally people are not in favour of using urine as a fertilizer as there is no value attached to it (Hanke, 2003). On the other hand, there are also superstitions associated with a widespread belief in witchcraft, which holds that urine could be harmful. Fear of spreading HIV/AIDS through the use of urine in the garden was also highlighted (*ibid*).

2.5 Operation and maintenance

This section will focus on the division of tasks and the relationship between men and women concerning sanitation issues, and the age difference of the users in terms of operation and maintenance.

The study conducted by Drangert (2004) revealed that most of the women were available at home during the day, while men who were unemployed were not at home. This had an influence on the division of tasks in the household. It has been reported that bachelors in parts of Africa, such as Manyatta in Kenya are responsible for all household chores (including cleaning and cooking) in most instances. Some, however, only do light cooking and cleaning, while for heavy tasks arrangements are made with neighbours for a fee. This is different in Majumba Sita in Tanzania where the tenants are responsible for all the chores, while the cleaning of the toilet and bathroom (communal places) has to be shared with other tenants. In this regard, a roster is used and all tenants are compelled to clean. Alternatively, those who cannot do the cleaning have to pay someone to take up their duties. Generally, residents, both single men and single women, do most of their own household chores (*ibid*).

In African cultures, females are generally responsible for chores in the kitchen and bathroom/toilet, while men carry out construction, the repair of installations and emptying the urine container and faecal vault (Drangert, 2004). Generally, women are more concerned about sanitation than men as a result of the particular social and economic structures. Furthermore, they are responsible for various domestic duties, including water collection, and its use for laundry, cooking and domestic hygiene. Women have also expressed their concern about the dangerous duties of caring for the sick - i.e. laundering and cleaning soiled clothes when water supplies, sanitation and washing facilities are inadequate. The findings of the same study by Drangert (2004) have further revealed that women and girls, and occasionally young boys, are responsible for cleaning the toilet in the four African study areas. In the case of communal toilets, female tenants in a given compound organise themselves to clean the toilets by rotation. In Mexico and Stockholm, females (women or girls) are responsible for cleaning the toilet. A different situation in terms of community work projects in

Cuernavaca highlights that both males and females participate, with females being involved in digging the pit for a toilet but not in its construction (*ibid*).

Drangert (2004) highlighted that the fact that women are expected to take on food production does not necessarily mean that they have the freedom to make their own decisions. It was reported in Majumba Sita that there are barriers that limit the ability of rural women to promote the economic security of the family and themselves. These include lack of title to land, women being over-represented due to the tribal background that prevents them from voicing their needs, and men tending to lead and dominate decision-making. In rural Mexico, men are responsible for emptying the faecal heap and use it in the cornfield since the act is perceived to be a "heavy" job (*ibid*).

In terms of decision-making in families with UD toilets in Cuernavaca, Mexico both women and men can initiate the decision (Drangert, 2004). These families in Cuernavaca tend to be non-traditional regarding gender roles. Both males and females work outside the house. Most men work inside the home while also going to work in offices. They also share cooking responsibilities. In contrast, in Kabale, Uganda, women sometimes initiate the decisions regarding the UD technology since they are usually the ones most concerned with health in homes. In Majumba Sita, it has been the residents' decision to install the UD toilet. In one instance it was the decision of the head of the household (male) to install the toilet (*ibid*).

It has been reported that women rarely urinate in public, compared to men (Drangert *et al.*, 2002 and Duncker *et al*, 2007). This gender difference seems universal. Generally, defecating in public is totally unacceptable, with the exception of small children (Drangert, 2004). Adults normally squat or sit on a seat when defecating. While females urinate in a squatting posture, men prefer to stand up, mainly to prevent their sexual organs from touching the ground or toilet surface. This could even result in them contracting some infections. The different cleansing materials used range from water to paper (including toilet paper and old newspapers), based on different beliefs or religions (*ibid*).

Faeces from babies are often perceived to be harmless, compared to those of older children or adults (Drangert, 2004). In Addis Ababa, Ethiopia, there is disapproval around the disposing of menstrual blood in UD toilets, as it discourages the reuse of

urine as fertiliser due to suspicion of transmitting diseases like bilharzia and HIV/AIDS. Some users in Majumba Sita wonder whether ecosan toilets require them to come into contact with menstrual blood produced by women. Similarly, there is a general perception that disposing of sanitary pads in the faeces vault also discourages the use of compost from faeces (*ibid*).

In conclusion, scholars have attested to the fact that every community has different ways of viewing and doing things. Therefore, it is important to note that socio-cultural aspects are taken into account when implementing developmental projects or technologies in communities to ensure their acceptance and use. It has also been revealed that the success or failure of any sanitation system relies on the relationships between environmental, human and technical factors. Handling or touching human faeces is unacceptable in many cultures, including South Africa. Aesthetic aspects, such as the smell and appearance of human excreta, play a role in the socio-cultural viability of UDD toilets (acceptance or rejection).

What is the level of acceptance or rejection of UD toilets by the users, both men and women who share the same environment in urban settings, including medium density mixed houses?

2.6 Examples of urine diversion toilets in medium density mixed housing

This section gives account of a few case studies where ecosan technologies, mainly UD toilets (both flush and dry) were implemented in various medium density mixed housing developments globally.

In Linz, Austria, UD flush toilets were installed at a primary school and in residential buildings comprising stand-alone houses and flats (Ulrich, 2009). The reuse of urine has not yet been done because the Upper Austrian legislation prohibits its application in agriculture, so collected urine is then released into the sewer system. In this project, the final stage of the ecosan project, closing the nutrient loop by using compost and urine as fertiliser in agriculture was not yet implemented, but is to be considered in future. It was also highlighted in the Linz project that the operation of the urine diversion flush toilets is similar to conventional waterborne toilets. The user has to be seated also for

urination (*ibid*), which is unusual for male users, as they prefer to urinate while standing up (Drangert, 2004).

Experience and lessons learnt in the Linz project highlighted that around 90% of the residents in the medium density mixed housing equipped with UD toilets did not move there purposefully for an ecological lifestyle. Therefore, the acceptance of the urine diversion toilet has posed a challenge (Ulrich, 2009). This issue is exacerbated by operational short-comings, including odour problems (from wrong deposition of faeces into the urine receptacle) and inadequate water flush volumes to carry away faeces and/or toilet paper. The incorrect use and/or the design of the UD toilet itself (causing a splashing of flush water onto toilet seats) and neglected maintenance also add to these problems. These factors resulted in the cleaning of urine diversion toilets being a bit complex compared to conventional flush toilets. That is, users are provided with one litre of diluted citric acid to prevent urine scale deposition in the urine valves. This was confirmed by a high number of users (71%) complaining about the special maintenance work for this sanitation technology. General acceptance of the UD toilets in this project was very bad to neutral. User information is cited as extremely crucial for the acceptance of innovative sanitation systems and the user's willingness to cooperate (*ibid*).

In Wucum, a town in southern China (Guangxi province), a modified version of double vault urine diversion toilets has been installed inside the house, usually on the second or third floor (Winblad and Simpson-Hébert, 2004). Faeces drop through a 20cm wide PVC chute to a ground level double vault processing chamber. Urine is diverted from a specially designed squatting pan to a ground level collection point, from where it is either fed to the household pigs or used as fertilizer in the household's own vegetable garden. Buckets are provided for ash, another one for the disposal of toilet paper and water can for rinsing the urine bowl in the bathroom (*ibid*).

Several lessons were learnt from the China-Sweden Erdos Eco-town Project (EETP). It was highlighted that the participation of users is significant for the success of the UDD toilets (McConville and Rosemarin, 2011). It is necessary for the design of this toilet to be appropriate and suitable for use. One of the major challenges identified has been the seat riser, which was too immature in its development and uncomfortable to use and

unacceptable to the users. Since ecosan puts the sanitation system closer to the user, users' awareness of benefits (from agricultural reuse and water saving) and their acceptance is vital. Furthermore, active participation by the users throughout the entire process of the project is crucial, as they not only become self-reliant and independent, but also develop a sense of ownership and responsibility for management and maintenance of the infrastructure. Such an involvement also results in a smooth handover of the project. It was also found to be necessary to establish a continuous and truthful communication strategy between all stakeholders, particularly for the benefit of the user. This can be achieved by involving the professional public relations officer (*ibid*).

Other lessons cited include the importance of identifying local champions (e.g. 10% of the population) who will be responsible for leading the remaining community in awareness and acceptance (McConville and Rosemarin, 2011). These are supportive structures that play a critical role towards sustainability of the technology. It was further indicated that implementers of UD technologies should recognise that changes in mindset and behaviour take a long time, especially when introducing a new system and concept. One way of enhancing the acceptance level of the users is for the implementers to ensure that the cost-benefit ratio for the overall system is acceptable when compared to the conventional system. Costs for the operation and maintenance (O&M) should not be higher than for the flush system or the users should directly experience benefits (*ibid*).

The major barrier to the EETP has been household acceptance. Consequently, the sustainability of the solutions has always been questioned because of user resistance (McConville and Rosemarin, 2011). The authors cited users' reasons for rejecting the technology as follows: the toilets have been awkward to use and explaining their function to visiting family relatives and friends was considered an embarrassment and unnecessary burden. Another major problem was the cost of collection and maintenance, which the local government did not want to take on itself. The dry sanitation system also faces several challenges in terms of operation and maintenance. The system is perceived to be inconvenient as it was mostly associated with the need to separate streams of urine and faeces, the use of sawdust, and the difficulty of keeping

the toilets clean. These perceptions eventually resulted in conversion of the UD system into waterborne facilities (*ibid*).

Mexico and Central America have been reported to have lots of modern examples of the urban use of double vault dehydrating toilets (Winblad and Simpson-Hébert, 2004). An example in El Salvador includes Hermosa Provincia, a small and high-density squatter area in the centre of San Salvador. One hundred and thirty households built LASF toilets in 1991, with each household owning a toilet (*ibid*).

In Sweden, The UD flushing system is mainly installed in apartments or cluster housing called "eco-villages" (Austin and Duncker, 2002). In these housing developments, urine is collected and stored in underground vaults, from where it is collected by farmers. Faeces are flushed into a conventional waterborne sewerage for further treatment. Sweden is probably the country with the most advanced system of collection and reuse of human urine, where it is practised by farmers on a large, mechanised scale (*ibid*). The farmer's perception of the use of urine in Sweden is that the more concentrated the urine is the better it is from his perspective (Stintzing, 2005).

In Ekoporte, Norrkoping, a four-storey building with 18 modern, high-standard apartments has been rebuilt and retrofitted with urine diversion flush toilets (Winblad and Simpson-Hébert, 2004). Furthermore, in Stockholm several Vietnamese-type double vault dehydrating toilets are fitted inside weekend houses, permanent houses, apartments, industries and institutions. In fact, urine is piped into underground tanks and later used as fertiliser by local farmers, whereas faeces are separated from flush water in an "Aquatron" separator and then composted in an automatic composting device together with paper, kitchen and garden waste and wood pellets. The compost product (faecal matter) obtained through dehydration and composting is used by the tenants in vegetable and flower cultivation (*ibid*).

A study conducted by Toilettes Du Monde (2010) gives an account of the current use of dry toilets (UDD toilets) in several countries, such as France, Germany, Finland, Sweden, Switzerland, Denmark, Norway, New South Wales and United States. Out of these countries, socio-cultural aspects regarding the UDD toilets are more significant in France, Germany and Sweden. France provides a practical approach in that two thirds of

the organisations working in the dry toilet sector offer them (UDD toilets) on a rental basis for events. This approach is appropriate in creating public awareness (*ibid*).

But in Finland, of the 500 000 UDD toilets used (the majority of these are installed in second homes) 20 000 of these are installed inside houses (Toilettes Du Monde, 2010). There is a high public demand for the modern UDD system. This is an indication of its socio-cultural acceptability. This demand has prompted competition among different dry toilets manufacturers regarding the delivery of quality products.

Similarly, the use of UDD toilets in Sweden is predominantly in second homes. However, the government runs a website dedicated to sanitation, where information on UDD toilets is shared with an emphasis on recommendations for dealing with end products. Sweden has no national regulations for on-site sanitation, except for guidelines developed by certain municipalities (*ibid*). What is common with the above countries is how they deal with the socio-cultural aspects of UDD toilets. The core focus is on educating the public on the UDD toilet system so as to achieve acceptability.

Germany demonstrates classical benefits of the use of UDD toilet systems and more than 30 000 units have been installed (Toilettes Du Monde, 2010). Most homes have vegetable gardens or allotments. The UDD toilet system is supported by the majority of gardening associations. In the Bielefeld-Quelle ecological settlement, dry toilets were installed in a mixed-use building conversion and connected to four composting containers (Berger, 2004). According to Rauschning *et al*. (2009) all residents in these eco-settlements were home owners and a vision of a sustainable lifestyle was instilled among them. They participated actively throughout the process of the project (i.e. planning, design, implementation, operation and maintenance), thus leading to increased commitment in operation and maintenance activities (*ibid*).

Despite the widespread use of the UDD sanitation system, as in Sweden, the German regulatory framework does not acknowledge it (*ibid*). This is similar to the South African situation where the sanitation policy refers to the UD sanitation technology only as an option (DWAF, 2002). It can be assumed that the socio-cultural barrier on the use of human excreta as manure has been broken in Germany.

UDD toilets have been successfully integrated into various urban settings, including MDMH developments in several countries. However, acceptance of this sanitation

technology remains a challenge, which can be attributed to the fact that users are not conscious of the ecological aspects. That is, households did not move into the housing developments for ecosan purposes.

2.7 Conclusion

As explored in this chapter, the main objective of a sanitation system is to protect and promote human health by providing a clean environment and breaking the cycle of disease. The UDD toilets need to be well designed and convenient to use in order to enhance the acceptance level of the users. Inferior or incorrect design of UD toilet was highlighted as a barrier to the acceptance of the technology. Appropriate design, coupled with a lack of or very little smell of faeces and urine is likely to contribute towards the rate of acceptability of UDD sanitation arrangements. In order to be sustainable, a sanitation system has to look at health and hygiene aspects, the environment and natural resources, be economically viable and technically and institutionally appropriate, as well as socially acceptable.

The literature review further highlights that human urine and faeces have been used as a valuable resource for food production in many parts of the world for centuries, particularly in China. In some countries in Africa, the use of human urine and faeces is also accepted. Moreover, attitudes and perceptions about health hazards, and people's revulsion towards faeces and urine, vary between cultures, and often people's attitudes towards urine differ from those towards faeces. Every social group has a social policy for excreting; some norms of conduct will vary with age, marital status, gender, class, religion, locality and educational background. It is clear that cultural taboos and perceptions across the globe need to change before people accept using faeces and urine as fertilizer for food crops.

Experience indicates that projects often fail because proposed solutions are only partial solutions. At the same time they may address one problem, while they may miss or neglect other challenges in other areas. Often, technological solutions are the primary focus, while social, organizational and other factors are not addressed adequately. Such partial solutions may fit well with some dimensions but generate problems in other dimensions like socio-cultural aspects. Consequently, projects and new technologies

whose characteristics are not well designed and aligned with their specific context run a high risk of failure.

A gender focus, such as specific requirements of both women and men in sanitation projects, is crucial for attaining the objectives of social justice and sustainability. Generally, the traditional gender roles in some African communities were still observed and sanitation was regarded as a women's issue, while in countries like Stockholm both males and females are involved in decision-making and share household chores.

UD toilet systems are developed in many ways and for many purposes. All of them need maintenance. Regular maintenance is such a daunting process and is time consuming. In this way, the amount of effort for maintaining the system is often decisive for the acceptance of the special system by the user. Users should realise that a conventional sanitation system is not the sole solution for every location.

Urine diversion sanitation technology has been used successfully in some medium to higher density developments - mainly in Mexico, Sweden, China, El Salvador, Austria, Germany, France, Denmark, Finland, Norway and South Africa. The limitation in this regard has been that some cases did not address the socio-cultural aspects of the users on the acceptance or rejection of the technology. Ownership tenure of housing units with a UD sanitation system has some advantages, as operation and maintenance functions are performed by the residents themselves. Those owning the houses are interested in sustainability and more comfortable with using the fertilisers in their gardens. In contrast, most of the renters are not ecologically conscious, hence their low level of acceptance of the UDD toilet systems.

Users who are actively involved in all stages of the project contribute positively to the success of the UD sanitation. Management of UD sanitation technology in MDMH requires a higher level of commitment from the users compared with other sanitation technologies. This becomes a challenge as users are expected to carry out some responsibilities for maintenance and /or emptying the bin.

Water as a resource has been identified as a scarce commodity worldwide. Black and greywater has impacted negatively on the environment, with more emphasis on

wetlands[5]. UD toilets, by virtue of their design, are aimed at using a very little amount of water or none at all. Considering the cost of purifying black and greywater at the treatment plants, and the ever-increasing demand for water attributed to the increase in the world population, there is a strong need to educate the world on the diminishing resource (water) and methods of saving it. The UD toilet provides a necessary solution to addressing part of this challenge, and it also contributes towards human and environmental sustainability.

The literature review has contributed significantly in identifying the relevant research methods to be employed in data collection. The next chapter will explain the methods used for conducting the study.

[5] Greywater contains detergent compounds that are harmful to the environment, wetlands may not cope with larger volumes of it. Furthermore, black water contaminates wetlands owing to the overflowing of treatment plants.

CHAPTER 3: RESEARCH METHODS FOR THE UDD STUDY

The study was qualitative in nature. The qualitative method focuses on explanation and description rather than measurement, with the aim of gathering as many diverse options as possible. Qualitative research is conducted through intense contact with a "field" or with a life situation and is typically reflective of the everyday life of individuals, groups, societies and organizations (Miles & Hubermann 1994).

According to Marlow and Boone (2005), the qualitative approach involves collecting data that involve non-numerical examination of phenomena, using words instead of numbers. It focuses on the underlying meaning and patterns of relationships.

