

**AN EVALUATION OF THE DEVELOPMENT OF
RURAL SANITATION AT EISLEBEN VILLAGE IN
LIMPOPO PROVINCE, SOUTH AFRICA**

BY

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DECLARATION

I hereby declare that this research paper submitted to the University of Limpopo for the degree of Masters in Developmental Studies has not previously been submitted by me for a degree at this or any university, that it is my own in design and execution and that all material contained therein has been duly acknowledged.

Signed:.....

Date:.....

MAMATŠHEU BERNARD MOLOPA

DEDICATION

This work is dedicated to my wife, Tsakani Patience Molopa

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ABSTRACT

Rural sanitation researchers, particularly in the Limpopo Province, have not offered theories in relation to the patterns of the development of rural sanitation. Several researchers have concerned themselves with the need for the solution of water supply but not sanitation services.

The present study seeks to enhance the understanding of the dynamics of the patterns of the development of rural sanitation in the Capricorn District Municipality, in particular at the Eisleben Village.

This research paper applied an evaluative methodology to assess the impact of VIP sanitation technology at Eisleben Village at Ramokgopa under Capricorn District Municipality in Limpopo Province in comparison to dry sanitation. Supportive cases studies on sanitation delivery in South Africa have also been cited to where both technologies have been applied to assess their impact to the health and dignity of the communities, the environmental impacts. Examples of such case studies included examples of the Mosvold Hospital Sanitation Programme, the Northern Cape Household Sanitation Programme, the eThekweni Water and Sanitation Programme and the Dry sanitation in an urban environment at Weiler's Farm in Johannesburg.

The following five major findings emerged from the study:

1. Sanitation development should be community driven in terms of information, knowledge and decision making.
2. There is need for the vision of health, hygiene and education strategy for water and sanitation. Efficient and effective hygiene education is urgently needed.
3. There is resounding evidence from previous sanitation projects done in various places in South Africa that dry or waterless sanitation has been found to be an adequate sanitation technology that best suits urban, peri-urban and rural areas.
4. There is need to replace VIP with a better technology such as dry sanitation as a matter of urgency to avoid unhygienic and unhealthy conditions due to inadequate VIP sanitation technology.

5. Sanitation solution and technology should comply with the Department of Water Affairs and Forestry (DWAF) policies of adequate sustainable water and adequate sustainable sanitation solution, Millennium Development Goals (MDGs) and the German Helmholtz Association HFG's "concept of integrated sustainable development".

In the main, the study suggests possible strategies and mechanisms to overcome the challenges that are identified in the research, with the idea in mind of contributing in improving sanitation, not only in the Eisleben Village, but rather to all rural communities in the Limpopo Province, South Africa.

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CHAPTER ONE

GENERAL ORIENTATION OF THE STUDY

1.1 Introduction

Policies and industries of the first world countries systematically depleted resources of the third world countries and developing, without any meaningful investments for the nations and communities, which they have robbed of livelihoods. The methods of waste management and pollution management from the First world countries that have been introduced and supported financially to third world and developing countries, have also come to fall short, due to the negative impact that they have made on the environment world wide. Sanitation management is one of the most problematic areas of waste management and pollution.

The study seeks to evaluate the development of rural sanitation at Eisleben Village in Limpopo Province in South Africa. The study will this aim by analysing the challenges relating to the status of sanitation globally, in South Africa and finally at Eisleben and sanitation solutions applied to address the challenges. Sanitation is a serious problem globally and it cannot be divorced from socio-economic, health and biodiversity problems. The problem of sanitation is compounded by the lack of and diminishing resources of water and poor management of faeces and urine. Sanitation is one of the key issues that should be holistically and adequately addressed in order to meet the Millennium Development Goals and improve the health status of the whole world and in particular developing countries with the inclusion of South Africa.

1.2 Overview of the Study

South Africa has a new strategic framework defines the sector vision for water services as *“reinforcing the critical elements of equity, efficiency and sustainability, with respect to reform in the entire range of emerging institutional arrangements for service provision including water and sanitation”*:

- All people living in South Africa should have access to adequate, safe, appropriate and affordable water and sanitation services, use water wisely and practise safe sanitation;
- Effective, efficient and integrative sustainable institutions that meet the Millennium Developmental Goals should provide water supply and sanitation services. Water services institutions should reflect the cultural, gender and racial diversity in South Africa; and
- Water should be used effectively, efficiently and integrative sustainable in order to reduce poverty, improve human health and promote economic development.
- Water, excreta and wastewater should be managed in an environmentally responsible and integrative sustainable manner.

Researches conducted in relation to the problems of sanitation reveal that there is lack of adequate, integrative sustainable sanitation management in the world. This includes South Africa. According to Peasey (2000), over six billion people of the world produce over a million tons of faeces and current waste management methods are not coping, either in terms of protecting human health or the environment. World Health Organization (1996) estimated that approximately 3 billion people lack even the most basic sanitation: that is nearly half of humanity.

Brian E. Barbier and W. R. Ross also commented in the Water Environment and Technology publication, 1991, *“there is no adequate disposal system for sanitary wastes and domestic refuse are lacking in South Africa because of demographic, sociological, and economic factors”*.

Studies by the South African Water Research Commission (1995) and the [National Sanitation Task Team – Draft Paper, November 1995, Republic of South Africa, Draft White Paper report for comment purpose](#) have estimated that over 22 million South Africans do not have access to adequate sanitation facilities.

Of the 22 million South Africans who do not have adequate sanitation facilities

- 7.67 million reside in urban areas,
- of the 7.67 millions over 2 million people rely on the bucket system, which is generally not acceptable system from a health perspective or in terms of community acceptance.
- Of the rough estimates of service levels available from rural areas, more than 14.1 million do not have adequate sanitation services (i.e. bucket systems, pit latrine or the veld), which is more than 95% of the rural population.

The study will explore whether Eisleben is amongst the rural villages, whose communities are included in the 22 million in South Africa that are without adequate and integrative sustainable sanitation management.

Republic of South Africa is already under pressure about meeting the costs of the backlog necessity for infrastructure development and services, housing, education and social services can ill afford to perpetuate the abuse of the environment and various ecosystems to the extent that they would need costly repair. The effects of sanitation in South Africa are threefold:

1. Environmental Impact – The undisputed fact is that of pollution of water resources and a lot of expense in the treatment of water, while health of communities is under unrelenting attack from untreated water supplies, and the destruction of fertile productive lands since waste is improperly recycled.
2. Health Impact – the impact of the conditions, as represented by the statistics have an impact on the quality of life, education and developmental potential of communities and the health of the urban and rural poor significantly.

3. Economic Impact – Poverty, illness, illiteracy and lost income are the characteristics that affect the national cost of low and lost productivity, reduced educational potential and curative health costs affecting the local and national economy.

1.3 Environmental Impact

The current and highly practiced sanitation management technologies are inadequate, and promote the pollution and contamination of clean water resources. This includes adequately designed or operated waterborne sewerage systems where the impact of failure on the health of the community and the pollution of the environment is extremely serious. These inadequate facilities combined with unhygienic practices and a general lack of formal water supplies, as well as safe disposal of other domestic wastewater, represents South Africa's sanitation problem.

The study will also determine the position of Eisleben village in regard to the availability of water resources; and whether the existing sanitation management technologies implemented or being implemented at Eisleben village are adequate and sustainable conservation of the water resources from contamination and pollution from sanitation technologies implemented and being implemented.

1.4 Health Impact

The consequences of inadequate sanitation management includes amongst others pollution and contamination of water resources such as rivers, lakes, sea and underground water which results into waterborne sanitation related diseases. Studies have also produced findings in relation to the impact and health problems that results due to inadequate sanitation management.

The study will evaluate studies in relation to the impact of sanitation technologies to inadequate sanitation management and the spread of many infections of viruses, bacteria, protozoa and worms through direct contact with excreta, indirectly via consumption of food, water ingestion and soil or via carriers and vectors that have dire consequences to health. Poor hygienic practices exposes people to waterborne and viral diseases such as *poliomyelitis*, *infectious hepatitis* and *gastroenteritis*; bacterial diseases such as *cholera*, *typhoid*, *paratyphoid* and *bacillary dysentery*; protozoal disease such as amoebic *dysentery* and *giardiasis*; and worm infections such as *ascariasis*, *trichuriasis* and *pinworm* are passed on when people touch faeces and then food or drink. (<http://www.dl.saywell@lboro.ac.uk>)

The water-borne sanitation- related diseases is responsible of more than 22 million deaths worldwide because of sanitation-related diseases; and of these deaths, the most vulnerable are the children. **Water-based disease** - a disease that spreads through water contaminated with parasites (worms), either when you drink it or when it penetrates the skin, usually through an open wound. Water-based diseases include **Water-borne disease** - a disease that spreads through water containing human or animal faeces and urine, either when you drink such water directly or you eat food washed with it. Water-borne diseases include cholera and other diarrhoeal disease; typhoid fever; polio; roundworm; and whipworm. Water-borne diseases also count as water-washed and this includes water-based disease such as schistosomiasis and guinea worm and water-related insect vector disease.