By using qualitative methods, the researcher acquires a better understanding and in-depth information about users' perceptions of and attitudes towards the UDD toilet. As explained by Terre Blanche *et al.,* (2006), qualitative research seeks to make sense of feelings, experiences, social situations, or phenomena in their real world. Therefore it involves studying them in their natural setting.

Each research method has its strengths and weaknesses. A qualitative research method was preferred over quantitative research in this study because it provides an understanding of people's personal experiences of phenomena as described by the respondents (Johnson and Onwuegbuzie, 2004). It also enables the researcher to identify the contextual factors of the setting as they relate to the phenomena studied. In so doing the researcher may be responsive to local situations, conditions and the stakeholders' needs. This being said, it is acknowledged that qualitative research is often time consuming compared to quantitative methods. The findings might also be more easily influenced by the researcher's personal biases (*ibid)*. This may lead to a situation where findings cannot be used to assess other settings as they are restricted to a particular context and are influenced by the researcher's own perceptions. To avoid this, the research procedure has been developed to achieve objectivity and replicability.

3.1 Research design

The research used a case study design. According to Yin (1984:23), a case study research design refers to "an empirical inquiry that investigates a contemporary phenomenon within a real life context, when the boundaries between phenomenon and

context are not clearly evident, and in which multiple scores of evidence are used". Phenomenological research design was used, which is a cluster under the broader case study research design. The case study method is about "asking the 'how' or 'why' questions around a contemporary set of events over which the researcher has little or no control and the focus is on contemporary phenomena within a real-life situation" (Yin, 2009:2).

Phenomenological research design is concerned with understanding social and psychological phenomena from the perspectives of people involved (Welman *et al.*, 2005). The phenomenologist, therefore, attempts to experience these phenomena as the individuals involved must have experienced them (Welman *et al.,* 2005).

Using a phenomenological research design enables a direct understanding of the phenomena being studied. This implies that the researcher can understand the circumstances of the object of study because he/she can picture him/herself in the latter's shoes (Welman *et al.,* 2005). By using this method, the researcher will not be solely confined to the statistical analysis of data, but also understand the behavioural conditions of the respondents in their own settings (Zaida, 2007). Despite this strength, this method has been criticized for lack of robustness in that it allows biased views to influence the findings of the study (Yin, 1984). There are several categories of case study - namely, exploratory, descriptive and explanatory. All these were applicable during the fieldwork. That is, the researcher explored any phenomenon she was interested in. Furthermore, she described the natural phenomena which occurred within the data and explained them in detail (*ibid)*. The researcher used the UDD toilets in various houses during fieldwork.

3.2 Sampling

Purposive sampling, also known as judgemental, selective or subjective sampling is a non-probability sampling technique used in this study. When using this technique, selection of participants involved in the study was based on the researcher's judgement as in Laerd's dissertation (undated). That is, the researcher selects informants with a specific purpose in mind (Neuman, 2003). This sampling technique is suitable in three situations. First, a researcher has a choice to select a sample that will provide the information sought. The technique can also be used to access a sample that is difficult to

locate (*ibid*). In this instance, the researcher, with the assistance of the employees of the SPHC selected households that shared characteristics relevant to the study (users of UDD toilets) from the company's database or register. The characteristics included: race, gender, position in the household (head of household or spouse), age, language, duration of stay in Hull Street, preference for the UDD sanitation system and unit size. Finally, purposive sampling is carried out to identify a particular class sample so as to obtain in-depth information related to the study (Neuman, 2003).

The sample studied is not representative of the population (Laerd dissertation, undated). Purposive sampling allows the researcher to sample a small number of participants. Another advantage of this sampling technique is that it uses different non-probability sampling techniques, such as critical case sampling, homogeneous sampling and more. However, it has a limitation in that judgement lies solely with the researcher, which increases elements of bias (*ibid*).

In this research study, the researcher was provided with a list of 31 participants (21 females and 10 males). A site plan (map) was also used to indicate the location of units in order to ensure an even selection of participants from both sections of Hull Street (see Appendix B). This tool also made it easier for the researcher to locate the respondents. The sample consisted of 13 residents. The two criteria for inclusion were that all were dwellers of Hull Street, Kimberley, and all were users of UDD toilets. Since the focus was on users, the study was extended to include employees of the housing company, as the latter also used UDD toilets in their offices and spent most of their time at work. Three employees (two office-bound and one general worker/maintenance) were selected, using the same criteria as that for the residents, making a total sample size of 16 participants.

3.3 Research tools

The researcher used semi-structured interviews and a Dictaphone recorder to collect data.

3.3.1 Semi-structured interviews

Interviews are regarded as the simplest means of obtaining "facts", in that an investigator goes directly to the people who may have answers regarding the questions on hand. In semi-structured interviews, the interview guide provides a series/set of questions to be raised during an interview. The interviewer is at liberty to stray from the guide should a need arise; this has the advantage of obtaining an in-depth understanding of the subject (RWJF, 2008).

These semi-structured interviews were conducted with the use of an open-ended questionnaire (see Appendices C and D for residents and employees' questionnaire respectively). The use of open-ended questions in qualitative research of this nature is critical, as no clues are provided and provision is made for a greater depth of response. The interviewer can deviate from the specific core questions to explore in-depth information and probe according to the way the interview proceeds, allowing for elaboration (Neuman, 2003).

Semi-structured interviews were suitable for this study as the topic of discussion was very sensitive for some participants. One-on-one interviews yield a highest rate of response owing to the presence of the interviewer leading and guiding the session (Cargan, 2007 and Neuman, 2003). This type of interview is also favourable in the sense that it allows the interviewer to elicit information through probing, in order to get clarity and in-depth information (Welman *et al.,* 2005).

Similarly, the informants have an opportunity to ask for clarity in the event of misunderstanding. Moreover, the interviews provide an opportunity to evaluate and validate the respondents' answers by observing non-verbal cues (such as avoidance of eye contact or nervousness), which are particularly useful when discussing sensitive topics (Gordon, 1975; Cargan, 2007) such as sanitation and human excreta. Another benefit of this type of interview is that it can "provide reliable and comparable qualitative data" (RWJF, 2008). Finally, semi-structured interviews are suitable tools to explore attitudes, values, beliefs and motives (Richardson *et al*, 1965 and Smith 1975).

In contrast, these interviews have several limitations, including the fact that they are costly and time consuming (Cargan, 2007 and Neuman, 2003). Respondents may not trust the researcher, and therefore withhold relevant information and responding less

frankly (Cargan, 2007). In addition, data may be affected by differences in class or ethnic background and the personality of the researcher and participants, and impede the latter from expressing their attitudes and beliefs accurately (*ibid*). Confidentiality was ensured where applicable.

3.3.2 Dictaphone

A Dictaphone is a voice-recording device that could be played back later and its content transcribed (eHow, undated). It was used in this study to record the interviews after respondents granted permission and field notes were taken during the interviews. According to Terre Blanche *et al.* (2006), the advantages of recording an interview are: it saves the researcher's valuable time and allows him or her to keep a full record of the interview without being distracted by detailed note-keeping; it also shows the interviewees that the researcher takes what they said seriously.

Nonetheless, this tool is criticised for its weakness in that the recordings may have background noise, slurred speech and wrong pronunciations (eHow, undated). Transcription is time-consuming, especially for a new transcriber, as one has to listen over and over, which requires patience, listening and fast typing skills (*ibid*). Transcriptions and translations (from Afrikaans) were done by the researcher and an external expert (transcriptionist).

Field notes are also necessary in data collection as the researcher can take note of any non-verbal behaviour that is important for the study (Welman *et al.,* 2005). It is also indicated that field notes are advantageous in research, since raw field notes, when reviewed, stimulated the fieldworker/researcher's memory of things said at the time that were not included in the original notes (Welman *et al.,* 2005). On the other hand, note taking can be time consuming, resulting in a long interview that can be tedious for the informant.

Here, brief notes (in the form of key issues) were written on the questionnaire to enable the researcher sufficient time to observe the non-verbal cues of the respondent while mostly relying on the Dictaphone.

3.4 Pilot study

A pilot study is a preliminary run that provides an overview of the subject to be studied prior to implementing the study on a large scale. According to Terre Blanche *et al., (*2006), a pilot study is necessary as it helps to identify potential problems with the design, particularly the research instruments.

Terre Blanche *et al.,* (2006) also indicates that the structured pilot studies assists the researcher to ensure that no offensive language is contained in the questionnaire, to check the clarity of instructions and questions, establish the administration time, layout and data input and conduct preliminary data analysis.

In the current study, the researcher with the assistance of the CSIR's candidate researcher, Yasmin Shurpujee, conducted a mini-study with three residents and one SPHC employee. The researcher explained the project in details (including its purpose, the questionnaire and the research assistant's role) prior to conducting the interviews. The pilot study was done to assess the feasibility of the research. The researcher interviewed the participants and unclear questions were restructured and some were replaced. It was also established that interview session took longer (in one instance, the interview lasted almost two hours) as the researcher was writing down all responses. To address this, the researcher subsequently employed a Dictaphone and notes taken were very brief.

It was revealed during the pilot study that one of the employees was a Muslim and did not use the toilet for defecation owing to a conflict between one of the principles of the UDD toilets (which restricts the use of water inside the faeces vault) and Muslim culture (which requires the use of water for anal cleansing after defecation). Therefore, five Muslim participants were included in the study (four residents and one employee).

3.5 Data collection

The researcher was granted permission to conduct the study by the management of SPHC. The SPHC's employee sent notices/correspondence to selected respondents looking at the following strata: age, race, gender, preference for the UDD toilets and duration of stay in this housing development. This was followed by unannounced visits

to their houses from 29 to 31 August 2011. Interviews were conducted with either the head of household or a spouse.

Forty-five minutes to an hour-long individual interview was conducted with each participant. This was done in order to prevent interruption by another person who could bias the results and also to maintain the confidentiality of the participant's information. However, there were two instances where interviews were conducted with both the head of household and the spouse, as well as the head of the household and her adult son (staying together). It did not seem to have an impact on the responses.

The recordings of the participants' narrations were done by Dictaphone. Field notes were taken during the course of the interviews. Data were collected by the researcher with the assistance of an intern, S'bonelo Zulu (a research assistant) from the CSIR, who has reasonable experience in data collection. The research assistant has a BSc (Hons) degree in Hydrology. The researcher explained the project in details (including its purpose, the questionnaire and research assistant's role) prior to conducting the interviews. The research assistant's contribution during the field work included conducting some interviews and taking pictures. All the work executed by the intern was performed under the supervision of the researcher, who in the process transferred some interviewing skills to an intern.

3.6 Data analysis

In content analysis, the basic technique involves counting the frequency and sequencing of particular words, phrases or concepts, in order to identify key words and themes (Welman *et al.,* 2005).

According to Neuman (2003), content analysis includes counting how often certain words or themes occur. This technique allows the researcher to discover such features in large amounts of material (*ibid*).

Content analysis enables the researcher to identify themes important to the study. This type of analysis is inductive in that themes emerge from the data and are not imposed by the researcher (Welman *et al.,* 2005). Another great advantage of content analysis is that it is non-reactive because the process of placing words, messages, or symbols in a

text to communicate to a reader or receiver occurs without influence from the researcher who analyses its content (Neuman, 2003).

The method was suitable for this study as its assumption is that words and phrases mentioned most often reflect important concerns in communication.

3.7 Ethical considerations

The researcher complied with professional ethics when conducting this study. Ethics are moral principles and rules aimed at protecting the interests of the respondents when conducting a research. The study considered the following ethical issues:

- Informed consent

Informed consent was gained from the participants by means of a verbal and written agreement. The researcher informed the participants about the study, its goals, the procedure to be followed and the rights of the participants. She also highlighted the extent to which the participants' information would be kept confidential. The researcher also obtained permission to conduct the study from the management of the SPHC (See appendix E).

- No harm to participants

The researcher did not subject the participants to physical or psychological harm. The researcher did so by creating an interview environment free of physical harm. She did not force the participants to answer questions that they felt were too sensitive for them.

- Voluntary participation

Participants were informed that their participation in the study was voluntary and that they had a right to withdraw from the study at any time. Participants were also not compelled to take part in the study.

- Confidentiality

Participants were assured by the researcher that all the information obtained from them was to be kept in strict confidence.

- Informed consent

The researcher explained the content of a consent form. Subsequently, all the participants signed a form as an agreeing to participate in the research.

- Anonymity

Respondents' names were obtained from the SPHC's offices for tracing purposes, but they were informed that on the research report their names would not appear, they would only be recognised by numbers. The participants' names and their unit numbers were provided on the list of participants

3.8 Limitations of the study

The following limitations of the study were observed:

- Due to sensitivity of the topic, one female participant was reluctant to provide certain information, even after probing, resulting in an incomplete interview. The informant was specifically uncomfortable about responding to some questions on using human excreta as fertilizer, this may have compromised some relevant information.
- Some interviewees were unwilling to participate in the study - probably due to a lack of interest and/or sensitivity around the research study. This was evident when the research team was denied access to two housing units even though they could hear voices from within the houses.
- Some participants were unavailable at the time the research team visited their housing units. Most participants were unavailable from morning until late afternoon as most of them were at work or had other commitments. This impacted negatively on the data collection schedule, resulting in extension by a day to complete the interviews, which were mostly conducted until late at night.
- Language was also a barrier as some participants were Afrikaans speaking and the researcher was not proficient in speaking the language. A combination of English and Afrikaans in this regard was used to facilitate communication. A professional transcriptionist was outsourced to transcribe and translate some audios (inclusive of all the Afrikaans).

- External factors such as distance and cost could make it difficult for the researcher to go back to the field for clarification of certain information.

The aforementioned research methods used to collect data were applied in the case study, as described in the following section.

CHAPTER 4: UDD TECHNOLOGY WITHIN AN URBAN CONTEXT: THE CASE OF HULL SREEET

This section provides background information pertaining to the project site, Hull Street in Kimberley.

The Hull Street housing development is located within the city of Kimberley, within the Sol Plaatje Municipality (SPM) in the Northern Cape Province of South Africa (SPM, undated). Kimberley (also known as the Diamond city) is the economic and institutional heart of the SPM and boasts a diamond mining heritage. It was founded after diamonds were discovered in 1871 (De Beers, 2004 cited in Drangert *et al*., 2002). Kimberley with its mines was the centre of industrialization in South Africa (SPM, Department of Tourism, undated). Its mining capital and expertise facilitated the subsequent development of South Africa's gold mines (*ibid*).

4.1 Background to the Sol Plaatje Municipality

According to its Integrated Development Plan or IDP (2008), the Sol Plaatje Municipality is located in the eastern part of the Northern Cape, close to the border with the Free State Province. It is the provincial capital of the Northern Cape and is considered a "secondary city" in South Africa (*ibid*). The municipality is named after Solomon "Sol" Thekiso Plaatje, the first Secretary-General of the African National Congress who was an intellectual, journalist, linguist, translator and writer (SPM, Department of Tourism, undated; and SPM, undated). The SPM is among the four local municipalities within the Frances Baard District Municipality, the smallest yet most densely populated region of Northern Cape (SPM, Department of Tourism, undated).

4.1.1 Socio-economic and demographic status quo of SPM

The municipality's area of jurisdiction is approximately 187 300 ha in size (SPM IDP Review, 2011). The total population of the SPM is around 245 606 with 52 120 households, which makes it the largest local municipality by population in the Frances Baard District Municipality (STATTSA, 2007 cited in SPM IDP Review, 2011).

The 2006 census indicated that 20.3% of the province's population was concentrated in the SPM, and for a period of 10 years, that is, from 1996 to 2006 (SPM IDP Review,

2011), the municipality experienced an average growth of 0.87%. Demographic representation highlighted that 55.1% of households in the municipality were Africans (Blacks), with an average growth rate of 3.63% per annum over the same period. About 26.8% of the households represented the coloured community, with an average growth of 2.50% per annum. The 20-65 age group years constituted 56.7% of the SPM compared to 53.9% for the entire Northern Cape Province (*ibid*).

The 2006 statistics revealed that 74 147 people in the municipality were living in poverty, with 77.5% of this population comprised of Africans (Blacks) communities (SPM IDP Review, 2011). It has been observed that there has been an average decrease in poverty at the rate of 1.7% per annum since 2001. Around 31.58% of the residents of the SPM are unemployed. The Sol Plaatje's GDP contributes 31.6% of the Northern Cape Province's economy. Through these statistics, one can assume that the SPM is the biggest contributor to the economy and to the socio-economic aspects of the province (*ibid*).

4.1.2 Sanitation in the Sol Plaatje Municipality

According to the SPM IDP Review (2011), the service backlog for sanitation was 8 290 by April 2010. The Sol Plaatje Municipality has a total of 54 593 households using waterborne sanitation, with urine diversion sanitation systems implemented in the following areas: Platfontein (880 households), Hull Street (114 units) and Moshoeshoe eco-village (13 units) (Mohalalelo, 2011). The previous form of sanitation used in formal areas was the bucket system, which was eradicated during the period 2007 to 2009 under the bucket eradication programme of former President Mbeki (*ibid*).

The sanitation backlog stood at 8 290 by April 2010 (SPM IDP Review, 2011 and Mohalalelo, 2011). This backlog is mainly made up by the following informal settlements (Mohalalelo, 2011):

- Ritchie/ Motswedimosa (bucket system) – 700 households.
- Rietvale (bucket system) – 650 households.
- Roodepan wards 1 and 2 (Ventilated Improved Pit/VIP toilets, 20 toilets installed on the street) – 2 200 households.
- Diamond Park (bucket system and VIP toilets) – 1 600 households.

- Lerato Park (bucket system) – 1 640 households.

The budget allocation for water and sanitation for the financial period 2010/2011 is R6 867 246 (Mohalalelo, 2011). Some of the challenges experienced with regard to sanitation include VIP toilets that need regular draining. This results in municipality's trucks struggling to clear them owing to unwanted stuff/ other non-sanitation related waste (such as dead dogs and cats) being thrown into the toilets (*ibid*). Moreover, the Homevale treatment plant has reached its maximum capacity (Bigen Africa, 2009). This is putting strain on the Kamfers dam, as surplus effluent flows on its pan. This has resulted in a moratorium on housing development in the area. There are plans to upgrade the treatment plant in order to address the above challenges and to reduce the costs of operating a number of pump stations in the area (*ibid*).

4.2 Background information on the Hull Street Housing project

The Hull Street Integrated Housing Project is one of the development projects co-funded by the Swedish International Development Co-operation (SIDA) in South Africa[6] (Jonah, 2007). It is a medium density development initiated by SIDA in collaboration with the Northern Cape Department of Housing in 1999 (Drangert *et al*., 2002; Jonah, 2007 and Landman *et al*., 2009). The housing is located on the periphery of Kimberley, en route to Bloemfontein, an area originally reserved for the diamond industry, conveniently located closer to the De Beers mine (Asplund, 2003 and Landman *et al*., 2009). The location is strategically positioned for housing development, in that Hull Street is situated between the CBD and the industrial areas, thus providing easy access to economic and social opportunities (Landman *et al*., 2009). Through negotiation, the SPM managed to buy the land from its previous owner (De Beers mines), even though the sale involved trade offs/ bartering (Asplund, 2003; Jonah, 2007 and Landman *et al*., 2009).

Hull Street was developed with the purpose of it becoming a sustainable human community to include social, environmental and economic aspects (Asplund, 2003 and

[6] Other ecosan projects co-funded by SIDA in South Africa include the Moshoeshoe eco-village in Galeshewe, Kimberley, a pilot study in the Buffalo City municipality in East London and two projects in the Neslson Mandela Metropolitan Municipality (Jonah, 2007).

Landman *et al*., 2009). This was done in several ways including (SIDA, 2007:26 cited in Landman *et al*, 2009:13):

- Community participation in planning to establish ownership.
- Low income housing closer to economic opportunities and services.
- A central location to enhance access and to reduce transport costs.
- Improved public transport systems.
- Integration of people from different income levels (but still in the lower range), racial and age groups.
- Social housing and a variety of tenure options.
- Mixed plot sizes and varied house designs that allow for different affordability levels and the future upgrading and extension of houses.
- Mixed land use for housing and appropriate commercial activities.
- Activity nodes and corridors, areas for home-based trading and industry.
- Increased income opportunities in low income areas.
- Innovative, ecological and affordable technical solutions and municipal services.
- Provision of public services, facilities and open spaces within walking distance, including municipal offices, libraries, recreation areas, sports fields, playgrounds, meeting places, schools, nurseries, churches, shops and clinics.
- Increased densities to optimise service provision.

In addition, the housing project was established to promote Local Agenda 21 through the demonstration of ecological and sustainable development principles (Landman *et al*., 2009). Like any other project, Hull Street also had its own challenges with a particular risk profile. The following are the challenges that led to the development of sustainable building (Asplund, 2003): a lack of water, unaffordable services, and a need for densification and resistance to small housing ("small boxes").

The key objectives of the Hull Street project were to provide housing for families with low and medium incomes, to build houses with sustainable sanitation with low water use, to create new urban planning promoting a sense of community, and to provide housing for mixed ethnicities in order to work for a more integrated society (Drangert *et al*., 2002). Other objectives included improvement of the lives of low-income households and to boost the local economy through involvement of emerging

contractors and local labour in the construction phase of the project (Drangert *et al*., 2002; Asplund, 2003 and Jonah, 2007).

According to Asplund (2003) and Jonah (2007), the IDP of Kimberley (then as a municipality) was developed from the Comprehensive Urban Planning (CUP) process compiled by SIDA, which resulted in the establishment of the Hull Street project. The SPHC is an independent company responsible for overseeing the daily operation and management of the project (Asplund, 2003; Jonah, 2007; Landman *et al*., 2009 and Schoeman, 2011 (personal communication)).

4.2.1 Socio-economic aspects/ Population settings and characteristics

The project was piloted at the Moshoeshoe eco-village (13 units) located in Galeshewe Township outside Kimberley (Drangert *et al*., 2002 and Jonah, 2003). Ecological solutions implemented in this housing development include: solar energy panels, UDD toilets, gas stoves, a small windmill for electricity (Asplund, 2003). There is also an underground urine tank supposed to be used as fertiliser in the garden but to date it has not been used (*ibid*).

The project comprises five phases with more than 2000 units (Asplund, 2003, Jonah, 2007, Landman *et al*., 2009). To date, only phase one has been completed (in 2003), with 144 units arranged in two eco-blocks - 59 and 55 units in each block (Jonah, 2007 and Landman *et al*., 2009) – see Figure 11. These housing units are arranged around a communal central piece of land earmarked for recreational and gardening purposes (Jonah, 2007) – see Figure 12.

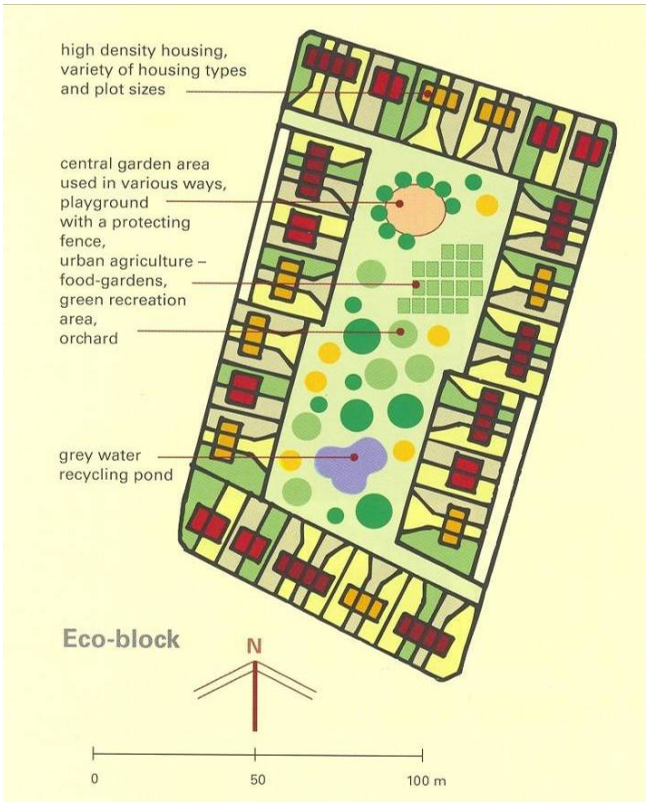

Figure 11: Plan of eco-blocks (Source: SIDA booklet, 2002:10)

Figure 12: Housing units around communal central land (Source: CSIR, 2011)

The information provided during fieldwork indicated that there were 114 units, of which two were unoccupied, as they were used for storage (Jonah, 2007 and Brink, 2011; personal communication)). The figure of 144 could be erroneous, taking into account the number of units in each block. The design of the housing units is a town house style, flat roofed, single-storey semi-detached or double-storey row houses (SIDA,

2002; Asplund, 2003 and Jonah, 2007) – See Figures 13 and 14. There is currently no mix of land use.

Figure 13: Double storey semi-detached units in Hull Street (Source: Landman *et al*., 2009).

Figure 14: Single and double storey units in Hull Street (Source: Landman *et al*., 2009).

In the second phase 370 social housing units will be built for those qualifying for institutional subsidies while 45 units will be sold to those not eligible for subsidies (Landman *et al*., 2009). These units are also suitable for small businesses. Phase five will comprise 1 658 units. Schools, community facilities and parks will be incorporated in this housing development *(ibid*).

According to Asplund (2003), Jonah (2007) and Landman *et al*. (2009), Hull Street has a mix of housing units: two-bedroom single-storey units (42 m^2), three-bedroom single-storey units (45 m^2), corner unit double stories – can be either two or three bedroom (53 m^2); and middle unit double stories – can be either two or three bedroom (55 m^2). Every housing unit has some private space in the form of small piece land at both the front and back to be used for gardening purposes (Jonah, 2007), see Figures 15 and 16.

Figure 15: Gardening in Hull Street (Source: CSIR, 2011)

Figure 16: Gardening in Hull Street (Source: CSIR, 2011).

The tenure statuses of the Hull Street units include rent-to-buy and rental options (Asplund, 2003; Jonah (2007) and Landman *et al*. (2009)), with 58 households renting the units and 56 households on a rent-to-buy option (Brink, 2011: personal communication). The minimum monthly rental is R900 and a maximum of R1 640 depending on the availability or lack of subsidy. Tenants earning over R3 501 do not qualify for Institutional subsidy. Despite the fact that requirement in terms of total household income is between R2 800 and R3 500 (lower than the criteria used in other social housing developments of between R3 500 and R7 500. As part of the SPHC's policy, exception has been made to accommodate a smaller percentage of tenants earning above R7 500 (*ibid*). An agreement was reached between occupants on the rent-to-buy option and the SPHC that houses will be transferred to owners after four years, so far there has been no action to this effect (Asplund, 2003; Jonah (2007) and Landman *et al*. (2009)).

The population of Hull Street consisted of whites, blacks, one Indian family and coloured people, with the latter dominating. Residents were from various income groups Landman *et al.* (2009). All the households in Hull Street received 6Kl of free potable water on a monthly basis (Drangert *et al.*, 2002). Pre-paid electricity was used in all units. All units were fitted with showers and UDD toilets, mainly to save water. One of

the Muslim families, which participated in the study had replaced a shower with a bath in order to use water freely for cleansing after defecation.

The UDD toilet used by residents is designed in such a way that, when one sits on the pedestal, there is a mechanism (at the rear component/chamber for faeces) that opens to enable faeces to drop into the vault (See Figure 2). Dry faeces and toilet paper stored in the vault (lined with a refuse bag) is collected from outside on a weekly basis – see Figure 17 and 18. The mechanism closes when the user gets up, to cover faeces. The front part of the toilet (the urine receptacle) is connected to a tube which directs urine away to the main urine stream. The design of the toilet pedestal is modern with a removable kiddies' seat. A urinal for men is attached to the wall and urine from there is also directed to the main urine stream. The toilet is also fitted with a fan for extracting the smell from the toilet.

Figure 17: Lined faecal vault with toilet papers and newspapers (Source: CSIR, 2011).

Figure 18: Door to access a faecal vault from outside the housing unit (Source: CSIR, 2011).

Sol Plaatje Housing Company has separate UDD toilets for office staff (indoors) and maintenance team (outside) – see Figures 19 and 20. The design of the UDD toilets for the SPHC is similar to the one previously installed for residents with a big faecal drum located deeper in the vault

Figure 19: Indoor UDD toilet for office staff at the SPHC (Source: CSIR, 2011).

Figure 20: Outdoor UDD toilet for the maintenance team of the SPHC (Source: CSIR, 2011).

Hull Street is a MDMH development located in Kimberley in the Northern Cape province of South Africa. It was initiated and co-funded by SIDA, in collaboration with the Northern Cape Department of Housing, in 1999. Hull Street was developed in order to engender a sustainable human community to include social, environmental and economic aspects. Furthermore, it was established to promote the Local Agenda 21 through the demonstration of ecological and sustainable development principles. The purpose of Hull Street was to address the following challenges: lack of water, unaffordable services and a need for densification.

The key objectives of the Hull Street project were to provide housing for families with low and medium incomes, to build houses with sustainable sanitation with low water use, to create new urban planning that promotes a sense of community, and to provide housing for mixed ethnicities in order to work towards a more integrated society. Other objectives included improving the lives of low-income households and boosting the local economy through the involvement of emerging contractors and local labour in the construction phase of the project.

Hull Street was planned to have five phases with more than 2000 units. To date, only phase one has been completed (in 2003), with 114 units. The following social and spatial mixes were applicable in Hull Street: building or unit type, tenure form, race and income. The SPHC is responsible for the operation and management of the project.

From this case study the researcher was able to use the research tools employed in chapter 3 to gather necessary information, which will be presented, analysed and discussed in chapter 5.

CHAPTER 5: PARTICIPANTS' PERCEPTIONS OF UDD TOILETS IN HULL STREET

This chapter presents and discusses the results of the study.

5.1 Presentation of findings

This section presents the results of the interviews. Terms "participants", "interviewees", "informants" and "respondents" are used interchangeably to protect the identity of the participants for ethical purposes.

5.1.1 Participants' socio-economic data

A total of 16 respondents comprising of 13 residents of Hull Street and three employees of the SPHC participated in the study.

a) Gender and position in the household

There were 13 (81%) female and three (19%) male participants. Within the residents, eight (62%) interviewees were heads of households and five (38%) were spouses.

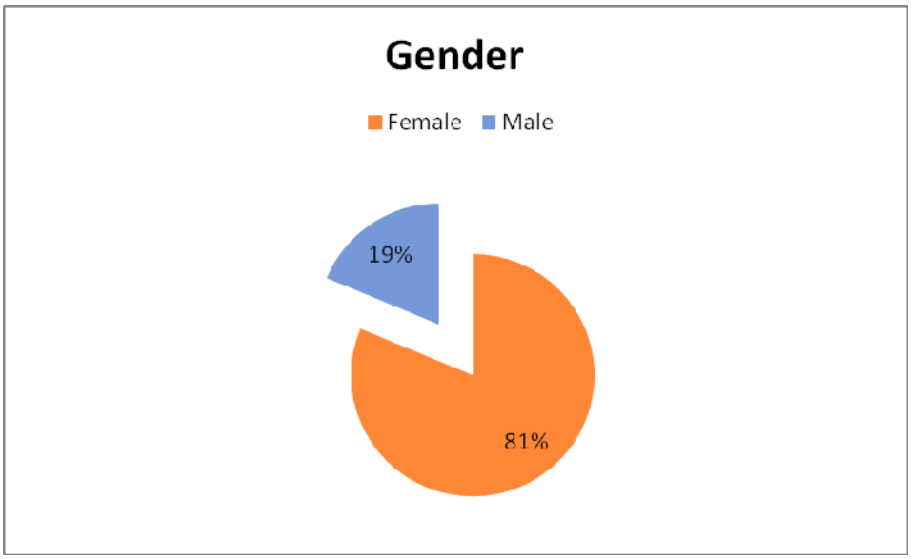

Figure 21: Gender of participants

b) Race

Racial grouping of the sample consisted of seven coloureds (44%), five blacks (31%), three whites (19%) and one Indian (6%).

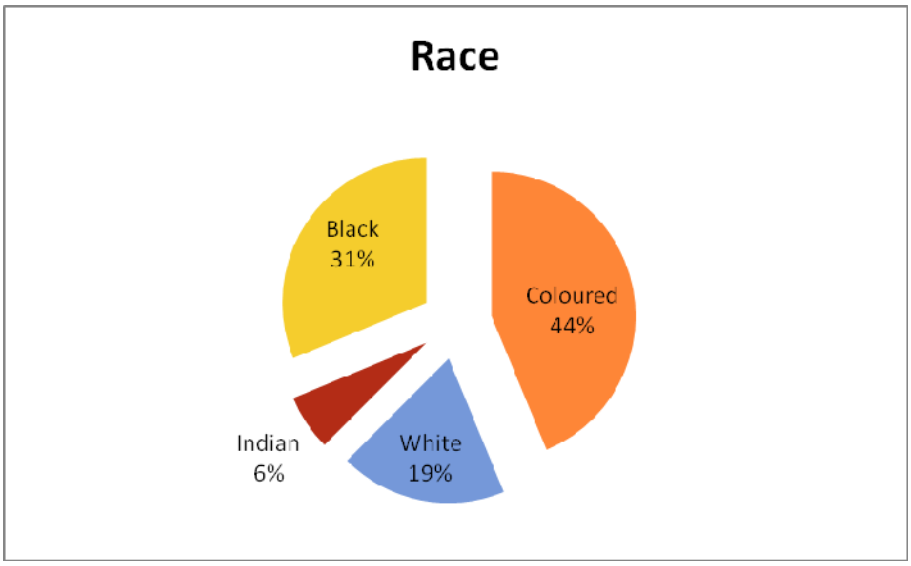

Figure 22: Race of respondents

c) Age

Most of the interviewees, six of them (38%) were between the ages of 30 and 34 years, followed by three (19%) within the 45 to 49 age range. The following age groups: 35 to 39 and 60 to 64 each constituted two participants (13%), while the age groups of 20 to 24, 40 to 44 and 50 to 54 had one participant each (6%).

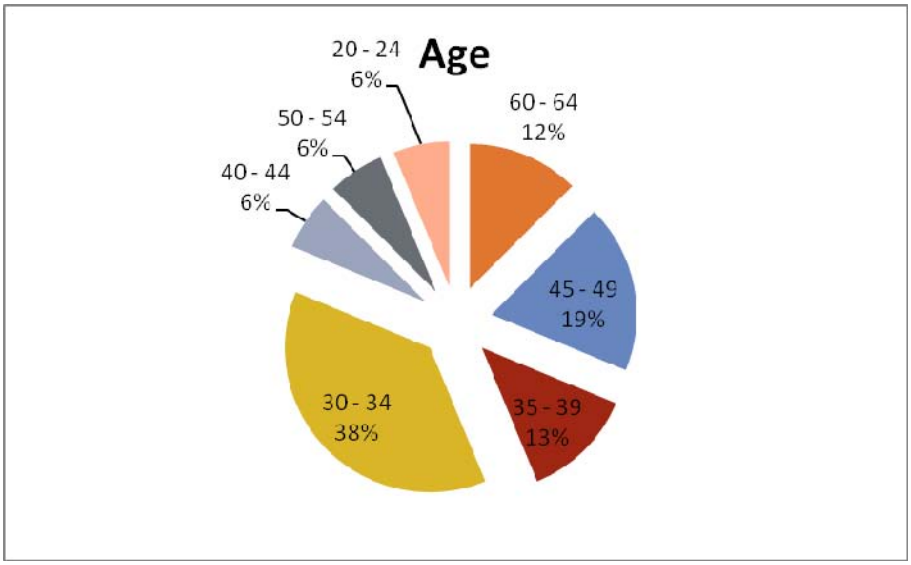

Figure 23: Age of respondents

d) Educational level

Amongst the respondents, five (31%) had completed secondary schooling or matric (Grade 12) and another five (31%) had obtained a higher or tertiary qualification. Three participants (19%) had some form of primary education and another three (19%) had completed secondary education.