Researches estimate that poor drinking water and inadequate sanitation causes:

- 80% of the diseases in developing countries such as cholera, typhoid, polio and gastrointestinal disease; (Beeld, 22 March 2006);
- 3.1 million people worldwide die annually as a result of gastrointestinal illness or malaria (Beeld, 22 March 2006);
- About 34 000 deaths daily, diarrhoea causes death of 5 children per minute, and about 650 South Africans, mostly children die of diarrhoea daily. (Barbier, 2006: 264)

- The short-term medical costs about R5 billion per annum in South Africa alone. Related total annual direct hospital costs is estimated at R15 billion per annum according to the Water Research Commission (quoted in <http://www.scienceinafrika.co.za/2001september/wetland.htm>)

1.5 Economic Impact

Amongst the papers presented in Islamabad, Pakistan in 1998 during the 24th WEDC Conference on Sanitation and water was a paper on '**Measures to alleviate sanitation and health problems**' presented by Mesfin Shenkut, Nowergian Church Aid Ethiopia, and Deputy Country Director. The paper stated that that majority of the people living in developing countries are suffering from disease, hunger, ignorance, and or in most cases interlinked problems. While enormous resources are around them, the people suffer from poverty and hunger. Over half of the total population suffers from diseases caused by poor sanitation when simple sanitary measures can make a big difference. This study will also explore to find out the status of Eisleben villagers about the problems of water-borne sanitation-related diseases, hunger, ignorance, and or interlinked problems.

A study conducted by WEDC in 1997 in Indonesia has proven that there is a direct relationship between poverty level and environmental health status as well as hygienic living attitude and concludes by disclosing that the level of poverty will get better result by improving environmental sanitation. There is also interrelationship between poverty and illiteracy, poorly informed about the causes and consequences of poor sanitation systems. Even if they have a general perception on this issue, they have limited knowledge of alleviating the situation by using resources bound around them.

Moreover, it is common practice to find people not using or misusing such facilities even when provided free. This research at Eisleben will also evaluate the relationship of poverty and limited knowledge about sanitation management by Eisleben community.

The evaluation of the problems in relation to development of rural Sanitation at the Eisleben village in Limpopo Province will take into consideration the factors discussed, reflect on possible solution to the problems in order to address sanitation adequately and holistically. Thus, whatever intervention is proposed will not just serve the purpose of demonstrating technical competencies and skills of engineering, but will ensure that there is efficiency that should be measured in terms of making sense in terms of the physical, political and cultural situations in which they are operating to suit the social, economic and ecological requirements.

1.6 Problem Statement

Eisleben is one of the villages under the Molemole Local Municipality, in the Capricorn District Municipality of the Limpopo Province, South Africa, that has a serious problem with regard to sanitation. It is not an isolated incident in terms of this problem but it is a general problem in South Africa. The village has high rates of poverty and decent wage form of employment is only available 50 minutes' drive, in Polokwane, and 3 hours 30 minutes' drive, in Johannesburg.

In South Africa, a country of some 40 million people in 1994, the situation was complex. Prior 1994 South Africa consisted of four local governments in 4 provinces and 10 nominally autonomous homelands under apartheid rule. Services of water and sanitation in white ruled areas were of standards and quality of industrial countries, for urban blacks services were mixed and completely no services in rural areas. (Lane, 2004: 1) The fate of lack of services in rural areas also affected Eisleben.

Post apartheid era has brought many improvements (sanitation included) to the whole country also to Batlokwa villages including Eisleben through the new democratic government. Despite some provision of sanitation resources to intervene, sanitation development remains a matter of priority at Eisleben village. This is the reason why this research focuses on evaluating whether sanitation management at Eisleben is adequate and sustainable.

Most communities under Molemole municipality including Eisleben occupy areas, which have limited water resources and low rainfall. The communities are dependent on borehole or underground water supply. Due to insufficient water resources water, sewerage system is therefore not an option to solve sanitation problems at Eisleben village. The real option left for Eisleben village is either dry sanitation or pit latrines this includes Ventilated Pit Latrines.

The current considered sanitation management solutions at Eisleben Village includes pit latrines dug by villagers who can afford, Ventilated Improved Pit (VIP) Latrines which are provided by Capricorn District Municipality and Molemole Local Municipality, and Enviro loos which are provided through Department of Health in Limpopo Province for a clinic at Eisleben.

In order to establish or determine whether sanitation management in the development of rural sanitation at Eisleben is adequate and sustainable, the research should be able to provide answers to the following questions:

- To what extent is sanitation management at Eisleben village still relevant in addressing the adequate and integrative sustainable sanitation service provision as promoted by the South African government Constitution and Water and Sanitation policies and World Sustainable Standards on Development (WSSD) policies and objectives?
- Are the activities and operational outputs on sanitation management consistent with the program's mandate - which is to provide adequate and sustainable sanitation to Eisleben villagers?
- Are the outputs on sanitation management at Eisleben village plausibly linked to the objectives of providing better life for all inhabitants of South Africa, prevention of contamination and pollution, management of waste, prevention of diseases and promotion of health, biodiversity management, and sustainable economic development and participation of all citizens of South Africa?
- In what manner and to what extent were appropriate objectives achieved or not achieved because of the adopted sanitation project for Eisleben Villagers?

- What are community benefits and broader outcomes, intended and unintended, resulted from carrying out the VIP sanitation project?
- In what manner and to what extent does the sanitation programme at Eisleben village complement, duplicate, overlap or work at cross-purposes with other sustainable developmental programmes?
- Is there more cost-effective alternative way to sanitation programmes destined for rural areas such as Eisleben that might achieve the adequate and integrative sustainable management of sanitation?
- Are there more cost-effective ways of delivering the existing sanitation project?

1.7 Motivation for the Study

There is always a challenge in applying policies to provide better life for all, and this study will demonstrate that fact through evaluating the development of rural sanitation at Eisleben Village in Limpopo Province. To motivate this study the following points are vital as a point of departure:

- The vision and mission of water and sanitation services in South Africa
- Water and Sanitation Objectives in South Africa
- Sanitation Problems and Issues in South Africa
- Challenges that South Africa faces in regards to water and sanitation services

The Vision and Mission of Water of Sanitation Services in South Africa

DWAF and the Department of Health in collaboration with the National Task Team (NSTT) and the other relevant stakeholders have produced the National Health and Hygiene Education Strategy for Water and Sanitation. The vision is, “*A clean and healthy South Africa free from the burden of disease in relation to water and sanitation services*”. The mission is, namely, “*Efficient, effective and hygiene education in all communications targeting those at greatest risk: young children, women, and those affected by sickness*” (DWAF & Department of Health, 2004: 10).

The execution of the policies in compliance with the collaborated vision and mission challenges is contradictory by parties involved

There are instances that highlight the challenge in application of the water and sanitation policy in rural areas.

- VIP Latrines for Eisleben Village and Enviro-Loo for Eisleben Clinic:
 - is also a recipient of Ventilated Pit (VIP) Latrines sanitation facilities to provide adequate and integrative sustainable sanitation management from Capricorn District Municipality, which work with Department of Water Affairs in relation to water and sanitation services.
 - Limpopo Department of Health on the other hand recommended the installation of Enviro-Loo (Dry sanitation which uses forced aeration) sanitation facilities at the clinic at Eisleben Village. Department of Education of Education has also passed a policy position to implement Enviro-loos / dry sanitation technology at schools. (Barbier, 2006: 267) In Limpopo Province a task team for the Department of Education evaluated Enviro Loo dry sanitation in 1995 into cost-effective sanitation system for the schools. The conclusion arrived at was that *“If either a main sewer line or a sewage farm or enough water were not available then the tested Enviro Loo dry sanitation system should be installed and be given preference above the other alternative sanitation systems”* (Barbier, 2006: 267)
- Health Clinic at Ga-Matlala
 - In June 2005, the Minister of Water Affairs and Forestry; and the Minister of Health, celebrated the sanitation clinic programme at Ga-Matlala in the Limpopo Province. The type of sanitation used for this programme is Enviro Loo Composting Latrines for the whole Limpopo. The Minister of Water Affairs and Forestry, at the celebration, reiterated the strategic partnership in the programme comprising of the Department of Education, the Department of Local Government and Housing, the Department of Public Works, SALGA and various other NGOs, for the success of the programme (DWAF, 2005:3).

It is interesting to note that what is integrated sanitation solution for rural areas is not the same to Department of Health and Department of Education, and Department of Water and Forestry in Limpopo. The Department of Health and Department of Education in Limpopo are unanimous with the usage of recommendation of dry sanitation technology, while Municipalities, Department of Water, and Forestry promote and use VIP Latrines.

It is crucial to understand the seriousness of the implications of the choices by Department of Health and Department of Education, and DWAF in regard to the provision of adequate and integrative sustainable sanitation management. There seems to be no clear position concerning on what is sustainable adequate sanitation for rural areas in this case.

Water and Sanitation Objectives

- Improve the living conditions of households by implementing safe and integrative sustainable sanitation facilities;
- Stop contamination of water resources and over time improve the quality of groundwater;
- Reduce current and future capital expenditure on bulk sanitation infrastructure
- Reduce monthly household municipal bills;
- Implement systems whereby organic waste (urine & faeces) can be used for irrigation or composting in agriculture;
- Re-use of household greywater ;
- In terms of the environment, meet the needs of the present generation without compromising the opportunities of future generations; and
- Improve the living conditions of those living with HIV/AIDS, to prevent them from being exposed to other life threatening diseases.

The Challenge that South Africa Faces in regards to water and sanitation

The truth of the matter is that the objectives are far from being met; since there is rampant, pollution because of this attitude is rather unrestricted but widespread concerning sanitation management. The WCR Report in 1993 estimated that **46%** of South Africa's groundwater resources were contaminated above the internationally acceptable level. The major cause of contamination took place through seepage from inadequate sanitation. (WRC Report: 38/1/93). Seepage causes contamination and pollution of underground water resources. Thus, any sanitation technology that deposits faecal waste in the ground directly contributes to seepage to the water resources. Of sanitation technologies that encourage seepage of faecal content into underground water resources and into streams pit latrines (VIPs included). The report by Hodgson and Manus (2006: 14) gives further evidence to this problem. This point will be further analysed in Chapter 2.

Sanitation Problem / Issues

- Lack of proper sanitation of households and educational facilities;
- Valuable water resources are being contaminated due to the lack of proper sanitation facilities;
- Valuable water resources are being wasted by not using recyclable water (Greywater); and
- Contaminated water increases diseases like hepatitis, shingle, dysentery and cholera.

The sanitation problem results chiefly due to sanitation technology utilised and health practises. Hence evaluation of the advantages and disadvantages of both dry sanitation and VIP latrines will shed light during the literature review about these serious implications and will shed light to the reasons why one technology comply with the adequate and integrative sustainable sanitation management compared to the other. Both technologies are in use at Eisleben village.

It is noteworthy to comment that there are studies that focused on both technologies in South Africa and other parts of the world prior to Eisleben village. Thus, where there are gaps due to lack of data, citing of related sources and results relevant to this study will be applicable.

The experiences by the villagers of Eisleben in their use of these sanitation technologies for the sanitation management have prompted interest to conduct a study to evaluate the impact of these technologies concerning the development of adequate and integrative sustainable rural sanitation solution.

The results of this study should serve as a catalyst to:

- conduct further scientific researches to evaluate the impact of existing sanitation management technologies to the environment, health, social and economy to South Africa in general, and rural environments;
- research and investigate into existing sanitation management technologies in order to recommend only those technologies that can provide adequate and integrative sustainable technologies in rural areas;
- to invest in research and development to improve adequate integrative sustainable sanitation management technologies; and
- to review water and sanitation management policies to promote adequate and integrative sustainable sanitation services in South Africa.

The current policies in water and sanitation management in South Africa promote the use of septic tank, ventilated pit latrines, night soil bucket system, waterborne sewage systems, sewage with septic tank, chemical sewage management, and dry sanitation through the recommendations of Department of Water and Forestry.

1.8 Aim and Objectives of the Study

Aim of the Study

The aim of the study is to evaluate the development of rural sanitation at Eisleben Village and determine the adequacy of the sanitation management technologies currently implemented and recommended by the Department of Health and Capricorn District Municipality and Molemole Local Municipality for the Eisleben Community.

Objectives of the Study

The objectives of the study are namely to:

- Investigate and evaluate the patterns and extent of the development of rural sanitation at the Eisleben Village;
- Investigate and evaluate the ablution system at the Eisleben Village; and
- Contribute to the resolution of the problem of rural sanitation at the Eisleben Village.

1.9 Definition of Terminology

For the purpose of this study the definitions provided are core to aims of the study to evaluate the integrated sustainable development of rural sanitation at Eisleben Village and determine the adequacy of the sanitation management technologies currently implemented and recommended by the Department of Health and Capricorn District Municipality and Molemole Local Municipality for the Eisleben Community, in South Africa. Key words that come out of the purpose of the study are as follows:

1. Adequate sanitation
2. Adequate water supply
3. Integrated Sustainable Development

The following definition of terminology adopted from UNICEF shall apply to this study on evaluating the development of rural sanitation at Eisleben Village:

- **Adequate sanitation** - Access to sanitation services that is convenient for all households members (including women and children), affordable and that eliminates contact with human excreta and other wastewater within the home and the wider neighbourhood. **Sanitation** – is a service of collecting, removing, and disposal of human excreta; domestic wastewater effluence, sewerage and effluence resulting from the use of water for commercial purpose. South African Government defines sanitation as *provision and ongoing operation and maintenance of a safe and easily accessible means of disposing of human excreta and wastewater, providing an effective barrier against excreta-related diseases, which is used by all members of a household, and does not have and unacceptable impact on the environment.* ([Government of National Unity National Sanitation Task Team – Draft White Paper for Comment, Republic of South Africa, November 1995](#)) **Sanitation** - measures to promote good health, especially those involving safe disposal of excreta and maintaining a clean environment.
- **Adequate water supply** - Supply of safe water that is safe, sufficient, regular, convenient, and available at an affordable price. **Safe water** - water that is free of contaminants. It often comes from improved water sources.
- **Sustainable Development** - about growth and change that improves standards of living and quality of life. 'Sustainable' development is doing this without causing social or environmental damage, or depleting (reducing) resources.

http://www.unicef.org/voy/wes/explore_1870.html

1.10 Research Questions

The researcher asked the following questions in order to understand the development patterns of the rural sanitation at the Eisleben Village and the impact of the sanitation management technologies implemented:

- Is the Ventilated Improved Pit (VIP) latrine hygienic vis-à-vis the use of boreholes?

- To what extent was the community consulted and participated with regard to the sanitation system of VIP in relation to Enviro Loo or other sanitation systems available in South Africa?
- Does VIP comply with sustainable integrative Millennium Development goals?
- Are the reasons justifiable for providing VIP as an integrative sustainable sanitation for rural environment and in particular Eisleben village?
- What is the outcome of the installed VIP sanitation system to the community of Eisleben?

1.11 Significance of the Study

The study shed light in terms of the empowerment and integrative sustainable patterns of the development of sanitation system, which will benefit Eisleben village. It also helps in further understanding the dynamics of the development of sanitation. In addition, the study established facts and knowledge that pertains to sanitation. Finally, it contributes to the increase of literature in the area of sanitation.

1.12 The structure of this mini-dissertation is as follows:

- **Chapter 1 – General Overview of the Envisaged Study**

This chapter provides an overview of the study. It also includes problem statement, motivation for the study, aims and objectives, definition of concepts and research questions and the significance of the study.

- **Chapter 2 – Literature Review**

Literature Review will evaluate information concerning the study, from the journals, books, papers, news reports, periodicals, internet research, and published articles. The information sources will involve documented or formal views and responses of all stakeholders such as engineers in the fields of water and sanitation, health practitioners, communities, health organisations, World Health Organisations, Non Government Organisations, Health ministries or departments and research experts in various aspects covered in this study.

- **Chapter 3 – Research Methodology**

This chapter explains how the research was conducted, and it covers the following: Research Design, Area of Study, Target Population, Sampling Method, Data Collection Procedures, Methods of Data Analysis, Ethical Considerations and Limitations of the Study.

- **Chapter 4 – Data Analysis and Interpretation**

This chapter analyses the data collected on VIPs through the research methodology conducted at Eisleben village. The data consists of quantitative and qualitative approaches of analysis of collected data, and in addition lessons learned from other case studies on adequate sanitation services provision are used in relation to VIPs and the reviews conducted as a result.

- **Chapter 5 – Conclusion and Recommendations**

This chapter outlines the synopsis in terms of the background of the study, objectives of the study, literature reviews, research methodology, conclusion and recommendations.