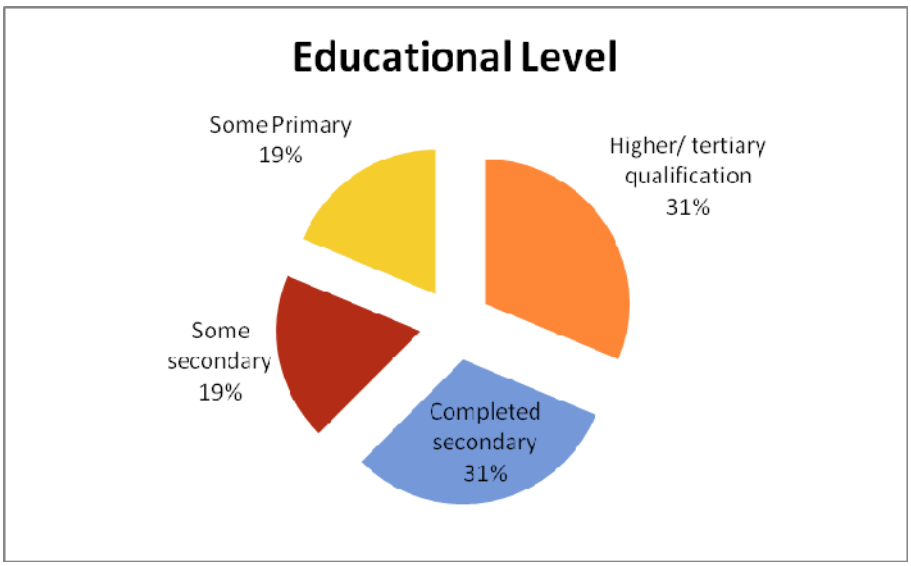

Figure 24: Educational level of participants

e) Household income

The information on household income related to residents only as they were paying for some services (employees were not asked this question). The total household income for most of the respondents was as follows: five (39%) within R6001 to R10 000 bracket, with three (23%) earning between R10 001 and R15 000. Two interviewees (15%) were earning less than R3 500 and the other two fell within the range of R3501 and R6000. Only one (8%) household earned the highest income of between R15 001 and R20 000. Sources of the income included salaries, wages and a range of state grants.

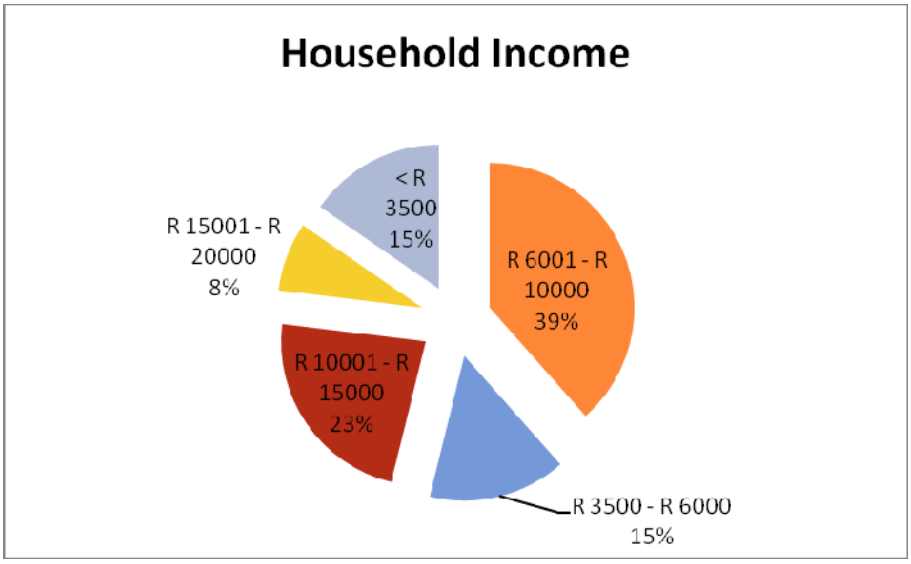

Figure 25: Total household income of the sample.

Most interviews were conducted in English and/or a combination of English and Afrikaans for coloureds, whites, Indian and few blacks. Most groups were not proficient in English. Setswana and English were used for blacks, except for one interview which was conducted in Setswana only.

Of the majority of the respondents (residents), five (39%) occupied double-storey three-bedroom units, four (31%) double-storey two bedrooms, with three (23%) in single-storey three bedrooms and one (8%) in single-storey two-bedroom unit. The rental for these units ranged from R880 to R1 640.

All respondents were from the surrounding areas of Kimberley and the majority (69%) have been residing at Hull Street for more than three years.

5.1.2 Findings from the residents' survey

Categories and sub-categories of themes are presented in detail below.

Participants' knowledge of UDD toilets

Most of the participants (69%) did not have enough knowledge of the UDD toilet, that is, they did not even know the name of the toilet. This is evident in the following quotes regarding what they termed the UDD:

Bucket system (participant # 3, 4, 6, 11and 13)

Bucket toilet (participant # 5, 12)

This one is a bucket, the dry powdered toilet (participant # 10)

No, I don't know, fly nest (participant # 8)

However, a few participants (31%) knew the type of toilet currently used as reflected in the statement below:

Dry sanitation (participant # 1, 2 7and 9).

History of access to sanitation

All respondents had previously used a waterborne system. A large number of interviewees (92%) preferred a flush toilet to the UDD system. This is evident in the following statements:

Bucket toilet is worse because it is unhygienic. We are using powder (lime) now. We are using powder to dry up inside. There's a hole underneath. So when you finish using the toilet at the back for "no 2"[7], not to urinate, and put powder it can get inside you (inhaling). That's why we women get lot of infections here in Hull Street. You see, and the toilet is unhygienic, man! And when it's hot also we can't use this toilet really. We don't actually use it, we go to my granny's house. We don't use it a lot during summer, only when there's an emergency (participant # 3).

It's totally different because this one (UDD toilet) is vey unhygienic, it always smells, we must buy these chemicals to get rid of the smell. The flush was better than this one, they clean it once a wee. If we want them to clean twice you must pay for the other day, the second one like I'm paying on the Tuesday I'm paying cash, I'm paying R10 a week for one day so I'm paying R40 a month because If you come back on Friday it is full, it's a small bucket there (participant # 5).

Oh, the flush is much better. We are spending more money on this toilet than we spent on the flush toilet. We are spending more money on chemicals and cleaning stuff for this toilet. The flush is much cheaper and much better than this one. The flush toilet got no smell and it's not unhealthy. You can use like Domestos hygienic stuff that you can't get

[7] "No. 2" refers to a local jargon for defecating.

infections. This one is bad. We are dying of infection. We are dying of sore throats, we've got sinus and the small children, even my granddaughter, and this child they all get infections, burning bladders and kidneys. My daughter is now suffering because of kidney infection (participant # 7).

The flush one is better than this one. It is cleaner than this one. This one has a lot of germs and flies. Flies sit on your food and all those things and you smell the stink (participant # 2).

The previous one (flush toilet) is very good, clean, hygienic and no infection something like that and this one (UDD toilet) I don't want to comment. I don't like this one, it's not hygienic. You can't even invite friends over because of it. They clean it every week but me I clean it myself, I can't have somebody else cleaning my.... I clean myself. We normally take it to the sewerage farm. I clean my own... You know. On this one I don't want to comment, the smell is terrible (participant # 6).

<u>Design, use and functionality</u>

This theme is divided into sub-themes:

a) Duration and adaptability of using the UDD toilet

The majority of participants (69%) had been residing in Hull Street for a long period (e.g. three years and more) and seemed not to have acclimatized to the UDD toilets. This is based on the following quotes:

Since we moved in 2004. When we moved in the type of toilet we were using had a bigger vault for faeces and was later converted to the current one that closes/covers faeces (residents were using the modified design of the UDD toilet). None of them is better (participant # 11).

I go for eight years now, Ja, I use the toilet always, I can't go to the bush and shit over there, I must do it here (participant # 8)

Since 2007, for four years. No, we all have like stomach problems you know hard to go and it's very difficult to adjust to this toilet. The toilet is very uncomfortable and it's not normal. The wind is blowing all the time and for women, we get infections

very easy. It's very difficult. Some people complain about the snakes[8]. One needs to be careful of the snakes when seating. Most of the people complain about the snakes. I once got the infection (participant # 6).

Now, this year will be 8 years so… 2003, yeah. 2003 – 2004. I can't remember. It must be in 2003 if this is the 8th year. No, we don't use it regularly during summer months because of the smells and when you get many visitors… and during winter time, it's not so hot. And this toilet you can't use it when it's so hot, man. It gets too hot here in Kimberley during summer time. If you get visitors, you can't accommodate them with this toilet because they don't want it. You don't know what must I tell them how to use the toilet and how must they do the things. It's not the right thing (participant # 3).

b) Functionality and usability of the UDD toilet

Some participants (54%) found it easy to use the toilet in terms of sitting position, particularly females and those with large body size. This is supported by the following quotes:

Ja (yes), the toilet seat is fine, I have no problem with it, it's just the bucket problem you know but the toilet seat is fine. The first few days it was not really easy but maybe after a month I made peace with it, we have acclimatized to it including my child, she knows how we use it and keep it clean. I have no problems in moving around when urinating and defecating (participant # 13).

Ja, it's okay for a man, but I don't think for women. Ja, well if you do a "number two" (meaning defecate), daar kom a hellse, (there comes a hell of a wind), a woman's situation, is that she must squeeze her a bietjie front, bietjie backward - moving front and backward positions (participant # 2)

Ja, we all find it easy, we are not fat (participant # 1)

However, others (46%) found the UDD toilet not to be user-friendly. The following responses illustrate this point:

[8] Snakes were found in some toilets owing to the fact that Hull Street is located at the edge of the city of Kimberley near the bush.

It is not easy for any person who has never been exposed to a UDD toilet to use it. In her case, it is different in that she has been using it for quite a while even though it was difficult for her to use it in the beginning but had to acclimatize over time. It is a challenge for a female to use since one has to position herself towards the front to ensure that urine is kept into the correct receptacle without spilling into the faecal receptacle/chamber. When defecating, one has to move backward (participant # 12).

It is not easy to use the toilet as one has to position herself accordingly/properly, that is, moving forward when urinating and backward when defecating. People are not keen to visit me because of the difficulty of explaining how to use the toilet. For instance, when my pastor/priest has to visit, it is embarrassing to explain to him how to use the *toilet. There are some friends or family who do not want to visit us because of this type of toilet* (participant # 11).

How can I explain, it's not easy for me and like the wind is blowing from under, it's open there underneath the toilet, the wind comes through here. Do you know what happened two weeks ago? There was a snake there in the toilet, it went through from outside, a small one, you can just see outside, it's open there. I was going to a toilet and saw a tail of the snake lying underneath where you put in… It was also in the newspaper, some lady opened the toilet to use it and there was a snake in the bucket. I'm not sure in which house and there are mice and the office knows about it. There by the fourth house with a green car they also found a snake in the toilet in a month or two. It's uncomfortable when the wind blows. I called someone to kill it, my children's father was here after school to see them and he killed it (referring to her ex-husband). I'm very scared. These people from the office are always making empty promises each year, telling people they'll put flush toilets, every year the same story, I'm not long here but can hear what people are saying (participant # 5).

<u>Operation and maintenance</u>

a) Knowledge on how the UDD toilet operates

All the participants were knowledgeable on how the UDD toilet functions as it was the company's policy (SPHC) to educate potential residents when viewing

the units. This was also reinforced by the maintenance staff members when empting faeces' vaults on a weekly basis. This is reflected in the following statements:

Men have the urinal in one side, if they want to pass water, they use the urinal. The woman got the toilet to use it, you must sit more to the front when you want to pass water. You sit more to the front and if you sit more to the front you'll feel your bladder is pressing down and if you are fat you won't be able to use it, you must sit to the back and make sure that the urine must not get into the faeces. I think that's why some people' toilets have a smell, it's not a faeces' smell, I can't explain it, it's a funny smell that they have. If your stomach is working, the flap opens up once you sit on the toilet seat and everything goes to the back. Once finished what you are doing you use the toilet paper and the lime to cover the faeces (participant # 1).

As I said when somebody is sitting, there is a hole for the urine and the hole for "number 2" (faeces), when you sit the button presses down and the hole open up and you can sit and do whatever you wanted to do. When you finish or you are busy you can put on the fan for the smell to go out, that's how it works. When you are finished there is "kalk"[9], you throw it over "number 2". Training was provided by people from the office and those doing maintenance work (participant #9).

Yes I know how the toilet works since I was informed before moving in. They said you must use the powder to cover faeces and in the urine side where the urine goes in, you must put in water or you can make use of your own Jik or Handy Andy. Use detergents to clean the entire toilet with hot water where the urine goes. That's all (participant #3).

b) Maintenance of the UDD toilet

A large number of respondents (85%) found it easy to clean the toilet. This is reflected in the following narratives:

For me, yes, it is, although I know when I do clean it, at least once in a quarter, you have to clean it thoroughly, spray with water, use your disinfectant, you have to

[9] "Kalk" is an Afrikaans term for lime that is used to cover the faeces so as to counter odour and enhance drying.

take the bucket outside and put it there, wash it also and dry it. So when you do all those things there is water coming through into the bathroom, so it's quiet a….. but on every third or second day to clean it is not such a hassle. So it's only when you are doing spring cleaning quarterly. I use bleach (put in water) and Handy Andy to wash it. So whenever I clean it I'm cautious that I should not get germs and stuff. I wash it and then I dry it. I wash the seat cover, the seat itself and you know there is that thing that opens at the back, people tend to not want to touch it but you have to clean it so that it stays clean, the side of the urinal you pour Jik so that it can drain. I don't use a lot of water in the second hole (for faeces), I wipe off the black thing (lid that covers faeces) with a wet cloth dipped into Handy Andy water to avoid water from getting into the bucket (participant #13).

Yes, it is, we clean with Jeyes Fluid and Handy Andy and that stuff and Jik. But mostly with Jeyes Fluid, but then sometimes Jeyes Fluid makes a dark colour, but then you get the Jeyes fluid and Handy Andy, so we use that now. We clean the toilet with a brush or a cloth, but it's only for toilet use. Inside the toilet we will use that cloth that we are using. Yes, I have to clean it now with a little bit of water and Jik and stuff to just to kill the germs. When we clean it, it's mainly when they come and take it out on a Friday, so water doesn't really come in. Yes, there is no bucket (participant #10).

Yes, I use Pine Gel, Jik and Dip to clean the toilet and Deoblock on the urinal and front part of the toilet (urine receptacle). We take the bucket out (from outside) and clean it, leave it in the sun to dry and take it back. We use a separate cloth to clean the toilet floors and inside the bucket (participant # 5).

However, there were a few participants (15%) who neither found it easy nor disliked cleaning the toilet. This is expressed in the following statements:

No, when the kids messed up the interior of the pedestal, I wet the toilet brush to clean the interior of the toilet messed up by the children. I avoid using water inside the faeces vault as it is restricted, faeces should not get wet, if wet it causes smell. It's only after they have emptied the bucket whereby I pour water inside the pedestal to clean it thoroughly (participant # 9).

No, (responding by shaking head in disapproval), in the event urine is spilled into the faeces' receptacle, this combination results in an unpleasant odour and one is compelled to use Jik and Domestos to counter it (odour). I pour water into the bucket to clean it. I took out the bucket (from outside) after they have collected the bag of faeces and clean the toilet thoroughly, I only do this on Fridays and the interior part is cleaned daily. I use a wet cloth and Handy Andy to wipe off the interior part wearing gloves. I use Domestos or Hand Andy or Jik with water and cloths (participant # 12).

In terms of cleaning, most respondents felt that it is too expensive to maintain the UDD toilet because they have to spend a lot of money on detergents and pay extra for additional maintenance service from the housing company. This point is reflected in the following quotes:

But then you have to use Jeyes fluid, Jik, Handy Andy, Domestos. We spend such a lot of money on it, it's unbelievable. And we use the black bags also. Yes, hot water for the pee pot (participant # 7).

Once a week on Fridays I pay an additional fee of R10 per session, seldom on Tuesdays in the event I hosted a number of visitors. Vaults in other units are collected twice or thrice. Unfortunately, I cannot afford to pay for such session(s), since I am unemployed. Once or twice in a week (participant # 11).

It's totally different because this one is vey unhygienic, it always smell, we must buy these chemicals to get rid of the smell. The flush was better than this one. They clean it once a week, if you want them to clean twice we must pay for the other day, the second one like I'm paying on the Tuesday I'm paying cash, I'm paying R10 a week for one day so I'm paying R40 a month because if you come back on Friday it is full. It's a small bucket there (participant # 5).

The new thing I have started is since there is a fan for the toilet, I have stopped operating it because my thinking is that it blows the wind and whatever that is there will go into the air, resulting in the toilet smelling bad. The fan uses a lot of electricity (participant # 13).

Users' perceptions and attitudes

a) Users' interest in UDD toilet

When asked whether they liked the toilet or not, most interviewees highlighted that they preferred a flush toilet to a UDD and would not recommend the UDD to others. This was evident in the following extracts:

I would not recommend this toilet to other people. Now they are saying that there water reduce, don't flush it, it's not expensive. Hahaha! I rather pay for the right toilet (participant # 3).

No, I will not recommend this toilet to other people, this one smells very much. Sometimes when you sitting there in the sitting room, I mean you feel shy when people are sitting there. There's this smell that comes out there. It's not healthy (participant # 4).

I hate it, I don't like it. For the sake of my children's health and my family's health, really I am just praying they will come to their senses, you know the people from the office are not living here. I know if you do marketing, you promote something, but then you must experience it, to see how it works and how it sells. This thing, I won't ....., the way the professor say, the way they put it, is not the way they are supposed to put it in. They did it wrongly. So I don't know if they put it in the right way, maybe it will work better. That man also told us that this bucket wasn't supposed to be inside the house. It's supposed to be outside, so that the smell cannot come inside. The flap that they put outside, that the wind is coming in; that flap wasn't supposed to be there (participant # 7).

No, I want a flush toilet. It's neater. It doesn't leave a stink in the house. This one (referring to the UDD toilet) smells a lot. Look here, smell here, and look at the fly nest. Everything is sticking together (participant # 8).

No, I do not like it (UDD toilet) because one is compelled to sit in a particular way and it has an unpleasant odour. There is an electric fan provided to eliminate the odour, which is switched off during the day and turned on at night. In the event they are not at home, they leave the house's windows and doors closed, which aggravates an unpleasant odour. To counter or minimise the odour, they are

compelled to open the window when they are not at home. The odour is from faeces combined with urine. Somehow the urine is spilled into the faeces chamber despite how experience one is with this toilet (participant # 12).

However, a few respondents had no problem with the toilet, as gauged from the following responses:

I don't have complaints with the dry sanitation, in the beginning I used to get smell but now I know how to use it properly. It's like the same as the flush toilet, the only difference is the use of lime and flushing. Ja, it's fine with me, aah if I could keep it, I'll keep it instead of a flush toilet (participant # 1)

Yes, for people who don't have the finances to have a flushing toilet, I will recommend these toilets to them (participant # 10)

Most of the informants liked the UDD toilet especially when comparing it to non-flushing toilets. The following responses attested to this:

Maybe this one is better I don't know, I have never used the other one. (Researcher had to explain about non-flushing toile. Respondent had not been exposed to other non-flushing toilets other than a bucket system). The non-flushing is hygienic, at least this one they take the plastic bag of faeces every Friday (participant # 5)

(The researcher had to educate participants about the non-flushing toilet, since they had little knowledge about them or had never been exposed to non-flushing toilets other than a bucket system). *It's like a bucket system, but it's like a deeper hole inside. Yeah this one is much better, I was in Barkley and have seen them there (area within Kimberley). This is much better because it is having a fan inside. I mean the making of the toilet (pit) looks like a normal toilet, but it's just a different style* (participant # 4).

This one is better, the toilet has a point there in the electrical box, and this toilet has a fan, while the bucket toilet doesn't have a fan. When you put on the fan, the smell goes out (participant # 9).

b) Socio-cultural perceptions

The Muslim participants felt that the UDD toilet conflicted with their religious practice, as they were supposed to use water for wiping or anal cleansing. However, one of the principles of the UDD toilet is to avoid water inside the faeces' vault as it aggravates the smell. This is highlighted in the following quotes:

We use toilet paper and we use water. It's very difficult now to do that on this toilet because you can't put water behind. You see the under space in front is a too small way. Sometimes we use the bath – (respondent fitted the bath last year (2010) without the consent of the housing company, SPHC (participant # 4).

We use wet toilet paper but it is not right, because we are not supposed to throw in water inside the toilet to avoid smell, you get used to the toilet. My aunts are always shouting at us because we are defying our religion but what can we do? We are supposed to wash with water not a toilet paper (participant # 5).

Husband is using water, sometimes he goes to the mosque and the child has a chronical stomach problem and she goes to school. It's better for him when he goes to the mosque, we are not here most of the time. Here you cannot use the water really. For men, it's different, he'll not use water on the "number 2" (faeces) but he'll wash himself after that, for me and my daughter we are forced to use a toilet paper (participant # 6).

Another aspect with regards to socio-cultural issues raised includes the fact that most participants found it embarrassing to explain the function of the UDD toilet to non-resident visitors. This point is illustrated from the following statements:

It is not easy to use the toilet as one has to position herself accordingly/properly that is moving forward when urinating and backward when defecating. People are not keen to visit me because of the difficulty of explaining how to use the toilet. For instance, when my pastor/priest has to visit, it is embarrassing to explain to him how to use the toilet. There are some friends or family who do not want to visit us because of this type of toilet (transcript # 11).

The other people that don't know it's a big problem. If they go in the toilet, if they don't know, you see the one at the back that you do number two and the one is for the pee only. If they don't know they must sit more backwards, then they sit to the front and then they leave all that mess there. Then you have to clean it, and you can imagine cleaning other people's pee. It happened four times already here by me. One needs to keep on explaining to visitors how the toilet works (transcript # 7).

There is a huge difference. I have never used……. (she could not finish her sentence), ok, let me say a flushing one is much better due to hygiene reasons and is more user-friendly compared to this one (the UDD toilet). Researcher probed for some more reasons. Other reasons this one, the problem is especially during summer you encounter lot of problem with a smell number one. Number two, when you have guests, you have to explain everything, the process as to what is actually happening and so most of the time rather you choose not to have guests due to the toilet. (Researcher asked if it is a challenge to explain to them). Yes, you will explain but still they will not get it unless they spend some time a day or two then they will understand what you are really talking about (participant # 13).

Participants' knowledge of the value of human faeces as fertilizer

All interviewees had heard about the value of human faeces in gardening from various sources but they did not use it and had a negative attitude towards using it. This is demonstrated in these statements:

Yes, like using faeces for gardening, yeah. I have heard of the story but don't believe in that shit, they must just stop coming with stories (participant # 3).

I know about it but not heard of it around here. You know what they did the office did, we wanted to plant grass in the last meeting we had and Sybil (chairperson of the Tenants' committee) told us that they (people from the office) sell our faeces for R10 a packet to use as fertilizer (participant # 5).

Yes, but it brings flies and it brings it back in the house (participant # 8).

Yes, before we thought about coming to stay here. We heard from the people and when my mother came here to do the application, the people told her about it and explained to her and everything. I never used faeces in the garden but urine (participant # 10).

I have heard hearsay but will never use it in the garden, it is dirt (participant # 12).

What have I heard? I have actually seen it happening, my dad used to work at the municipality, there is a sewerage place (referring to treatment plant) in the location (meaning township). It was a norm to go there around the month of August to get the manure and put it on the grass and it will be forever green. We also planted carrots and they were very well, good and big (participant # 13).

However, few participants had previously used it, or were still using it, on the lawn, plants and flowers but not on vegetables as they felt it was indecent and could not be used on food. This point is supported by the following extracts:

We have used human faeces in the garden, there are still people that get it at the back (meaning communal compost site), they got like a little yard closed. We used it already and it made the plants really grow but you see why I don't just like to use it now it's also because of him (participant referring to her grandson), you see some of the faeces and the toilet paper is not fine and he plays in the garden, you see and I don't want him playing with it. Sometimes there is mud and he starts chewing it because he is forever in the mud making pigs and what. We used it already and it made the plant really grow. If it wasn't for him (participant referring to her grandson), I'll still use it. It's not unhygienic, it's just unsafe sometimes with a big piece of faeces in the garden, but I don't have a problem about using it at all (participant # 1).

Actually what they are using it here for is nog al good, because I am using it in my garden. They have a way to make compost for the garden soil, but I use it only for my grass. I don't use it for my vegetable garden. I just throw it on my grass because I don't want poo for my vegetables. I won't eat it when I know I throw poo on it. It's good for the grass and stuff, but not for a vegetable garden. I am still using it. I'm actually using it every springtime after winter then I use it and it keeps my garden nice. Ja, if I put it on, my grass stays green the whole summer until the winter time.

If it goes dead, then I just pour it on again and it comes green again. I haven't problems with my garden dying, that I have to re-arrange it. It keeps growing and growing. It works, yes. I don't know, it seems like I am the only one who actually uses it, me and oom Lucas (participant # 7).

5.1.3 Findings from the employees' survey

This section entailed presentation of findings from the employees' perspective.

Participants' knowledge of UDD toilets

All participants had knowledge of the UDD toilet they used at work. This is illustrated by the following responses:

Urine diversion (participant # 14).

UDS, UDD (participant # 15)

Dry sanitation (participant # 16).

History of access to sanitation

All respondents were using a waterborne system at home. Some interviewees preferred a flush toilet over the UDD system. This is reflected in the following statements:

The flush toilet at home is better, obviously better because you can use the water and you can flush it. The only disadvantage is that with regard to today, our water was actually off, but it was running slowly because they were repairing pipes in town and I don't live very far from town and in terms of flushing then, it can be a problem. If the water is less in the city and maybe there are pipes that are bursting in the street or something, then the municipality has to come and repair it. When they repair it, they have to turn off the water. So if you don't have water in your household, then you know it's difficult to flush (participant # 14).

A flushing toilet I'm using at home is much better than a dry sanitation in that your waste (referring to faeces) is flushed away, it is not stored within, I don't see someone else's faeces (participant # 16).

However, one respondent's preference is more on the UDD toilet based on the statement below:

The flush toilet is not so much. You don't need to really pay particular attention but especially in the Kimberley area, sometimes we don't have water, then the flush toilet can present a problem. The UDD toilet can be better, because you are not dependent on water whereas, the flush toilet presents a problem if your water supply is off then you are in a predicament. If the flush toilet is working (if there is water) then they are the same, if the water is off, then its worse. Make it worse, because there are times when there is no water. This morning there was no water again (participant # 15).

<u>Design, use and functionality</u>

This theme is divided into sub-themes:

- Duration and adaptability of using the UDD toilet

  All the informants have been working at the SPHC for a long period (e.g. three years and more) and some seemed not to have acclimatized to the UDD toilets. They use the toilet because they have no choice, as it is the only form available. This is supported by these statements:

  I have been using the UDD toilet for 9 years. I *have to use it, there is nowhere to go, it's the only one available* (participant # 16).

  Yes we are just forced to use it, but I am working here for seven years and never in my life time did I do a number 2 in this toilet. If it should come to that point I will just drive home. Maybe there may not be time to drive home, then I will be forced to use it, and will wipe and clean properly later on. You finish your things (defecating) at home before you come to work (participant # 14).

  However, one respondent appeared to have acclimatized to the UDD toilet based on the statement below:

  I have been using it for eight because I came here in 2003 (participant # 15).

b) Functionality and usability of the UDD toilet

Two out of the three employees interviewed indicated that the UDD toilet was not really easy to use at the beginning, they had to adapt in order to acclimatize to using it properly. This is supported by the following quotes:

In the beginning it was difficult, because it's not just go in and sit on the toilet. You have to pay more attention so that you don't mess. It is a case of sitting forward and backwards. But over time you get used to it and adapt to the toilet. Now it's easier to use but if you just starting, then it is difficult to use. Yes you must get used to the position. You have to actually work out which position is going to work best for you (participant # 15).

Yes, it's much better compared to the one in the housing units (for residents'), this one has a hole where we put a green drum underneath the pedestal and residents' have buckets underneath" [residents have a modified version of UDD toilet with a shallow vault] (participant # 16).

However, one interviewee found the UDD toilet not user-friendly. The quote below illustrated this point:

But my whole point is coming to this. As I said, being Muslim you have to use water in both places, whether urinating or doing a No. 2 (defecate), so obviously it's difficult because you cannot throw water in there, then you just have to use the toilet paper and wipe yourself off in the urine part when you just pee (participant # 14).

<u>Operation and maintenance</u>

a) Knowledge on how the UDD toilet operates

All the informants knew how the UDD toilet operates. It was also part of the responsibility to educate new tenants on how the toilet operates. This is illustrated in the following statements:

Sprinkle lime after defecating to eliminate the smell and dry up faeces and close the pedestal lid afterwards. I empty the drum of faeces once a month for our toilets and the office's, for the residents, it is weekly due to small size of their buckets.

Collection at the eco-village is done fortnightly as their buckets are much bigger than those in Hull Street (participant # 16).

Yes, I am aware of how it works. It's just the way you sit and you ensure that when you pee, you pee in one hole and the faeces goes in the back side. One has to aim properly when using the toilet. I am also aware that the urine should not be mixed with the faeces behind. They told us that the faeces shouldn't get wet, it should remain dry. Obviously, it will start to smell and it should remain dry and then there is a powder that they use, that they call lime "kalk powder" which also dries it out. I was also one of the people who interviewed the people who moved in, in those years 2004/2005, so obviously when new tenants come and enquire about the houses, you need to inform them when you interview them about the toilet system and how it works. I was informed by one of my colleagues. It was part of my job to explain it to new beneficiaries moving in; this is how the toilet works (participant # 14).

Yes, basically your toilet is divided into two. The front portion of the toilet is for the urine and the back portion of the toilet is for the faeces and your toilet paper. So basically when you use the toilet, you need to make sure that you separate your urine and your faeces. Immediately after you have used the toilet, there will be an odour, but as long as the two are separated, there shouldn't be an odour, if your urine is working properly and you are not mixing. When the Swedish left, they basically left pamphlets here on the use of UDS toilets (participant # 15).

b) Maintenance of the UDD toilet

The general worker is the only person who is responsible for cleaning and maintaining the UDD toilets at the offices of the SPHC. The interviewee found it easy to clean the toilet. This is illustrated in this extract:

It's very easy, too much easy, the bags used to line the drums are clean, we wash them with HtH, powder soap and clean water after soaking them in water with HtH for a week. I use a hose pipe and its "baie maklik" (very easy) wearing gloves and a mask. I pour soapy water on the urinal and urine receptacle to counter a smell. For cleaning the floors in the office, I use the same cloths and mop used to clean the floors of the offices. For the outside toilet I use separate cloths and soap (participant # 16).

Users' perceptions and attitudes

a) Interest in UDD toilet

When asked whether they liked the toilet or not, most interviewees highlighted that they preferred a flush toilet to a UDD and would not recommend the UDD to others. This was evident in the following extracts:

A flushed one is much better in that your waste (referring to faeces) is flushed away, it is not stored within, and I don't see someone else's faeces. No, I don't like this toilet anymore. Due to lack of choice, I'm compelled to like it because I work here even though I do not like it. Sister, you see your waste, in a flushing toilet you do not see your waste as it is flushed away. It does affect one to defecate on top of someone's faeces. You inhale an odour from someone else's waste that can cause you to be sick (participant # 16).

Flush toilet is better, obviously better, because you can use the water and you can flush it. The only disadvantage is that with regards to today, our water was actually off, but it was running slowly because they were repairing pipes in town and I don't live very far from town and in terms of flushing then, it can be a problem. The waterborne that you also have if the water is less in the city and maybe there are pipes that are bursting in the street or something, then the municipality has to come and repair it. When they repair it, they have to turn off the water. So if you don't have water in your household, then you know it's difficult to flush. No, I will not recommend the toilet to others because they would ask me what type of Muslim am I to recommend it to people when I know how it is supposed to be. Other than for the Muslim culture, she could recommend the UDD toilet to non-Muslims. *Yes, definitely, in order to save water, because we have heard that when we flush the toilet, you flushing away how many kilo litres of water* (participant # 14).

However, one employee seemed to prefer a UDD toilet over a flush one from the response below:

The flush toilet is not so much, you don't need to really pay particular attention, but, especially in the Kimberley area, sometimes we don't have water, then the flush toilet can present a problem. The UDD toilet can be better because you are not

dependent on water whereas, the flush toilet presents a problem if your water supply is off then you are in a predicament (participant # 15).

b) Socio-cultural perceptions

The Muslim participant felt that the UDD toilet was in conflict with her religious practice as she was supposed to use water for wiping or anal cleansing. However, one of the principles of the UDD toilet was to avoid water inside the faeces' vault as it aggravates the smell. This is highlighted in the following quote:

My whole point is coming to this. As I said, being Muslim you have to use water in both places, whether urinating or doing a No. 2, so obviously it's difficult because you cannot throw water in there. You just have to use the toilet paper and wipe yourself off in the urine part when you just pee. Yes we are just forced to use it, but I am working here for seven years and never in my life time did I do a number 2 in this toilet. If it should come to that point I will just drive home. Maybe there may not be time to drive home, then I will be forced to use it, and will wipe and clean properly later on. But I don't do number two, never (participant # 14).

c) Use of human faeces in gardening

Participants' knowledge of the value of human faeces as fertiliser.

All interviewees knew about the value of human faeces in gardening from various sources and have used it. This is demonstrated in these statements:

I have heard they use it on the gardens as fertilizer. Actually I personally used it once before, also because I got it from this guy David, one of the maintenance guys and when we were planting the grass (lawn), we had to get the soil ready, I had some horse manure and then I took some of this also from the office and I used it and it wasn't a problem for me. It was obviously Hull Street's faeces; the people that are living here; their faeces. We actually just mixed it, because it was in buckets and others in plastic, so we made it half horse manure and half faeces compost. At the end of the day, the grass actually grew. It was beneficial. Up until today the grass is still fine and I didn't plant the normal grass. You get the two types of grass; you get the kiwi grass and the LM grass. The LM grass is the one that grows under shade because of the trees; yes that compost actually helped. I found it a way to save also,

because I thought where am I going to get money now to go and buy compost. So I just got it here at work and it's the same thing. It's cheaper on the one hand if you can recycle it. Yes only for the grass. Before we planted the grass we dug the ground right to make it fertile, put the grass in and threw it over again. We used it in the soil. No, I didn't use it on my herb garden, it was actually fine, they grew on their own and I am assuming that the soil was alright. Yes, definitely because the grass grew. It's just the smell. The only thing was just the smell; that's a disadvantage (participant # 14).