1.13 Abbreviations

CPSI - The Centre for Public Service Innovation

DBSA – Development Bank of South Africa

DWAF - Department of Water Affairs and Forestry

EHP - Environmental Health Practitioner

IDP - Integrated Development Plans

ISD - Institutional and Social Development

MDG - Millennium Declaration Goals

MIG - Municipal Infrastructure Grant

NGO - Non-governmental organisation

SADC - Southern African Developing Countries

SMIF- Special Municipal Innovation Grant

VIP - Ventilated Improved Pit toilet

WHO - World Health Organisation

WISA – Water Institute of South Africa

WSSD - World Summit for Sustainable Development

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Adequate sanitation services is not just essential for the dignity, health and well-being of everyone, but it includes access to acceptable toilet conditions and the safe disposal of human waste; practices that support good hygiene; and a healthy living environment and sustainability and livelihood of the households and communities.

The previous chapter introduced the problem that this study investigated, based on the research questions to evaluate the development of rural sanitation at Eisleben Village. There are serious challenges and facts about water and sanitation utility that impact on sanitation management, which have a serious bearing to Eisleben community. Consideration of these facts is essential in order to provide a picture in what the situation is regarding water and sanitation globally, Africa, and South Africa as it relates to developing countries and rural areas. There are no published statistics available in South Africa from the national to the Provincial Departments of Water and Forestry, and the Departments of health about:

- the real status of the quality of water and sanitation (at local level down to the villages in the rural areas);
- how the status of water integrity is compromised by sanitation technologies and the dangers of such compromise to the health of the communities and especially rural areas who do not have adequate health facilities,
- the correlation of unsafe contaminated and polluted water to the health problems experienced by the rural communities in South Africa,
- the health problems that affect rural communities in South Africa and Eisleben in particular.
- the sustainable integrated adequate solutions for water and sanitation that comply with the World Sustainable Solutions for Development and Millennium Development Goals.

Due to the problems cited above sources of information quoted from experts within the field of health and water and sanitation, who conducted researches elsewhere in the world including some areas in South Africa will be used to show what the current preferred solution of providing VIP to rural areas including Eisleben translates into.

This chapter seeks to provide literature review about the following:

- Applying evaluation approach as a methodology to compare and analyse literature and studies relating to the impact of policies, strategies, solutions, technologies, systems, implementation, and the case studies of sanitation management in relation to integrative sustainable rural sanitation management.
- The relevance of adequate and integrative sustainable management of sanitation in rural areas and also its status in the world, Africa and South Africa currently
- To evaluate the gaps of the policies of South African government in relation to water and sanitation that has an impact on rural sanitation management.
- Evaluation of previous case studies relating dry sanitation and ventilated improved pit latrines in South Africa to ensure that all South Africans have access to essential water supply and sanitation services at a cost that is effective and affordable to all the households in the whole country.

2.2 The Relevance of Evaluative Approach to this study

Evaluative approach is relevant to this study since the aim of the study stated very clearly that it deals with evaluating the development of rural sanitation at Eisleben Village and determine the adequacy of the sanitation management technologies currently implemented and recommended by the Department of Health and Capricorn District Municipality and Molemole Local Municipality for the Eisleben Community.

For the purpose of this study a definition of evaluation was quoted from Wikipedia in order to clarify the usage of evaluation approach in context. Evaluation is the *systematic determination of merit, worth, and significance of something or someone. Evaluation often is used to characterize and appraise subjects of interest in a wide range of human enterprises, including the Arts, business, computer science, engineering, foundations and non-profit organisations, government, health care and other human services.* http://en.wikipedia.org/wiki/Evaluation_approaches

Evaluation Approaches

There are various or diverse evaluative approaches, which are all, involve conceptual distinct ways of thinking about, designing and conducting evaluation efforts. Many of the evaluation approaches in use today make truly unique contributions to solving important problems, while others refine existing approaches in some way. http://en.wikipedia.org/wiki/Evaluation_approaches

Classification of Approaches

Despite being diverse in terms of their unique and important underlying principles, House classifies evaluation approaches into ideology and liberal democracy. According to House the bases of all major evaluation approaches is common ideology (which include freedom of choice, the uniqueness of the individual, and empirically inquiry grounded in objectivity) and liberal democracy. What is fundamental about evaluation approaches to House is subjective ethics in which ethical conduct is a subjective or intuitive experience of an individual or group.

Based on these ethical positions are corresponding epistemologies to acquire knowledge capable of external verification (intersubjective agreement) through publicly inspectable methods and data; and based on existing personal knowledge and experiences that are (explicit) or are not (tacit) available for public inspection. House, E. R. (1978). Assumptions underlying evaluation models. *Educational Researcher*. 7(3), 4-12. http://en.wikipedia.org/wiki/Category:Evaluation_methods"

2.3 The Evaluation of the Current Status of Water and Sanitation Utility

The following information in relation to the status of water and sanitation utility is covered below:

- Evaluation of water and sanitation facts and impacts globally and Africa
- Evaluation of Water and sanitation facts and impact in Southern African Developing Countries (SADC) region and South Africa
- Analysis of the assessment of water and sanitation services in SADC
- Assessment of water and sanitation services in South Africa
- Health Risks on Unsafe Drinking Water for Rural Areas in South Africa

2.3.1 Evaluation of Water and sanitation facts and impact Globally and Africa:

The UN committed to halving the deficit of adequate drinking water and sanitation by 2015 in its 2000 Millennium Declaration Goals (MGD). MGD targets increased to include also halving the deficit of people without adequate sanitation by 2015 in 2002 in Johannesburg during the World Summit on Integrative sustainable Development. However, all these targets will depend on the commitment of all stakeholders, especially the developed countries who have vowed to fund or provide grants to enable the struggling countries to deliver on the MGD targets based on the Third World Water Forum in Kyoto in 2003.

The World Bank is one of the many organizations that have identified the provision of Water supply and Sanitation to underdeveloped countries as a high priority.

Perhaps more than any other sector, water supply and sanitation hits on all the main themes of the development agenda (*such as*) poverty alleviation, environmental sustainability, private sector-led growth, participatory development and good governance. Because water is so essential to life, the World Bank Group strives to help its member countries ensure that everyone has access to efficient, responsive and integrative sustainable water and sanitation services. <http://www.worldbank.org/watsan/>

A World Health Organisation report stated that the role of unsatisfactory, inadequate sanitation services must be one of the major causes of ill-health and contamination of environment and water resources, such as boreholes; while there are benefits to health in regard to safe and adequate drinking water and adequate sanitary disposal of human waste. (WHO, 1982: 11; 1993: 21; von Schirnding 1993: 17; and The Mvula Trust, 1995: 13).

Wright (1997: 90) records serious concerns about the far more reaching effect of this situation since *“human and domestic waste from any area has the potential to contaminate not just the local environment, but also groundwater, lakes, and rivers used by many others for supplies of fresh water.”*

Wright (1997: 90) states that the urban poor are the largest group without adequate sanitation services, who constitute more than half the population in many cities of the developing world. There is also a clear indication of the continuous increase in percentage of people without adequate sanitation services, which continue without abating. According to the statistics of 1990, at the end of the International Drinking Water & Sanitation Decade,

- 453 million urban people (or 33% of the urban population in developing countries) had no adequate sanitation services.
- Despite the sanitation improvement to 70 million city dwellers by 1994 in the world, urban population in developing countries without adequate sanitation increased from 1.4 billion to about 1.6 billion or 589 million or 37 percent.

Wright (1997:90)

It cannot be emphasised enough that the provision of water services (which includes water supply and sanitation) is essential in poverty alleviation, nutrition and health development, local economic development, community empowerment and long term household livelihoods. According to the assessments in 1997,

- 3 billion people were without adequate sanitation and produce over one million tons of human faeces each day, 50% of which remain uncollected (WHO, 1997:65).
- WHO-UNICEF global assessments of the sector in 2000 estimated 1.1 billion people without adequate access to potable water supply services and 2.4 billion people with access to adequate sanitation services.
- Estimates in Africa of 300 million people out of 780 million do not have adequate water supply and an unestimated numbers without adequate sanitation services. Hence, there is high incidents of water related infections and diseases, loss of productive time and perpetual poverty.
- Evaluation of adequate sanitation for about world's six billion people, in 2001 reflects that rural communities enjoyed 38% access compared to 86% coverage in urban areas. Despite the 1992 Rio Conference on Environment and Development and its Agenda 21, and the International Conference on Water and the Environment in Dublin in 1992, adequate access to water supply and adequate sanitation services by 2000 did not increase.