At my place of origin, while I was renting a room in "shanty town", I'll dig a hole and empty the bucket from the toilet to make compost. I used to tell my girlfriend to avoid disposing unwanted stuff like nappies and after a while I used it in my garden. I tried to use it in the past, it is not good for the garden, the produce is not good and most of the residents do not want to use it. The lime used is not good, it results in compost turning white, it is out of order and burned the lawn. Lime does not work on compost but ideal on houses (for painting). It would be ideal if the sorting was done by machines as it's currently done manually, using spades and fork spades, difficult to crush faeces. I know about the value of faeces as a resource and have no problem using it but not the one from here (Hull Street) as you find lots of unwanted dirty stuff, people throw in everything ranging from plastic bags to liquor bottles (participant # 16).

If it is treated properly, it is actually very good compost. I use it in my garden and the soil really becomes very rich. If you use the human faeces, you will see much more earth worms, which means there is much more air in your soil, so it's much more fertile. I have used it on the lawn and the flower beds and my lawn is green. Last year (2010) was my third year that I used it (participant # 15).

5.2 Emerging issues / themes and discussion

This section looked at detailed findings of the study and related discussions.

Overall perceptions of users of UDD toilets

Almost all participants highlighted their preference for a flush toilet over the UDD system and their willingness to pay extra for flushing water. Challenges cited include following:

- They perceived the toilet to be smelly, unhygienic and of an inferior standard (referred to it as a bucket toilet/system) not suitable for an urban modern housing development like Hull Street.
- Smell emanates from a combination of faeces and urine (incorrect use and maintenance of the toilet) and is strong mainly in hot and windy seasons.
- Women users (including large body size) experienced discomfort in terms of the seating position, that is, moving forward when urinating and backward when defecating.
- Women users felt uncomfortable using the toilet when the wind blows into the pedestal from outside (lid of the vault not properly sealed), and this led to an assumption that the wind was responsible for the contracting of diseases (infections).
- Some users complained of inhaling lime when it is sprinkled on top of faeces.
- Operation of the toilet is in conflict with the culture of Muslim users.
- The cost to operate and maintain the toilet is perceived to be higher than a conventional flush toilet as respondents spend a lot of money on cleaning detergents and disinfectants, and pay a fee for additional collection service, and an running an extraction fan consumes lot of electricity.
- Embarrassment in explaining the function of the toilet to visitors, thus respondents avoided hosting visitors in their homes.
- Snakes found in the toilet entering from the lid of the vault.

5.2.1 Design, use and functionality

The obtained results showed that some users of UDD toilets do not find it easy to use it due to its design, especially in terms of sitting positions as one has to aim properly when sitting depending on the purpose of using the toilet (urinating or defecating). This is consistent with McConville and Rosemarin's findings (2011) that it is necessary for the design of this toilet to be appropriate and suitable to use. One of the major challenges identified has been the seat riser, which was not fully developed and uncomfortable to use or unacceptable to the users. This was also supported by Drangert (2002), highlighting that inferior or incorrect design of a UD toilet was a barrier towards the acceptance of the technology.

Furthermore, a study conducted by Duncker *et al.* (2006) in four South African provinces revealed that the design of a UD toilet can influence its acceptance. It showed that the users liked UD toilets only when they were convenient, safe and comfortable, reduced the spread of diseases did not use water and were properly built (*ibid*).

Furthermore, some users found it a daunting task and embarrassing to explain to visitors how the toilet functions. This ultimately resulted in the incorrect use of the toilet. This was also found in McConville and Rosemarin's study (2011), which highlighted the following reasons cited by the users for rejecting the technology: toilets were perceived to be awkward to use and explaining their function to visiting family relatives and friends was considered an embarrassment and an unnecessary burden and the major barrier in the China-Sweden Erdos Eco-town Project (EETP) It was also indicated that the major barrier for this project was household acceptance. Consequently, the sustainability of the solutions was questioned because of user resistance (*ibid*).

It was also revealed in the study that the design of the toilet poses health risks, particularly for some women, who said that they found it uncomfortable to use the toilet and that when the wind blows in whilst they are using the toilet, they contract infections (suffering pains from the womb). This is in line with literature by McConville and Rosemarin (2011) indicating that poor design of UD toilet can cause health risks from unhygienic exposure to pathogens and hazardous substances by the application of this specific sanitation system.

5.2.2 Operation and maintenance

The findings of the research showed that, even though maintenance measures to address odour have been put in place such as the installation of fans and use of lime to cover faeces, participants still find the odour disturbing, especially when cleaning the toilet. This is supported by Drangert (2004) indicating that several measures had been proposed such as maintenance of the toilet, installation of ventilation pipes, use of air freshener and application of ash onto faecal deposit in UD toilets to minimize the smell. According to Drangert *et al.* (2002) and Drangert, (2004) ash is applied on top of faeces after defecation to counter the smell and accelerate dehydration. In Hull Street, lime was used.

It was further highlighted that it was costly to maintain the toilet as the informants had to spend lot of money to buy a range of detergents and disinfectants to keep the UDD toilet clean and alleviate the smell. They also indicated that since the maintenance people from the SPHC collect bags of faeces once a week, they (the participants) had to pay R10 for extra collection in that week (two or three times) as they felt that collection once in a week was not enough because the vault was small and smelled when faeces was stored for a longer period. This is consistent with one of the reasons for users rejecting the UDD technology in the China-Sweden Erdos Eco-town Project (EETP) owing to unwillingness of the local government to incur the cost of collection and maintenance (McConville and Rosemarin, 2011). A report by Duncker *et al.* (2006) indicated that users pointed that disposal of excreta should be the responsibility of the local municipality and not the household.

However, a large number of interviewees indicated that they found it easy to clean the toilet, which is contrary to Ulrich (2009) claiming that the cleaning of UD toilets is a bit complex compared to conventional flush toilets. This was confirmed by a high number of users (71%) complaining about the special maintenance work of this sanitation technology (*ibid*).

5.2.3 Users' perceptions and attitudes

The results of the study indicated that almost all respondents stated that they did not prefer the UDD toilet and would not recommend it to other people. They felt

that they would rather have a flush toilet, even referred to it as “the right toilet”. In addition, participants highlighted that they did not like the UDD toilet as they perceived it to be unhygienic, smelly and unhealthy.

Drangert (2004) concurred with this statement pointing out that aesthetic aspects such as smell and the appearance of human excreta play a pivotal role in acceptance or rejection or avoidance of a sanitation system. Furthermore, users of UD toilets in Linz, Austria, face challenges in accepting the toilets owing to operational shortcomings such as odour from the wrong deposition of faeces in the urine receptacle (Ulrich, 2009).

Despite the fact that one of the benefits of installing the UDD toilet is the production of fertiliser from nutrients in human excreta, participants did not buy into this idea as most of them felt that they did not need or use it in the garden. They considered it waste, and hence would rather have a flush toilet. This is supported by the study conducted by Duncker *et al.* (2006), in four provinces of South Africa (North West, KwaZulu-Natal, Northern and Eastern Cape) where it was indicated that a UD toilet can be accepted as a toilet but its major barriers may be emptying of the vault, handling of human faeces and the reluctance of users to use the products (excreta) from the toilet. In addition, handling of human excreta in South Africa remains a general challenge since faeces are perceived as waste products, unhealthy, unhygienic and detrimental to humans (Duncker *et al.*, 2007). The participants perceived UDD toilets as unpleasant and unhealthy due to offensive odours (Duncker *et al.,* 2006).

One of the purposes of implementing the UDD toilet was to cut down costs in terms of water usage, but the results obtained could not show any difference in terms of cost savings, as participants still spent a lot of money on cleaning detergents and antiseptic, as well as paying for extra collection service as previously mentioned. This is supported by Esrey *et al.,* (1998); Drangert, (2004), Austin *et al.,* (2005) and GTZ, (2009) who state that the benefits of a UDD toilet is that it uses little or no water for flushing, while a flush toilet uses 8 to 12 litres per flush (GTZ, 2009). This results in a cost saving for both users and the service provider (municipality). Furthermore, the UD toilet recycles phosphorus

from urine, may also create business opportunities through the sale of UD toilets and the fertiliser generated, there is less odour from separated faeces and urine, it can be indoors and minimises toilet-related groundwater pollution with nitrates and pathogens (*ibid*).

In spite of these benefits, respondents felt that the operation and maintenance of the UDD system was very costly. This is in line with the EETP study that emphasized one way of enhancing the acceptance level by users is that of implementers ensuring that the cost-benefit ratio for the overall system is acceptable when compared to the conventional waterborne system (McConville and Rosemarin, 2011). Costs for operation and maintenance (O&M) should not be higher than for the flush-system or they should experience direct benefits (*ibid*).

5.2.4 Socio-cultural influences/impact

The obtained results revealed that Muslim participants felt that some of the principles of the UDD toilet conflict with their culture of using water for anal cleansing, thus influencing their reluctance towards a UDD toilet. This statement is consistent with the literature by Nawab *et al*. (2006), which indicated that it was common practice in Muslim cultures to keep water in the toilet for anal cleansing. The Islamic religion requires cleaning of all body openings, including anal cleansing as a common practice for purification rituals prior to praying. In addition, Machaki villagers in the North West Frontier Province in Pakistan preferred a squatting commode installed in a north-south direction to avoid facing Mecca The reason behind this preference (squatting commode) was mainly because it was considered to be ideal for anal cleansing, which is difficult to follow when using urine diversion toilets or common sitting commodes (*ibid*).

The findings of the study showed gender bias in terms of cleaning the toilet. Most informants cleaning the toilets were females who were responsible for the upkeep of the entire household. Although they did not like cleaning the UDD toilet, they felt obliged to do so since it was part of general cleaning of the household.

This is supported by Drangert (2004) pointing out that in African cultures, females were generally responsible for chores in the kitchen and bathroom/toilet, while men carried out construction, the repair of installations and emptying the urine container and faecal vault. Generally, women were more concerned about sanitation than men as a result of the particular social, economic and political structures. The findings of the same study further revealed that women and girls, and occasionally young boys, were responsible for cleaning the toilet in the four African study areas. In the case of communal toilets, female tenants in a given compound organised themselves to clean the toilets by rotation. Furthermore, in Mexico and Stockholm, females (women or girls) were responsible for cleaning the toilet (*ibid*).

CHAPTER 6: TOWARDS BETTER ACCEPTANCE OF THE UDD SANITATION SYSTEM

This chapter focuses on conclusions drawn from the findings of the study and recommendations.

The study revealed that majority of interviewees had previously used waterborne systems and regarded the UDD toilet as inferior, backward and unsuitable for modern urban areas. The UDD toilet is associated with the bucket system, which was previously used in most formal areas around Kimberley before the introduction of flush toilets. Participants were unfamiliar with the ecosan concept, including the name of the toilet and the rationale for implementing the UDD toilet.

The tenants' move to Hull Street was primarily influenced by housing needs and not ecological lifestyle and the UDD sanitation system was not a key issue in terms of locational decisions. Challenges became apparent when they started using the UDD toilet, acceptance became a concern. Some participants also said that most tenants had moved to Hull Street because the rent was reasonable, compared to other rental places in Kimberley. The residents' level of commitment towards the operation and maintenance of UDD toilets is low, particularly as they were not owners of the housing units yet (all residents are tenants since the rent-to-buy tenure status is not yet applicable in practice).

Nearly all interviewees preferred a flush toilet. They disliked the UDD toilet for the following reasons: they said it was smelly, unhygienic (causing infections), unhealthy, of sub-standard design (hence being referred to as a bucket system/toilet), and uncomfortable to use. An inferior or incorrect design of the toilet has contributed to some of the challenges highlighted above, hence the low acceptance. The design of the UDD toilet in Hull Street was of an inferior quality compared to UDD sanitation systems in developed countries such as Finland, Sweden and Germany, where the sanitation system was widely accepted and various manufacturers were in competition to deliver quality products. The majority of the Hull Street participants have accepted the UDD toilets by virtue of lack of choice and have used them for more than three years. Moreover, Muslim informants perceived the UDD toilets as depriving them of their

Islamic culture of using water for anal cleansing. It is therefore necessary to ensure that the design of the toilet is appropriate and suitable to use.

The operation and maintenance cost of the UDD toilet was higher than that of a flush toilet as respondents spent lot of money on detergents and disinfectants to clean the toilet and reduce odour. A small faecal vault contributed towards the increased cost of maintenance in that it needed to be emptied frequently at a cost to the users (residents). The extractor fan also consumed lot of electricity, hence was used minimally or not at all.

Although most participants had knowledge of the fertilizer value of human faeces as compost from various sources, they still regarded it as waste and as unhealthy. Most of them had gardens (lawn, plants, flowers and fruit trees), but only a few of them were using dry faeces as compost on non-edible plants or lawn.

Other benefit of the UDD sanitation system include water saving. Furthermore, it recycles phosphorus from urine and has less odour from separated faeces and urine compared to other on-site sanitation technologies such as the Ventilated Improved Pit (VIP) toilet. Another advantage is that it may also create business opportunities through the sale of UD toilets and fertiliser generated. In addition, it can be installed indoors, which minimises toilet-related groundwater pollution with nitrates and pathogens (GTZ, 2009).Despite these benefits, the UDD toilet has not accepted by the users and it lacks institutional support from the politicians and officials at the local municipality. This has led to a decision to retrofit the waterborne system in both the Hull Street and Moshoeshoe eco-village housing complexes. In view of the above factors, possibilities of enhancing acceptance of the UDD technology appear to be futile.

Some of the challenges experienced by the Hull Street respondents are similar to those encountered by the users of UDD toilets in the China-Sweden Erdos Eco-town project (EETP). These include, inter alia, incorrect or uncomfortable design of the UDD toilet (e.g. awkward to use), the high cost of operation and maintenance of the toilet and the embarrassment in informing visiting family relatives and friends on how the UDD toilet functions. Non-acceptance of the UDD toilets ultimately resulted in conversion of the system into a waterborne system. Likewise, the incorrect design of the UD flush toilet at

a primary school in Linz, Austria was converted into flush toilets owing to the big size of the toilet for small children.

With the given challenges the following are recommendations to be considered for future UDD sanitation projects.

Recommendations

The recommendations emanating from this study are detailed below:

- Planning is political. There is a need for a buy-in from politicians for the success of developmental projects. Despite efforts put by the SPHC to promote and provide training on the UDD systems, the project could not succeed owing to lack of political support (for the project).

- Since South Africa is a water-scarce country, there is a need for government to invest in educating the general public (including politicians and government officials responsible for making and implementing decisions, as well as policy makers) on the wider benefits of the UDD sanitation technology and environmental sustainability aspects. The UDD sanitation system is in this regard one of the possible solutions towards addressing this challenge as it is a waterless system.

- It is important to first establish if there is a real demand for an organic best fertilizer (human excreta) from a sanitation system and then design the sanitation system accordingly taking into account the needs and cultural norms and values of the targeted users.

- The UDD sanitation system should be made available to everyone, particularly those with an interest in environmental aspects or who will derive some benefits from them (e.g. farming communities).

- The South African national sanitation policy document mentions dry sanitation as an option, which indicates a lack of official support for ecological alternatives. Given the future challenge of water scarcity, it would be appropriate for the sanitation policy to be reviewed and make ecosan a mandatory technology for future sanitation in water-scarce areas.

- It is essential to pilot the UDD sanitation projects in well-frequented places (e.g. community centres). For instance, a practical approach was followed by France (in the literature review) in which UDD toilets were introduced to communities through events and users were then requested to share their opinions on the system. This is significant in identifying a system that meets the needs of the users. This approach is also appropriate in creating public awareness.

- An integrative approach to housing and UDD sanitation supply is recommended, where both fields are viewed as equally important issues in delivery of sustainable human settlements. It is therefore, necessary to ensure that potential users are thoroughly engaged throughout the process in order to be well informed about the UDD sanitation system.

The findings of the study revealed a high degree of dissatisfaction regarding the use of the UDD toilet, which outweighs the benefits. Users reported several negative effects, including health problems related to their use of the UDD system. In addition, the design of the toilet seat creates discomfort and an unpleasant odour in the house. It should be noted that occupants pride themselves on their houses. Currently, there is a feeling of hopelessness in maintaining that pride as they are of opinion that they believe they have tried in vain to get rid of the odour inside the housing.

Therefore, it is of great significance for future research to explore the UDD system addressing the key challenges that are design-related. Furthermore, there is a stronger need for implementation of sanitation technologies that are environmentally-friendly, such as UDD toilets. Emphasis should be put on continuous education of the public at large to the sustainability aspects of the UDD technology, so as to change perceptions about it.

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APPENDICES

Appendix A. DFA NEWSPAPER ARTICLE

DFA
Diamond Fields Advertiser
INDEPENDENT NEWSPAPERS
GAUTENG

Let's look at our friends

YOU know you are way behind the curve on an issue when the ambassador of a country condemns his own government's human rights abuses more strongly than you do.

That was the South African government's embarrassing predicament last week. It had issued a mild statement urging "restraint" from the Libyan government which has been massacring hundreds of pro-democracy demonstrators. It emerged, even more embarrassingly, that SA had been selling arms to Libya, including sniper rifles and ammunition, possibly used in the killings, as recently as late last year.

Then on Friday Libya's ambassador to SA, Abdullar Alzubedi, went further than South Africa had, strongly condemning his government's armed attacks on unarmed civilians.

Abdurrahman Mohamed Shalgham, Libya's ambassador to the UN, went further still, strongly backing a Security Council resolution which slapped an arms embargo on Libya, targeted travel and financial sanctions on Gaddafi and his cohorts and ordered an International Criminal Court (ICC) probe of their actions for possible prosecution of crimes against humanity. Being outflanked, as it were, by Alzubedi and Shalgham seemed to have jolted SA into action as our UN ambassador, Baso Sangqu, voted for the resolution, and also strongly condemned Gaddafi's "untold atrocities".

There is a lesson for SA in all of this and it can be summed up in one word ... foresight. The government defended the past sales of weapons to Libya on the grounds that Gaddafi's security forces were not firing on their people then.

But anyone could have predicted that the brutal Gaddafi would shoot to kill if confronted with demonstrations. And in any case our laws forbid sales of weapons to governments which "systematically violate or suppress human rights and fundamental freedoms" of their people, as Gaddafi has been doing for decades.

We should now be taking a closer look at some other allies on the continent who are also systematically abusing their people in case they also embarrass us in the future.

Bug-fighting fungi

USING genetically modified fungi to infect mosquitoes that harbour malaria parasites could be an effective way to control the spread of malaria, researchers said on Thursday.

Scientists from Britain and the US inserted the genes of human antibodies or scorpion toxins into a fungus called Metarhizium anisopliae that infects mosquitoes. They found that certain combinations of them were able to stop the development of malaria-causing parasites.

Researchers said the approach could become an environmentally friendly way of fighting malaria, and might also be used to control other insect- or bug-borne diseases such as dengue fever or Lyme disease.

worldofrugby

peter bills

Ideal man for the Cup

THE CRUSH and the rush for places in the Springbok back row in this World Cup year gathers pace. It is starting to look like a very intense field of competitors indeed.

The likes of Schalk Burger, Pierre Spies, Heinrich Brussouw, Dewald Potgieter, Francois Louw and Ryan Kankowski all have aims and ambitions in that direction, never mind others such as Keegan Daniel and Juan Smith who is a big doubt after tearing his Archilles tendon.

And then there's the man who starts to look as though he simply cannot be left out.

You don't judge anyone on the first serious game of their season, especially when you know they will still be playing the game eight long months later.

But anyone watching Willem Alberts perform for the Sharks against the Cheetahs in last weekend's Super 15 opener in Durban must have realised that the big back row man starts to look a shoe-in for a Springbok place.

Alberts is the type of player coaches love. Big, strong, tough and durable, his powerful, no-nonsense type of play makes him a key ingredient in any side. He drives the ball up into the opposition with serious intent, his low body position ensuring he is always hard to stop or put to ground.

Alberts excels in so many areas – tackling, ball carrying, running the ball back from the re-start kick and of course, the close quarter work. He is industrious and highly committed. Yet he is also a thinking player, a man with a rugby brain. He can step and ride tackles, offload and read the play.

In one example against the Cheetahs, he picked up a kick dribbled through on a wet ground with a slippery ball, as though he was a cricketer at third slip pocketing the ball with his eyes shut. These are highly valuable qualities in so strong a loose forward.

But of course it is in defence where Alberts impresses most of all.

As former Springbok back row man Bob Skinstad said last weekend during the clash with the Cheetahs, "Alberts' defence is absolutely superb. The number of tackles he makes and the sheer brutality of the tackles he executes is such an asset to any side".

It certainly is.

And now here is another piece of good news about Alberts for Springbok fans. His style makes him an ideal player in New Zealand conditions.

The All Blacks have always loved the Willem Alberts type of back row forward – hard driving, no nonsense and strong in the tackle. New Zealanders see that sort of player as essential to the balance of a back row and they have had any number of similar type players down the years just to prove the point.

Willem Alberts could hardly have made a better start to this important rugby year.

But let us, above all this, spare a thought for those who endured the earthquake in Christchurch last week. It has thrown into doubt the matches scheduled for the city in this year's Rugby World Cup. Of course, the first thing to say is to offer our sympathy and condolences to the families of the bereaved.

For the moment, the event of nature completely overtakes the upcoming sporting event.

But there should be one thing made clear. Despite early talk of moving some matches across the Tasman to Australia, all the RWC matches must stay in New Zealand.

DFA 100 years ago

REGISTRATION of Voters in the Electoral Division of Kimberley is set to begin. Notice is hereby given to the inhabitants of the several Fieldcornetcies of this Division that the Registering Officers will now commence in accordance with the provisions of the Parliamentary Voters Amendment Act.

DFA 50 years ago

THE MAYOR of Kimberley, Mr L Jawno, last night officially opened the Queen's Park swimming bath, five months after it was opened to the public. In his speech, the mayor mentioned the many favourable comments people made about the bath, saying it was one of the finest in the country.

DFA 25 years ago

AMATEUR astronomer in Kimberley, Mr W Goeieman of 8 Arabia Street, Homestead, has spotted Halley's Comet. He managed to pinpoint the comet about 15 degrees above the horizon at 5am on Thursday last week. "I was using the celestial co-ordinates and my telescope, but actually spotted the comet with my binoculars," he said.

DFA 10 years ago

THE OBSERVANCE of the Women's World Day of Prayer was held on Friday at St Mary's Catholic Cathedral in DuToitspan Road on Friday at 6.30pm. The theme for this year was "Informed Prayer – Prayerful Action". Resources for the World Prayer Day 2001 were prepared by the Christian women of Samoa.

Thought for the Day

"A PERVERSE man stirs up dissension, and a gossip separates close friends." – Proverbs 16:28

A RUMOUR is as hard to unspread as butter. – Pastor Andrew

letterscolumn

LETTERS TO THE EDITOR PO BOX 610, KIMBERLEY 8300 **FAX** 832-1141 E-MAIL: patsy.beangstrom@inl.co.za

One in a million

SIR – We would like to express our gratitude to Mr George Mosimane (Department of Education) for his intervention regarding the unplaced Grade 8 learners.

Had it not been for him, our children would still be at home and not attending school.

Mr Mosimane, we thank you in a very special way for your spirit of Ubuntu.

You have displayed it in an indescribable manner. We are very grateful to you that our daughter Ororiseng was eventually placed in a school.

Your commitment in accelerating the possible solutions to this predicament indicate your best understanding of Batho Pele principals and for that you are to be congratulated and declared the best public servant of the year.

May the good God bless you abundantly and keep you safe in the palm of His hand.

MR AND MRS MOSEKI
Kimberley

Kick the bucket, Sol

SIR – I am a resident of De Beers (Hull Street Housing Complex). In 2007, the President of South Africa said that there would be no bucket systems any more.

We at the Hull Street complex, however, are still using the bucket system.

It is unfair to expect us to vote for the Sol Plaatje Municipality because they are the ones delaying the process of providing proper toilets for us.

Our children are getting sick because of these buckets. No living human being can live like this.

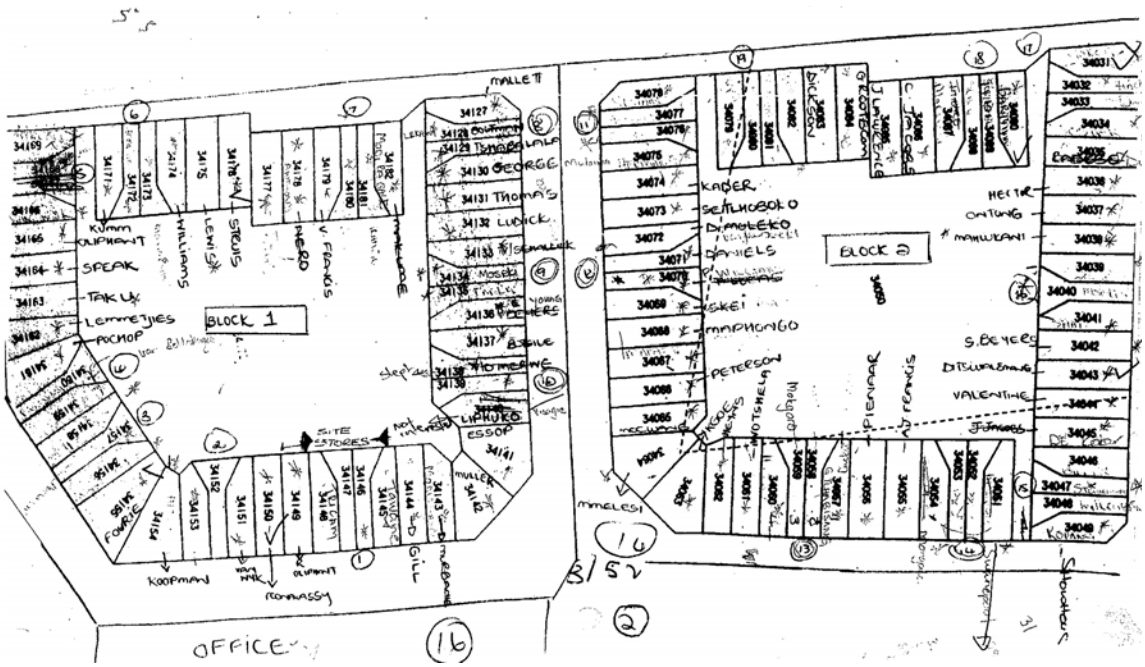
The Sol Plaatje Municipality is not doing anything with regard to the bucket systems. We also pay our monthly rent, water and electricity accounts. How can we be treated like this?

What about our young children?

We don't deserve to live in these circumstances!

DISAPPOINTED RESIDENT
Kimberley

Appendix B. SITE PLAN/MAP



Appendix C: RESIDENTS' QUESTIONNAIRE

Form of Consent and Participant Information Sheet

To be filled in by the interviewer prior to the interview

Hello, my name is Gertrude Matsebe and I am a student at Wits University. I am conducting research on the perceptions of the users of urine diversion dry toilets (UDD) in medium density mixed housing in Hull Street housing project. The aim of the research is to understand your feelings and views with regard to the UDD toilet in Hull Street. The information gathered will be used purely for academic purposes, but the final document will be a public document in the form of a research report. I am asking for 45 minutes of your time.

Participation in this research is voluntary and you are free to withdraw anytime. There will be no remuneration or gifts in exchange for information provided. Your identity will remain anonymous and the information you provide will be confidential. You are entitled to withhold information that you feel is too personal or sensitive to you and you can choose not to answer any of the questions.

Do you give consent for photographs of your house/toilet to be taken and use of dictaphone?

Yes _____ No _____

If you are willing to participate in this research, please sign this form:

Signature _____ Date _____ Time _____

Place: _____

Thank you for agreeing to participate in this research study.

Interviewee no.

1. DEMOGRAPHIC INFORMATION (TICK APPROPRIATE BOX)

1.1. HOUSEHOLD INFORMATION

1.1.1 Interviewee details

Position in household	Gender
☐ Head of household	
☐ Spouse	
☐ Other (please specify)	

1.1.2 Age

☐ < 20 years

☐ 20 – 24 years

☐ 20 – 24 years

☐ 25 – 29 years

☐ 30 -34 years

☐ 35 - 39 years

☐ 40 -44 years

☐ 45 – 49 years

☐ 50 – 54 years

☐ 55 – 59 years

☐ 60 – 64 years

☐ 65 years +

1.1.3 Race

☐ Black

☐ White

☐ Coloured

☐ Indian

☐ Asian

☐ Other (please specify) _____

1.1.4 Educational Level

☐ No schooling

☐ Some primary

☐ Completed primary

☐ Some secondary

☐ Completed secondary

☐ Higher / Tertiary qualifications

☐ Other (specify) _____

1.1.5 Household Composition

Age	Gender	No.	Gender	No.	Total – (including interviewee)
0 – 4 years	Male		Female		
5 – 9 years	Male		Female		
10 – 14 years	Male		Female		
15 – 19 years	Male		Female		
20– 24 years	Male		Female		
25 - 29 years	Male		Female		
30 -34 years	Male		Female		
35 - 39 years	Male		Female		
40 -44 years	Male		Female		
45 – 49 years	Male		Female		
50 – 54 years	Male		Female		
55 – 59 years	Male		Female		
60 – 64 years	Male		Female		
65 years +	Male		Female		

TOTAL					

1.1.6 Household total income level per month

- ☐ < R 3500
- ☐ R 3500 – R 6000
- ☐ R 6001 – R10 000
- ☐ R10 001- R15 000
- ☐ R15 001 – R20 000
- ☐ > R20 001

1.1.7 Source of income (it could be more than one)

- ☐ Monthly salary
- ☐ Self-employed (please specify) _____
- ☐ Child grant
- ☐ Old age pension
- ☐ Disability grant
- ☐ Other (please specify): _____

1.1.8 Physical description of the unit

Unit no. _____

- ☐ Single- storey with 2 bedrooms
- ☐ Single-storey with 3 bedrooms
- ☐ Double-storey with 2 bedrooms
- ☐ Double-storey with 3 bedrooms
- ☐ Other (please specify): _____

2. HISTORY OF ACCESS TO SANITATION

2.1. WHAT TYPE OF SANITATION SYSTEM DID YOU USE BEFORE YOU MOVED INTO HULL STREET?

- ☐ Waterborne
- ☐ UDD
- ☐ VIP
- ☐ Bucket
- ☐ Other (please specify): _____

2.2. WHAT TYPE OF SANITATION SYSTEM DO YOU CURRENTLY USE IN HULL STREET?

- ☐ Waterborne
- ☐ UDD
- ☐ VIP
- ☐ Bucket
- ☐ Other (please specify): _____

2.3. HOW WOULD YOU COMPARE YOUR PREVIOUS SANITATION SYSTEM BEFORE YOU CAME TO HULL STREET WITH THE CURRENT UDD TOILET?

- ☐ Same
- ☐ Better
- ☐ Worse

Comment

3. DESIGN, USE AND FUNCTIONALITY OF UDD TOILET

3.1. WHEN DID YOU MOVE INTO HULL STREET? _____

3.2. WHERE DID YOU STAY BEFORE YOU MOVED INTO HULL STREET?

_____

3.3. DO YOU USE THE UDD TOILET REGULARLY? ?

- ☐ Yes
- ☐ No

Explain

3.4. DO YOU FIND IT EASY TO USE THE TOILET SEAT?

- ☐ Yes
- ☐ No

Explain.

3.5. HOW LONG HAVE YOU BEEN USING THE UDD TOILET?

_____ WEEKS

_____ MONTHS

_____ YEARS

4. USER'S PERCEPTIONS AND ATTITUDES

4.1. DO YOU LIKE THE UDD TOILET?

- ☐ Yes
- ☐ No

Explain.

4.2. IN YOUR OPINION, HOW DOES THE UDD TOILET COMPARE TO OTHER TOILETS THAT ARE NOT FLUSH TOILETS?

4.3. WOULD YOU RECOMMEND THE UDD TOILET TO OTHERS?

- ☐ Yes
- ☐ No

Explain.

4.4. DO YOU KNOW THAT YOUR TOILET IS GOING TO BE CONVERTED TO A FLUSH TOILET?

- ☐ Yes
- ☐ No

4.3.1 If yes, what led to this change and what do you think of it?

4.5. WHAT TYPE OF A GARDEN DO YOU HAVE?

- ☐ Vegetables
- ☐ Flowers/plants
- ☐ Lawn
- ☐ Nothing

4.6. DO YOU HAVE AN INTEREST IN GARDENING?

- ☐ Yes
- ☐ No

Explain.

4.7. WHAT DO YOU THINK OF HUMAN FAECES?

4.8. WHAT HAVE YOU HEARD ABOUT USING HUMAN FAECES IN THE GARDEN AS FERTILISER?

4.8.1 What do you think about it?

4.9. HAVE YOU EVER USED HUMAN FAECES IN YOUR GARDEN?

- ☐ Yes
- ☐ No (if no, go to 4.12)

Explain

4.10. HAVE YOU NOTICED ANY CHANGES IN YOUR GARDEN AFTER YOU USED HUMAN FAECES?

- ☐ Yes
- ☐ No

Comment

4.11. WOULD YOU BE COMFORTABLE TO USE HUMAN FAECES IN YOUR GARDEN?

- ☐ Yes
- ☐ No

Explain.

4.12. WHAT DO YOU THINK OF HUMAN URINE?

4.13. WHAT HAVE YOU HEARD ABOUT USING HUMAN URINE IN THE GARDEN AS FERTILISER?

4.13.1 What do you think about it?

4.14. HAVE YOU EVER USED HUMAN URINE IN THE GARDEN?

- ☐ Yes
- ☐ No (if no go to 5)

Explain.