2.3.2 Evaluation of Water and sanitation facts and impact in SADC and South Africa

Africa depends largely on funding and grants by external agencies and first world countries to develop and improve on the access of adequate sustainable infrastructure to provide good quality water and viable sanitation services. First world countries offered investments of up to US\$1.5 billion to the sub-Saharan Africa per year over the period from 1990 to 2000, while internal annual investments amounted to about US\$700 million according to WHO-AFRO sector assessment. The breakdown of investments focused at provision of good quality water than sustainable sanitation.

Real results failed to make an impact because of the following factors:

- not fulfilling according to the promise
- the terms and conditions for the grants utility,
- the unsustainable approved programmes for services in water and sanitation,

- inadequate services and delivery contributed to slow economic growth,
- high levels of indebtedness,
- internal and external conflicts,
- weak sector policy and institutional frameworks, which undermined the delivery of sustainable water and sanitation.

Developed countries committed to providing further financial resources to aid towards sustainable development of water and sanitation for the developing countries to meet their millennium goals after the WSSD in Johannesburg in 2002.

However, the promise of aid still need to be realised as nothing is forthcoming from the developed countries to date. The table 1 below reveals the assessment of the status of water and sanitation in African countries in 2000.

Table 1: Access to water and sanitation services in the SADC Region

Country	Water Supply (%)	Sanitation (%)
Angola	38	44
Botswana	No data available	No data available
Democratic Republic of Congo	45	20
Lesotho	91	92
Malawi	57	77
Mauritius	100	99
Mozambique	60	43
Namibia	77	41
Seychelles	No data available	No data available
South Africa	86	86
Swaziland	No data available	No data available
Tanzania	54	90
Zambia	64	78
Zimbabwe	85	68
SADC Total	61	60

(Based on data from WHO-AFRO sector assessment, 2000)

2.3.3 Analysis of the assessment of water and sanitation services in SADC

The challenge is enormous in South Africa and Africa:

- Africa rank the lowest with about 38% of Africa's population without adequate water supply compared to 18% global average by 2001 at zero percent provision of adequate water supply between 1990 and 2000, despite the growth in population.
- 60% of Africans does not have access to adequate sanitation, which explains the reason why about 50% of all Africans suffers at least from at least one of the water related diseases and infections.

Of African population rural versus urban areas (adequate water and sanitation services):

- 47% of rural residents accesses adequate water services in comparison to 85% in urban areas,
- while adequate sanitation is 44% and 85%, respectively

In 2000, the SADC's 61% adequate water supply services.

- Angola and the Democratic Republic of Congo are the lowest, with more than 50% of the people having adequate access to water services,
- South Africa, Mauritius, Namibia and Zimbabwe have over 75% of the population accessing adequate drinking water (DBSA, 2005:8).

With regard to adequate sanitation services, 60% of the people had access:

- the Democratic Republic of Congo is the worst at only 20%, while Mauritius is about to provide complete access to its population.
- Angola, Lesotho, Malawi, Tanzania and Zambia report higher percentage of access to adequate sanitation than water services, unlike the trend in other developing countries (DBSA, 2005:8).

The consequences of lack of quality water and adequate sanitation services:

Michaud et al., (2001:73) observed that the consequences of lack of quality water and adequate sanitation links with poverty and malnutrition and the statistics reveals that:

- about 6 million deaths (11.7% overall) and 220 million DALYs (15.9% overall) to malnutrition related,
- 2.6 million deaths and 93 million DALYs were related to poor water supply, sanitation, and personal hygiene in 1990. These are top risk factor groups for the total global burden of disease.
- developing countries such as those in Africa are severely affected primarily by infectious and parasitic diseases that account to about 30% of the total disease burden due to poor disposal of faeces and urine, unsafe contaminated drinking water that reports high concentration of pathogens of fresh faeces, contaminated soil and food.

2.3.4 Assessment of water and sanitation services in South Africa

In 1994 estimates by the South Africa's first democratic government of people without adequate water supply was about 15 million people, about 22 million without adequate sanitation services. Since then over 10 million people received access to water supply with the aim to eliminate the backlog by 2008 and adequate sanitation services by 2010. While this statistics show progress, there is a need to evaluate the quality of the solutions provided in respect of the integrated sustainable approach, which involves taking health factors in to contribution than simple, by Department of Water and Forestry's progress.

Personal dignity, privacy, health and convenience are foremost to most people with regard to sound sanitation facilities for the enhancement of the quality of life. Whatever sanitation technology adopted should not pose a threat to the health of the people and protection of the environment from contamination.

The integrated approach to sanitation technology options becomes apparent when reviewing sanitation in terms of quality provision and excellent service provision (WRC, 1995: 10; and Barbier, 1987: 14).

The statistics below show issues of serious concern about water and sanitation services and resources.

- 1,5 billion people worldwide and 3,5 million people in South Africa do not have access to safe, potable water
- 2,6 billion people worldwide and 15 million people in South Africa do not have access to proper sanitation
- In Africa, with a population of about 800 million people, 300 million do not have access to water and 313 million do not have access to sanitation
- Only 40 per cent of water available worldwide can be accounted for

Source: Beeld, 22 March 2006

2.4 Health Risks on Unsafe Drinking Water for Rural Areas in South Africa

Access to safe drinking water is a basic human right and an essential component of effective policy for health protection according to World Health Organisation (WHO) Guidelines for Drinking-Water Quality 3 – Preface – Chapter 1 DRAFT – 17 February 2003). South African National Standard (SANS) regulates the state of water to ensure that is safe.

The problem of unsafe poor quality water is not only unique to South Africa but is prevalent to developing countries using non-piped systems water, such as boreholes, tube wells, dug wells and protected springs as sources of water for the rural and low-income urban populations. (WHO and UNICEF, 2000; Howard, Bartram, and Luyima, 1999: 83-93; Ahmed, and Hossain, 1997: 14-19)

The current approach by the Department of Water and Forestry (DWAF) is to provide sanitation technologies to all the population of South Africa; however, it has not looked at impact of pit latrines to biodiversity and environmental, health, and prevention of pollution and contamination of water resources.

In 1995, the South African Government approved the school and clinic rural latrines as good (Mvula Trust, 1995: 16). At the Water and Sanitation 2000 Workshop, it emphasis was on the cost effective sanitation solutions. Sewerage failed the test as it is expensive and would not be unaffordable to majority South Africans. Thus, provision of pit latrines is the kind of strategy that the country should consider, motivation being cost effectiveness.

The motivation to make this decision has nothing to do cost effectiveness since there are other better technologies that are cost effective even better than pit latrines in all their forms. The motivation does not consider the contamination and pollution effects of drinkable water sources and the health effect but on cost effectiveness.

The impact of such consideration of a pit latrine strategy is obviously of grave concern especially with the contamination and the health hazards that already claims lives in South Africa, for instance, about 650 South Africans, most of them children, die through waterborne diseases such as diarrhoea everyday. People are exposed to diseases are transmitted through pathogens from faeces and urine deposited in the pit latrines that contaminate drinking water from the wells and boreholes for villagers (The Mvula Trust, 1995: 13).

Decisions reached on behalf of South Africans in general have nothing to deal with health and cost effectiveness and the general public has limited understanding of the pollution and contamination risks caused by pit latrine (VIP included) and septic tanks, with regard to the extent and consequences of contamination of drinking water, environment and health of the people.

Three top risk factor groups and major threat to health is the rural areas

The three top risk factor groups and major threats to health for the total global burden of disease are:

- **unsafe drinking water,**
- **inadequate sanitation services, and personal hygiene combined, and**

- **poverty and malnutrition** globally.

Despite significant progress made since 1994 in the provision of basic services, including drinking water and sanitation, there is unacceptable high incidence of poor quality unsafe water at point-of-use especially in non-metro South Africa. Reasons for failure of drinking water standards include:

- Inadequate management including monitoring of drinking water services
- Inadequate asset management
- A lack of understanding by WISA regarding the requirements for effective drinking water quality management
- Inadequate WISA institutional capacity (staffing, funding, expertise, education)
- Lack of intervention to address poor drinking water quality when detected.

(Hodgson and Manus, 2006: 14)

To paraphrase what Hodgson and Manus presented is that there is:

- lack of adequate management systems (adequate infrastructure,
- Lack of and inadequate quality control,
- No proper monitoring system exist,
- Ineffective planning and management) and
- No system of independent surveillance to ensure that health quality standards and the safety of drinking water is based on safety targets established by a competent health authority.
- There are inadequate resources to monitor and carry out microbial (bacteriological viral, protozoal or other biological) tests on health-related water-quality in all the rural areas and non-metro areas in South Africa

(Lane, 2004; 2; Howard, Bartram, Schuab, Deere, and Waite, 2001a: 377-393; Bartram, 1999: 353-366; Adriaanse, 1997: 11-16; Ongley, 1998: 37-42)

2.5 Assessment of the Policies influencing Water and Sanitation Utility and their consequences

There are important areas, which the policies relating to water and sanitation in South Africa have addressed which also involve Eisleben village and rural areas, but there are also serious problems, which are in water and sanitation still persist unsolved to date, as already discussed in 2.1 to 2.3. However, the problems seem to continue mounting unchallenged. Amongst problems discussed are the following:

- usage of scarce and diminishing water resources,
- dependence of many rural areas including Eisleben on underground water, which is currently unsafe for drinking purposes (Hodgson and Manus, 2006: 14),
- lack and failure to test the status of water to determine the contamination and pollution levels of water in South Africa, (Hodgson and Manus, 2006: 14)
- health problems caused by contaminated and polluted water, and
- continual deliberate contamination and pollution of water resources by the use of sanitation technologies which do not comply with promotion of health and prevention of diseases and undermines sustainable development.

2.5.1 The areas addressed by the Policy, legal framework and Practice in water and sanitation in Practice in South Africa for rural areas including Eisleben

The new South African government reviewed policies relating to adequate supply of water services and adequate sanitation through the following policies:

- The 1994 Reconstruction and Development Programme (RDP) provided to a short-term goal to provide every household with adequate and safe water supply and sanitation;
- The *White Paper on Water Supply and Sanitation* published in November 1994, an enabling framework to address the gross inequalities in access of adequate water services and adequate sanitation services in rural areas and the role of the new national water department to fulfil RDP goals;
- The new South African constitution adopted in 1996 affirmed the right of all citizens to a healthy living environment, including the provision of affordable and adequate water and sanitation services. The three tier of government from

national, provincial and local levels was charged with the responsibility of delivery of services for adequate water and adequate sanitation as provided for in the constitution;

- The Water Services Act of 1997 introduced the demarcation between regulatory role of water services authorities (WSAs; local government) and regulatory role of the water services providers (WSPs) in the actual provision;
- The National Water Policy of 1997 and the National Water Act of 1998 affirmed the principle of water as a national resource, owned by people but under the custodianship of the state;
- The free Basic Water policy followed in 2000 promotes integrative sustainable access to basic water supply by subsidising the ongoing operation and maintenance costs;
- The Minister of Provincial and Local Government can authorize a local municipality to perform functions assigned to Metropolitan municipality or District Municipality under Municipality Systems Act. Municipality Systems Act 32 of 2000 and Section 10 (1) and 78 of the Municipality Act: authorised Metropolitan municipalities and District Municipalities to provide bylaws (subject to national regulations) to stipulate –
 - the standards, costs and tariffs of the services, payment of tariffs, interest charges and the payment and collection of service debts. The tariffs are to be structured to take the poor households access to basic services into consideration to ensure continued maintenance and operation costs.
 - circumstances under which water services may be limited or discontinued;
 - about control over potable water services, domestic waste water and sewerage systems.
- Minister of Water Affairs and Forestry, Ronnie Kasrils, procured a *White Paper on Basic Household Sanitation* in 2001 to address affordable access to:
 - basic level of sanitation, reveal the impact of poor sanitation of health, articulate government strategies aimed at addressing the backlog;
 - provide a framework for municipality driven implementation programmes;
 - ensure that sanitation improvement programmes are adequately funded; and

- finally put in place mechanisms to monitor the implementation of the policy and sanitation (DWAF 2001: 3, 4);
- The 2003 Strategic Framework on Water Services and Sanitation should comply with:
 - Millennium Development Goals (MDGs);
 - the Second World Water Forum at the Hague (2000) and the Water Supply and Sanitation Collaborative Council (WSSCCO);
 - NEPAD - International Conference on Freshwater in Bonn (December 2001);
 - Water and Sanitation Hygiene (WASH) campaign launched in December 2001;
 - the South African Chapter in March 2002 (DWAF, 2002: 1); and
 - an ongoing service provision by local government rather than addressing the backlog and community and household initiatives supported by external agencies;
- The target date of March 2010 was set for clearing sanitation backlog and access to basic level of sanitation in conjunction with the completion of phase 3 of the Integrated Rural Development Strategy (ISRDS) of the State President's Office (DWAF, 2002: 5; and Narayan 1993: 51, President Mbeki – Parliamentary Speech 11 February 2005).

Our social sector programme for the coming year will include the intensification of the programmes we identified last year, to meet our long-term objectives such as the provision of clean running water to all households by 2008, decent and safe sanitation by 2010 and electricity for all by 2012. (President Thabo Mbeki – 11 February 2005)

2.6 The Implications of water and sanitation Policies in respect of Eisleben Village

Capricorn District Municipality is responsible for the sanitation services of Eisleben village

The steward of providing water according to the appointment by Provincial Local Government policy to Eisleben village is Capricorn District Municipality.

- Molemole Local Municipality:
 - does not have powers in this regard as it does not have the capability like that of Polokwane Municipality, which conducts its own affairs outside the ambit of Capricorn District Municipality.
 - is simply an office of Capricorn District Municipality. The consequence is that decision taken about service delivery in particular water and sanitation under Molemole Municipality areas is sanctioned by Capricorn District Municipality.
 - does not own and allocate the budget for services and the type of sanitation solutions, but Capricorn District Municipality does.

Capricorn District municipality should comply with the Protocol to manage the Potential of Ground Water Contamination from Onsite Rural Sanitation

- Quality standards exist internationally as a benchmark for water and sanitation on the best practises in compliance with:
 - MDGs, the delivery framework;
 - the Groundwater Protocol;
 - the National Water Act (Act 36 of 1998);
 - the National Environmental Management Act (Act 107 of 1998);
 - the Environmental Conservation Act (Act 73 of 1989) in relation to integrated integrative sustainable sanitation and water services in order to promote safe environment and promote better health for all South Africans. ((DWAF) and the Department of Health, 2004: 4; & UNDP, 1986: 22). and
 - the Department of Health

- Communities should be involved in the continual assessments, monitoring and evaluation, and maintenance with regard health impacts related to contamination of the groundwater resources, vulnerability of the groundwater resources and the possible sources of contamination to contribute towards continuous maintenance, and development of solutions (DWAF 2004: 2; Muller, 1989:30; Slocum, 1998:3).

It is also clear that Capricorn District Municipality should engage the communities about sanitation choices rather than simply provide, since the communities are supposed to utilise the sanitation at the end. Failure to engage the communities undermines the people:

- whose dignity is crucial in terms of the kind of sanitation is provided;
 - whose votes are important to vote for a party that will deliver in accordance to their needs;
 - whose money should ultimately pay for the rates and services; and
 - whose lives will be affected whether positively or negatively.
- Provide communities with quality safe drinkable water and sustainable integrative sanitation solution.

2.7 Understanding Millennium Development Goals in regard to Water and Sanitation

The only influence on the selection of integrative sustainable solution should be compliance to Millennium Development Goals (MDGs) to achieve integrative sustainable development. In September 2000, 150 countries of the world declared and adopted the MDGs, in Sandton Convention Centre - Johannesburg during the World Summit for Sustainable Development (WSSD) to attain a better and safer world for the twenty-first century. The MDGs aim relating to sanitation set the target to ensure that the deficit of sanitation services all over the world is reduced by half in 2015. The adequate sanitation services and technology should comply with MDGS to be appropriate. Thus, sanitation technology should comply with the spirit of every

MDGs as a consequence. To this end, the German Helmholtz Association (HGF) introduced the “integrative concept of sustainable development” that can be used to evaluate every kind of technology’s compliance to integrative sustainable development.

The HGF introduced the integrative concept that emanates from three constitutive elements: intra – and intergenerational justice, global perspective and anthropogenic view that qualifies dry sanitation with the MDGs best than other technological options that use the ecological, economic and social pillars as frame for sustainability. The MDGs identified during the WSSD have a serious bearing to creating an environment that promotes a better and safer world and improvement of the living conditions of people in extreme poverty without the exploitation of the environment. Below is a table summary of the MGDs.

Table 4: Millennium Development Goals (MDGs)

GOAL 1 Eradicate extreme poverty and hunger	GOAL 2 Achieve universal primary education	GOAL 3 Promote gender equality and empower women
GOAL 4 Reduce child mortality	GOAL 5 Improve maternal health	GOAL 6 Combat HIV/AIDS, malaria and other diseases
GOAL 7 Ensure environmental sustainability		
<ul style="list-style-type: none"> ▪ Integrate the principles of integrative sustainable development into country policies and programmes; reverse loss of environmental resources; ▪ Reduce by half the proportion of people without integrative sustainable access to safe drinking water and basic sanitation; and ▪ Achieve significant improvement in the lives of at least 100 million slum dwellers by 2020. 		
GOAL 8 Global Partnership for Development		

2.8 Analysis of Table 4 - The MGD 7

Analysis focuses only on MGD 7, which relates to environmental sustainability. MDG 7 emphasizes the provision of adequate sanitation to people in a manner that ensures environmental sustainability and integrative sustainable use of natural resources such as supplying safe drinking water, combating diseases, poverty and hunger or environmental damage.