4.15. HAVE YOU NOTICED ANY CHANGES IN YOUR GARDEN AFTER YOU USED HUMAN URINE?

- ☐ Yes
- ☐ No

Comment

4.16. WOULD YOU BE COMFORTABLE TO USE HUMAN URINE IN YOUR GARDEN?

- ☐ Yes
- ☐ No

Explain

5. OPERATION AND MAINTENANCE

5.1. DO YOU KNOW HOW THE UDD TOILET WORKS?

- ☐ Yes
- ☐ No

5.1.1 If yes, please explain

5.1.2 If no, are you interested in knowing and why?

5.2. WHO IS RESPONSIBLE FOR CLEANING THE UDD TOILET?

- ☐ HEAD OF HOUSEHOLD (SPECIFY GENDER) _____
- ☐ SPOUSE (SPECIFY GENDER) _____
- ☐ GRANDFATHER
- ☐ GRANDMOTHER
- ☐ CHILD 1 (SPECIFY GENDER) _____
- ☐ CHILD 2 (SPECIFY GENDER) _____
- ☐ CHILD 3 (SPECIFY GENDER) _____
- ☐ OTHER (SPECIFY GENDER) _____

5.3. IS IT EASY TO CLEAN THE UDD TOILET?

- ☐ Yes
- ☐ No

Explain

5.4. HOW DO YOU CLEAN THE UDD TOILET?

5.5. WHAT DO YOU USE TO CLEAN THE UDD TOILET?

☐ DISINFECTANT (PLEASY SPECIFY) _____

☐ WATER

☐ SOAP

☐ OTHER (PLEASE SPECIFY) _____

5.6. WHERE DO YOU DISPOSE OF /STORE THE CLEANING MATERIAL USED TO CLEAN THE TOILET?

5.7. ARE YOU HAPPY WITH THE MAINTENANCE SERVICE OF THE UDD TOILET YOU ARE RECEIVING FROM THE HOUSING COMPANY?

☐ Yes

☐ No

Comment

5.8. DOES THE UDD TOILET SMELL OF URINE?

☐ Yes

☐ No

Explain

5.9. DOES THE UDD TOILET SMELL OF FAECES?

- ☐ Yes
- ☐ No

Explain

5.10. IS THERE ANY OTHER SMELL FROM THE UDD TOILET?

- ☐ Yes
- ☐ No

Explain

5.11. WHAT DO YOU USE TO WIPE AFTER USING THE UDD TOILET?

- ☐ TOILET PAPER
- ☐ NEWSPAPER
- ☐ CLOTH
- ☐ WATER
- ☐ OTHER (PLEASE SPECIFY) _____

5.12. WHERE DO YOU DEPOSIT MATERIAL USED FOR WIPING?

- ☐ CONTAINER INSIDE TOILET
- ☐ CONTAINER OUTSIDE THE HOUSE
- ☐ INSIDE THE TOILET VAULT
- ☐ OTHER (PLEASE SPECIFY) _____

5.13. WHERE DO WOMEN DISPOSE OF THEIR SANITARY PADS/TAMPONS? _____

5.14. WHAT DO YOU USE TO COVER THE FAECES IN THE VAULT?

- ☐ ASH
- ☐ SOIL
- ☐ LIME
- ☐ SAWDUST
- ☐ LEAVES
- ☐ NOTHING
- ☐ OTHER (PLEASE SPECIFY) _____

5.15. HOW OFTEN IS THE VAULT EMPTIED?

- ☐ DAILY
- ☐ WEEKLY
- ☐ MONTHLY
- ☐ OTHER (PLEASE SPECIFY) _____

5.16. DID YOU RECEIVE ANY TRAINING ON HOW TO USE AND MAINTAIN THE UDD TOILET?

- ☐ Yes
- ☐ No

Explain

5.17. WHO PROVIDED IT?

5.18. IF YOU RECEIVED TRAINING, WHAT WAS IT ABOUT? (TICK MORE THAN ONE WHEREVER POSSIBLE)

- ☐ CORRECT USE OF TOILET (NO HOUSEHOLD WASTE /CHEMICALS/WATER IN THE VAULT)
- ☐ CORRECT CLEANING OF THE TOILET (CLEAN PEDESTAL, FLOOR)
- ☐ USE LIME/SAND TO COVER FAECES
- ☐ FAECES CAN BE USED AS COMPOST IN THE GARDEN
- ☐ KEEP THE PEDESTAL LID CLOSED.
- ☐ KEEP THE DOOR CLOSED

Other

5.19. WAS TRAINING USEFUL TO THE HOUSEHOLD?

☐ Yes

☐ No

Comment

6. ECONOMIC ASPECTS

6.1. HOW MUCH IS YOUR MONTHLY RENT?

6.2. APPROXIMATELY HOW MUCH (IN RANDS) DO YOU PAY FOR WATER PER MONTH?

6.3. APPROXIMATELY HOW MUCH (IN RANDS) DO YOU PAY FOR ELECTRICITY PER MONTH?

6.4. ARE YOU AWARE THAT CHANGING TO A FLUSH SYSTEM WILL HAVE EXTRA COST?

☐ Yes

☐ No

6.5. ARE YOU HAPPY AND WILLING TO PAY AN EXTRA COST?

6.6. HOW MUCH WOULD YOU BE PREPARED TO PAY? _____

7. INSTITUTIONAL CAPACITY IN HULL STREET

7.1. WHAT DO YOU THINK IS THE ROLE OF THE MUNICIPALITY IN TERMS OF SERVICE PROVISION IN HULL STREET?

7.2. WHAT DO YOU THINK IS THE ROLE OF THE MUNICIPALITY IN TERMS OF PROVISION OF SANITATION SERVICES IN HULL STREET?

7.3. IS THERE AN ORGANISED STRUCTURE IN HULL STREET RESPONSIBLE FOR SANITATION MATTERS?

- ☐ Yes
- ☐ No

7.3.1 If yes, what is the name of the structure?

7.4. WHO ARE THE MEMBERS SERVING ON THIS STRUCTURE?

7.5. WHAT ARE THE RESPONSIBILITIES OF THIS STRUCTURE?

7.6. OTHER COMMENTS

Thank you very much for your time and contributions.

Appendix D: EMPLOYEES' QUESTIONNAIRE

EMPLOYEE

Form of Consent and Participant Information Sheet

To be filled in by the interviewer prior to the interview

Hello, my name is Gertrude Matsebe and I am a student at Wits University. I am conducting research on the perceptions of the users of urine diversion dry toilets (UDD) in medium density mixed housing in Hull Street housing project. The aim of the research is to understand your feelings and views with regard to the UDD toilet in Hull Street. The information gathered will be used purely for academic purposes, but the final document will be a public document in the form of a research report. I am asking for 45 minutes of your time.

Participation in this research is voluntary and you are free to withdraw anytime. There will be no remuneration or gifts in exchange for information provided. Your identity will remain anonymous and the information you provide will be confidential. You are entitled to withhold information that you feel is too personal or sensitive to you and you can choose not to answer any of the questions.

Do you give consent for photographs of your office/toilet to be taken and use of dictaphone?

Yes _____ No _____

If you are willing to participate in this research, please sign this form:

Signature _____ Date _____ Time _____

Place: _____

Thank you for agreeing to participate in this research study.

Interviewee no.

1 DEMOGRAPHIC INFORMATION (TICK APPROPRIATE BOX)

1.1. INTERVIEWEE INFORMATION

1.1.1. Position in the company _____

1.1.2. Gender

☐ Male

☐ Female

1.1.3. Age

☐ < 20 years

☐ 20 – 24 years

☐ 25 – 29 years

☐ 30 -34 years

☐ 35 - 39 years

☐ 40 -44 years

☐ 45 – 49 years

☐ 50 – 54 years

☐ 55 – 59 years

☐ 60 – 64 years

☐ 65 years +

1.1.4. Race

☐ Black

☐ White

☐ Coloured

☐ Indian

☐ Asian

☐ Other (please specify) _____

1.1.5. Educational Level

☐ No education

☐ Primary education

☐ Secondary education

☐ Matric

☐ Higher/ Tertiary qualifications

☐ Other (please specify)

1.1.6 Number of people in the office _____

1.1.7 Number of people using the toilets

Age	Position	Gender	No.	Gender	No.	Total – (including interviewee)
0 – 4 years		M		F		
5 – 9 years		M		F		
10 – 14 years		M		F		
15 – 19 years		M		F		
20– 24 years		M		F		
25 - 29 years		M		F		
30 -34 years		M		F		
35 - 39 years		M		F		
40 -44 years		M		F		
45 – 49 years		M		F		
50 – 54 years		M		F		
55 – 59 years		M		F		
60 – 64 years		M		F		
65 years +		M		F		

TOTAL						

2. HISTORY OF ACCESS TO SANITATION

2.1. WHAT TYPE OF SANITATION SYSTEM DO YOU CURRENTLY USE AT HOME?

☐ Waterborne

☐ UDD

☐ VIP

☐ Bucket

☐ Other: _____

2.2. WHAT TYPE OF SANITATION SYSTEM DO YOU CURRENTLY USE AT WORK (SOL PLAATJIE HOUSING COMPANY)?

☐ Waterborne

☐ UDD

☐ VIP

☐ Bucket

☐ Other: _____

2.3. DO YOU ACTUALLY USE THE UDD TOILET AT WORK?

☐ Yes

☐ No

Comment

2.4. DO YOU FIND IT EASY TO USE THE UDD TOILET?

☐ Yes

☐ No

Explain

2.5. HOW WOULD YOU COMPARE YOUR SANITATION SYSTEM AT HOME WITH THE CURRENT UDD TOILET AT WORK?

- ☐ Same
- ☐ Better
- ☐ Worse

Comment

3. DESIGN, USE AND FUNCTIONALITY OF UDD TOILET

3.1 WHAT TYPE OF SANITATION SYSTEM WERE YOU USING IN YOUR PREVIOUS WORKPLACE?

- ☐ Waterborne
- ☐ UDD
- ☐ VIP
- ☐ Bucket
- ☐ Other: _____

3.2 HOW LONG HAVE YOU BEEN USING THE UDD TOILET?

_____ WEEKS

_____ MONTHS

_____ YEARS

3.3. WHAT DO YOU USE TO WIPE AFTER USING THE UDD TOILET?

☐ TOILET PAPER

☐ NEWSPAPER

☐ CLOTH

☐ WATER

☐ OTHER (PLEASE SPECIFY) _____

3. 4.WHERE DO YOU DEPOSIT MATERIAL USED FOR WIPING?

☐ CONTAINER INSIDE TOILET

☐ CONTAINER OUTSIDE THE HOUSE

☐ INSIDE THE TOILET VAULT

☐ OTHER (PLEASE SPECIFY) _____

3.5 IF YOU ARE A WOMAN, WHERE DO YOU DISPOSE OF YOUR SANITARY PAD/TAMPON? _____

3.6 WHAT DO YOU USE TO COVER THE FAECES IN THE VAULT?

☐ ASH

☐ SOIL

☐ LIME

☐ SAWDUST

☐ LEAVES

☐ NOTHING

☐ OTHER (PLEASE SPECIFY) _____

4. USER'S PERCEPTIONS AND ATTITUDES

4.1 DO YOU LIKE THE UDD TOILET?

☐ Yes

☐ No

Explain.

4.2 WOULD YOU RECOMMEND THE UDD TOILET TO OTHERS?

☐ Yes

☐ No

Explain

4.3 IN YOUR OPINION, HOW DOES THE UDD TOILET COMPARE TO OTHER TOILETS THAT ARE NOT FLUSH TOILETS?

4.4 IS YOUR OFFICE TOILET GOING TO BE CONVERTED TO A FLUSH TOILET?

☐ Yes

☐ No

4.3.1 What do you think of this change?

4.5 WHAT TYPE OF A GARDEN DO YOU HAVE AT THE OFFICE?

- ☐ Vegetables
- ☐ Flowers/plants
- ☐ Lawn
- ☐ Nothing

4.6 WHAT TYPE OF A GARDEN DO YOU HAVE AT HOME?

- ☐ Vegetables
- ☐ Flowers/plants
- ☐ Lawn
- ☐ Nothing

4.7 DO YOU HAVE AN INTEREST IN GARDENING?

☐ Yes

☐ No

Explain.

4.8 WHAT DO YOU THINK OF HUMAN FAECES?

4.9 WHAT HAVE YOU HEARD ABOUT USING HUMAN FAECES IN THE GARDEN AS FERTILISER?

4.8.1 What do you think about it?

4.10 HAVE YOU EVER USED HUMAN FAECES IN THE GARDEN?

- ☐ Yes
- ☐ No (if no, go to 4.12)

Explain.

4.11 HAVE YOU NOTICED ANY CHANGES IN YOUR GARDEN AFTER YOU USED HUMAN FAECES?

- ☐ Yes
- ☐ No

Comment

4.12 WOULD YOU BE COMFORTABLE TO USE HUMAN FAECES IN YOUR GARDEN?

- ☐ Yes
- ☐ No

Explain.

4.13 WHAT DO YOU THINK OF HUMAN URINE?

4.14 WHAT HAVE YOU HEARD ABOUT USING HUMAN URINE IN THE GARDEN AS FERTILISER?

4.14.1 What do you think about it?

4.15 HAVE YOU EVER USED HUMAN URINE IN THE GARDEN?

☐ Yes

☐ No (if no, go to 5)

Explain.

4.16 HAVE YOU NOTICED ANY CHANGES IN YOUR GARDEN AFTER YOU USED HUMAN URINE ?

4.17 WOULD YOU BE COMFORTABLE TO USE HUMAN URINE IN YOUR GARDEN?

☐ Yes

☐ No

Explain

5. OPERATION AND MAINTENANCE

5.1. DO YOU KNOW HOW THE UDD TOILET WORKS?

☐ **Yes**

☐ **No**

5.1.1. If yes, please explain

5.1.2. Who provided this information/training? _____

5.1.3. When was the training conducted? _____

5.1.4. Was the training useful?

☐ Yes

☐ No

Explain

5.1.5. If no, are you interested in knowing and why?

5.2. WHO IS RESPONSIBLE FOR CLEANING THE UDD TOILET IN THE OFFICE?

_____

* GO TO 5.19 IF INTERWEE IS NOT RESPONSIBLE FOR CLEANING THE TOILET

5.3. IS IT EASY TO CLEAN THE UDD TOILET?

☐ Yes

☐ No

Explain

5.4. HOW DO YOU CLEAN THE UDD TOILET?

5.5. WHAT DO YOU USE TO CLEAN THE UDD TOILET?

☐ DISINFECTANT (PLEASY SPECIFY) _____

☐ WATER

☐ SOAP

☐ OTHER (PLEASE SPECIFY) _____

5.6. WHERE DO YOU DISPOSE OF /STORE THE CLEANING MATERIAL?

5.7. WHAT ELSE DO YOU HAVE TO DO TO MAINTAIN THE UDD TOILET (OTHER THAN CLEANING)?

5.8. DO YOU REMOVE FAECES FROM THE VAULT?

☐ Yes

☐ No

Explain

5.9. WHERE DO YOU DISPOSE OF FAECES?

☐ COMPOSTING SITE

☐ GARDEN

☐ COLLECTED AND TAKEN AWAY BY SOMEONE ELSE/SERVICE PROVIDER

☐ OTHER (PLEASE SPECIFY) _____

5.10. IS IT EASY TO REMOVE FAECES FROM THE VAULT?

☐ Yes

☐ No

Explain

5.11. HOW OFTEN IS THE VAULT EMPTIED?

☐ DAILY

☐ WEEKLY

☐ MONTHLY

5.12. DO YOU HAVE PROTECTIVE GEAR WHEN DOING YOUR WORK?

☐ **YES**

☐ **NO**

Explain

5.13. DID YOU RECEIVE ANY TRAINING ON HOW TO USE AND MAINTAIN THE UDD TOILET?

☐ Yes

☐ No

Explain

5.14. WHO PROVIDED IT?

_____

5.15. WHEN WAS TRAINING CONDUCTED? _____

5.16. IF YOU RECEIVED TRAINING, WHAT WAS IT ABOUT? (TICK MORE THAN ONE WHEREVER POSSIBLE)

- ☐ CORRECT USE OF TOILET (NO HOUSEHOLD WASTE /CHEMICALS/WATER IN THE VAULT)
- ☐ CORRECT CLEANING OF THE TOILET (CLEAN PEDESTAL, FLOOR)
- ☐ USE LIME/SAND TO COVER FAECES
- ☐ FAECES CAN BE USED AS COMPOST IN THE GARDEN
- ☐ KEEP THE PEDESTAL LID CLOSED.
- ☐ KEEP THE DOOR CLOSED

OTHER

5.17. WAS THE TRAINING PROVIDED USEFUL TO YOU?

☐ Yes

☐ No

Explain

5.18. HOW DO YOU FEEL ABOUT CLEANING AND MAINTAINING THE UDD TOILET?

5.19. DOES THE UDD TOILET SMELL OF URINE?

☐ Yes

☐ No

Explain

5.20. DOES THE UDD TOILET SMELL OF FAECES?

☐ Yes

☐ No

Explain

5.21. IS THERE ANY OTHER SMELL FROM THE UDD TOILET?

☐ Yes

☐ No

Explain

6. ECONOMIC ASPECTS

6.1. IS THE COMPANY AWARE OF THE FINANCIAL IMPLICATIONS OF CHANGING TO THE FLUSH TOILETS?

☐ Yes

☐ No

Explain

6.2. IF YES, IS THE COMPANY PREPARED TO PAY ADDITIONAL COST?

☐ Yes

☐ No

Comment

7. INSTITUTIONAL CAPACITY IN HULL STREET

7.1. WHAT DO YOU THINK IS THE ROLE OF THE MUNICIPALITY IN TERMS OF SERVICE PROVISION IN HULL STREET?

7.2. WHAT DO YOU THINK IS THE ROLE OF THE MUNICIPALITY IN TERMS OF PROVISION OF SANITATION SERVICES IN HULL STREET?

7.3. IS THERE AN ORGANISED STRUCTURE IN HULL STREET RESPONSIBLE FOR SANITATION MATTERS?

☐ Yes

☐ No

7.3.1. If yes, what is the name of the structure?

7.4. WHO ARE THE MEMBERS SERVING ON THIS STRUCTURE?

7.5. WHAT ARE THE RESPONSIBILITIES OF THIS STRUCTURE?

7.6. DOES THE COMPANY HAVE A ROLE IN THIS STRUCTURE?

☐ Yes

☐ No

7.6.1. if yes, what is it?

7.7. FROM YOUR EXPERIENCE, DO YOU THINK UDD TOILET CAN BE PROMOTED IN OTHER HOUSING DEVELOPMENT SIMILAR TO HULL STREET?

☐ Yes

☐ No

Explain

7.7.1. If yes, how best can this be done?

8. OTHER COMMENTS

Thank you very much for your time and contributions.

Appendix E Consent to conduct research from SPHC

Association Registered under Section 21
Registration number 2000/007995/08
Cnr. De Beers Terrace & Hull Street
De Beers, Kimberley, 8301.
P.O. Box 110103, Hadison Park, 8306
Tel: 053-8337302, Fax: 053-8337304

SOL PLAATJE HOUSING COMPANY

Ref. No./ Verw.: Verw: 15/1/1 Research

Enquiries / Navrae: J C Schoeman 053 8337302

11 June 2011

To whom it concerns

Consent to conduct research on the Hull Street Integrated Housing Project

I, J C Schoeman the managing director of the Sol Plaatje Housing Company hereby grant Gertrude Matsebe permission to conduct research on the above mentioned project.

Your sincerely

J. C. Schoeman

Managing Director: Sol Plaatje Housing Company