2.9 The integrative concept of integrative sustainable development

The core ideas of the basis for the operative approach to integrative sustainable development are provided in the Brundtland Report of the UN Commission on Environment and Development from 1987 and the Rio documents from 1992 (e.g., Agenda 21 and the Rio Declaration). The HGF started exploring and applying the concept of “integrative concept of integrative sustainable development” from 1997-2002.

This became a move away from existing approaches used so far are the “classical pillars” of integrative sustainable development (economy, ecology, social aspects). The integrative concept is derived from three constitutive elements of integrative sustainable development: intra- and intergenerational justice, global perspective and anthropogenic view. Edith Brown-Weiss (1989) commented that “planetary-trust theorie” promotes that “Every generation is authorised to use the natural, social, economic and cultural heritage of the preceding generation. At the same time the present generation is duty bound to hold this heritage in trust for future generations.” Following the “planetary-trust theorie,” the following three general sustainability goals from the pre-defined constitutive elements to allow an integrated view of all dimensions are derived:

- Securing human existence;
- Maintaining society’s productive potential; and
- Preserving society’s options for development and action.

Table 2: General sustainability goals and substantial sustainability rules

<i>1 Securing human existence</i>	<i>2 Maintaining society's productive potential</i>	<i>3 Preserving society's options for development and action</i>
1.1 Protection of human health.	2.1 Integrative sustainable use of renewable resources	3.1 Equal access of all people to information, education and occupation
1.2 Ensuring the satisfaction of basic needs (nutrition, housing, medical care etc.).	2.2 Integrative sustainable use of non-renewable resources	3.2 Participation in societal decision-making processes
1.3 Autonomous subsistence based on income from own work.	2.3 Integrative sustainable use of the environment as a sink for waste and emissions	3.3 Conservation of cultural heritage and cultural Diversity
1.4 Just distribution of chances for using natural resources.	2.4 Avoiding technical risks with potentially catastrophic impacts	3.4 Conservation of the cultural function of nature,
1.5 Reduction of extreme income or wealth Inequalities	2.5 Integrative sustainable development of man-made, human and knowledge capital.	3.5 Conservation of "social resources"

The integrative sustainable development was each unpacked into five integrative sustainable rules or action-guiding principles or minimum requirements from which the role of sanitation technologies options could be considered. Table 2 given outlined the general sustainability goals and substantial sustainability rules. In applying the "integrative sustainable concept" of the HGF, the MDGs become prerequisites integrative sustainable development within the multitude of requirements. For instance, the MDG No.7's aim of integrative sustainable development to ensure environmental sustainability corresponds to the substantial rules 2.1 – 2.5, 3.2 defined within the HGF – concept.

2.10 The role of sanitation within a integrative sustainable development

In terms of MDG, "clean" drinking water is a crucial prerequisite to achieve and is realized by practice of adequate hygiene and sanitation and a integrative sustainable development in general. This implies that any sanitation technology has to cover the integrative sustainable use of resources.

Following the HGF concept, the use of natural resources is in accordance with the general sustainability goal No. 2 of the HGF-concept [5, 6]:

- The loss of non-renewable resources (coal, mineral oil, fertile soils) should be kept to a minimum and the benefit resulting from the use of these resources should be assured for future generations by developing new technologies based on renewable resources. This concerns particularly fundamental needs for life that are irreplaceable;
- The use of renewable resources (water) should not rise above the potential to regenerate and additionally a basic contingent has to be reserved for the needs of nature;
- Feeding with anthropogenic materials should not rise above absorption capacity of ecosystems; and
- The use of a natural resource in one region must not affect the possibility to use the resource in another region (in the case of water: upstream downstream problem) (Zimbelmann, 2006: 24).

With regard to the unpacking of the use of natural resources through the HGF concept, it therefore becomes apparent that sanitation technologies should do the following:

- be adapted to the economic resources and the human capital;
- not promote contamination of drinking water resources with anthropogenic materials, but minimize the production of wastewater to minimize the wastewater treatment costs;
- promote the careful use of natural resources to maximize the quality of life and environmental sustainability;
- be integrated into material flow cycles so that disadvantages of conventional systems (e.g., the loss of nutrients, excessive feeding of ecosystems with anthropogenic matter) can be reversed and also avoided; and
- retrieve resources, e.g., by urine separation (phosphorus retrieval) or compost generation (humus retrieval), ammonium sulphate used as agricultural fertilizers, and also conversion of human waste, including all other carbon rich organic waste to produce electricity.

Following the above-mentioned “integrative integrative sustainable development concept” and MDGs with regard to the use of natural resources, sanitation technologies such as sewerage systems, Ventilated Pit Latrines, Sceptic Tanks promoted by DWAF, all do not comply with integrative sustainable development and, therefore, should not even be recommended.

2.11 VIPs do not comply with MGD Goals

VIPs and all pit latrines are “*drop and store*” technologies that contaminate and pollute water resources such as underground, rivers and lakes through seepage of faecal waste. According to research done by Werner, Fall, Schlick and Mang (2004: 8), “drop and store” technologies operate based on the assumption and the premises that the environment would assimilate excreta into the subsoil as possible and retain the solids, and the premise that excreta are waste suitable for disposal. However, “*these liquids contain all soluble elements of excreta as well as the viruses and pathogens*” that contaminate ground water and all water resources accessible. (Werner, Fall, Schlick, and Mang, 2004: 24)

One other problem of pit latrines, VIP and USD is that they eventually fill up as the environment is unable to assimilate the excreta and the alternative may be to empty the pits or dig another pit if space is available and if environmental conditions are suitable. (The VIPs toilets have one pit while the UDS system has double pits - separating urine from faeces.)

<http://www.buanews.gov.za/view.php?ID=06022811151001&coll=buanew06>. The ventilated improved pit latrine remains one of the most cost-effective ways of providing sanitation to rural areas. The way it works is simple: waste drops into the pit, where organic material decomposes and liquids seep into the surrounding soil. http://www.southafrica.info/ess_info/sa_glance/sustainable/sanitation_090503.htm

- The culture and the practise apply the later rather than emptying the pits, which is an unpleasant job and that the conventional suction technology is expensive to provide services to poor communities who cannot even afford to pay rates and levies by cash strapped municipalities.
- Even if the excreta would be emptied many developing countries including South Africa do not have suitable technology to treat the excreta.
- It is also expensive to dig a new pit and build a new superstructure each time the pit is very expensive.
- Many of these conventional pit latrines (VIP included) smell and are a breeding place for flies and other insects and inconvenience for children, girls and women as they are built at a distance from the house.
- Lesotho is already experiencing problems with pits that are full and this proves to be unsustainable. South Africa has also started to experience its share of the problem. (Lane, 2004: 6; Mutagamba, 2003: 8; Werner, Fall, Schlick, and Mang, 2004: 25,26)

According to Mutagamba pit latrines are not suitable and viable alternatives in environments:

- of high density, population space becomes a problem for each family to dig pits continuously to replace those that fill up,
- with a high water table since most of faecal matter easily finds its way into the water resources,
- with sandy soil conditions where the pits easily caves in,
- with hard, rocky soil conditions where you cannot easily dig.
- with arid and semi-arid conditions

(Mutagamba, 2003: 8; Werner, Fall, Schlick, and Mang, 2004: 25, 26)

Most of South Africa fits this condition including Molemole municipality areas and Eisleben village in particular. Eisleben village has hard, rocky soil conditions where you cannot easily dig. It has also increasing population density. High level of nitrates and faecal coliform bacteria for example is several times greater than the maximum level recommended by WHO for drinking water in many densely populated areas such as Winterveldt (referred to as “no man’s land”) area, Northwest Province. In 1991, the water from 34 wells and 25 boreholes in Klippan tested for faecal coliform bacteria by the then Bophutatswan Department of WATER Affairs’s Pollution Control Inspectorate. The quality of water was unfit for human ingestion. The densities are as high as 40 dwellings/ha on some plots. (A Faith-Based Response to HIV in Southern Africa: Choose to Care Initiative - by *Claudia Carthaus* from <http://www.globalhealth.org/reports/text.php3?id=268>).

Palmer attributed the poor quality of underground water and surface water to the use of pit latrines, in close proximity to wells and boreholes; the high water table and soil conditions which cause seepage and overflow from pit latrines into boreholes and wells.

<http://www.population.org.za/Winterveld%20Survey/WinterveldSurveyBackground.htm>

Nitrates are linked to high mortality rate contribution to babies by WHO. The most common source of high nitrate levels in water (besides the normal naturally levels in water) occurs in the soil due improper disposal of human and animal wastes (contains nitrogen-containing compounds which converts to nitrates in the soil).

Nitrates are extremely soluble in water and can move easily through soil into the drinking water supply. High levels can build up over time as nitrate accumulates in the water, but even at elevated levels, they are not likely to be a health hazard for most adults ...Identifying the source of nitrates for an individual well is often very difficult. Because nitrates move with the flow of groundwater, the source may be located a considerable distance from the well. In many cases, the time needed for nitrate to pass through the soil into groundwater is difficult to predict due to

many variables including application rate, the soil type, and the depth to the water table.

Nitrate in groundwater is of concern not only because of its toxic potential, but also because it may indicate contamination of the groundwater. If the source of contamination is animal waste or effluent from septic tanks, bacteria, viruses, and protozoa may also be present. Contamination of groundwater by fertilizers may also indicate the presence of other agricultural chemicals such as pesticides. The source of the nitrate may be a clue as to which other contaminants may be present. (Nugent, Kamrin, (Institute for Environmental Toxicology), Wolfson, D'Itri, (Institute of Water Research) Michigan State University Extension Revision Dec. 1993 Ext. Bulletin WQ – 19 <http://www.gem.msu.edu/pubs/msue/wq19p1.html>)

2.12 Contribution of dry sanitation to the MDGs and Integrative Sustainable Development

Pacey, Lachapelle, and Scott define dry sanitation as the disposal of human waste/excreta without the use of water as a carrier/medium for transportation. The final product is used as fertilizer (Pacey, 1978:45; Lachapelle, 1995:61; and Scott, 2002:34).

The introduction of dry sanitation also called ecological sanitation (technology that is ecologically sound and is designed to use human waste and turns it into commodity without polluting the Environment), has achieved greater acceptance to the communities (when given a choice of technologies), since it satisfy the social requirements best given the water, geological and cost constraints. A further factor, in its acceptance, has been the long-term support provided by the programme to ensure the cycle is completed before households are left to their own devices. (Holden, 2001: 3)

Esrey, after serious evaluation of dry sanitation technology advantages, commented that it was one approach to safe, and integrative sustainable sanitation is the use of dry sanitation toilets (Esrey et al., 1998:22). Dry sanitation with reuse is promoted as an appropriate technology for community settings without sewerage or plentiful water. It has been heralded as solving many of the problems encountered with other sanitation systems. Reviews in the literature have reported on the variety of technologies adopted around the world according to local conditions (del Porto & Steinfeld, 1999:29; and Esrey *et al.*, 1998:22).

Dry sanitation incorporating human waste reuse is a valid alternative to water-borne sanitation (Stockholm International Water Institute, 1999:37). Such an option has an intuitive appeal as it satisfies both objectives of human health and environmental protection, but also utility of waste for agricultural purpose after treatment to ensure that the fertiliser is pathogens-free. There is, however, substantial controversy in the sector about the technology.

Initially, dry sanitation was preferred in developed countries to be utilised in remote areas for practical and environmental reasons. Dry sanitation has become an alternative to conventional systems due to the increasing awareness of environmental sustainability. Dry sanitation is:

- a low cost sanitation technology option that is environmentally friendly and acceptable and an adequate hygiene option;
- a simple energy-saving technology that can principally be implemented regardless of one's wealth;
- flexible enough to be adjusted to individual design expectations. Decentralised on-site treatment is possible just as collection for centralised treatment.

There are two types of dry sanitation that are existent in the world, and these are, namely, dehydrating toilets and Composting toilets.

- Dehydrating toilets, which are divided into urine diversion and non-urine diversion:

- Urine Diversion: The urine is diverted away and the faeces are collected in a chamber or in two alternately used chambers. A hydrophilic, stench controlling or a PH-affecting material is added after each use (e.g. soil, ash, lime, sawdust). Upon filling up, the chamber is to promote anaerobic microbial digestion. The most familiar example is the Vietnamese double vault toilet (Pacey, 1978:66). The Vietnamese uses the Gopuri systems Ventilation pipes to remove odours.

The Council for Scientific and Industrial Research (CSIR) in South Africa saw urine diversion as a possible solution to many problems to avoid problems of ground water contamination and smell of VIP toilets (Holden, 1999:31). Urine diversion sanitation works well if properly implemented (Austin & van Vuuren, 1999; and Austin, 2000:81).

The single vault toilet like Ecosan has a vent pipe and uses ambient heat that dries the waste immediately upon disposal within a short space of time. The Society for Urban Development in East Africa (SUDEA) developed Ecosan. Ecosan diverts urine and faeces into different special containers (Terrefe & Edström, 1999a:11). The urine is collected in a special container and then directly used to water the crops as a fertiliser, while faeces is sprinkled with ashes, soil, leaves, grass or sawdust to develop manure. (Terrefe & Edström, 1999b:9).

- Non-Urine Diversion: An example of this kind of sanitation technology is Enviro loo. The Enviro Loo is a waterless dehydration / evaporation toilet system that provides a nonpolluting, environmentally friendly, cost-effective and low maintenance solution to the sanitation crisis. It offers a standard of respectability and convenience, comparable to a waterborne system, yet without the prohibitive costs and obvious strain on precious water resources. (Barbier, 2006: 263)

Various sizes for Enviro Loo commencing from family to public such as schools and clinic are available according to specifications. It uses one single chamber into which both urine and excreta are deposited. It also uses ambient heat to dehydrate all the moisture of both excreta and urine with immediate effect upon disposal. Enviro loo technology is an advanced technology compared to Ecosan in that you achieve similar results without diverting urine and the difference is the speed in which the moisture is dehydrated. (Barbier, 2006: 263)

The Enviro Loo is a sealed, zero-discharge unit that is driven by radiant heat and wind power. The human solid waste entering the tank is quickly separated from the urine, which is evaporated to atmosphere. The solids, by a process of dehydration and aerobic bacterial action, dramatically reduce in volume which results in the removal of an odour and pathogen free compost-like material, every two to three years, depending on number of users. The system was developed in South Africa where it has been operating since 1994 with over 18,000 installations worldwide.

The World Intellectual Property Organisation Award (Swiss based) awarded Enviro Loo first prize for a significant contribution to African innovation in the field of Health Care in 1997. (Barbier, 2006: 263)

- Composting toilets: the faeces are also stored in a chamber or in two alternately used chambers. Other organic matter such as organic waste from the household, bark-mulch, straw or others is added to the excreta. The breaking down of faeces depends on adequate temperature, airflow and moisture, and activity of different organisms, e.g., bacteria and fungi, to break down, while urine drains away or collected separately. The Indian Gopuri double-chamber dry toilet system is an example of anaerobic dry sanitation (del Porto & Steinfeld, 1999:67). Composting toilet systems are cost-effective and resource efficient when correctly operated. (del Porto & Steinfeld, 1999:26; and Esrey *et al.*, 1998:43).

2.13 Advantages of Dry Sanitation

Dry Sanitation provides the following advantages that are compliant to “integrative integrative sustainable development concept” without comparison with other sanitation technological options such as sewerage, VIPs, septic tanks promoted by DWAF and yet so cost effective. Dry Sanitation systems are beneficial as follows:

- Provide a clear environmental, social and public health advantages;
- Promote recycling of human excreta, back to the soil as fertilizer after pathogen reduction. Pathogen reduction can occur by either dehydration or biodegradation (Jenkins, 1999:73);
- Non-usage of water for sewerage infrastructure to little usage of water for hygiene purposes for their operation (Eiswirth, 2000:82);
- Replace the pit latrine including VIPs and have two advantages:
 - they do not pollute the environment, and
 - biosolid waste is sanitized.

These systems have the potential to improve public health by reducing illnesses caused by faecal-oral transmission of pathogens (Harper et al., 1999:65); and

- Reduce and destroy pathogenic microorganisms through biodegradation, desiccation, or a combination of the two (Brandl, 2003:122). Aerobic biodegradation achieves high temperatures, which destroys many pathogens that desiccation cannot (Federal Ministry for Economic cooperation, 2006:25).

Table 3 - Possible Effects of Dry Sanitation

POSSIBLE EFFECTS OF DRY SANITATION			
	INDIRECT	DIRECT	INDIRECT
General sustainability goals (HGF-concept)			
	<i>Securing human existence</i>	<i>Maintaining society's productive potential</i>	<i>Preserving society's options for development and action</i>
Positive	<ul style="list-style-type: none"> ▪ Reduced risk of water borne or water induced diseases by not contaminating surface and underground water with pathogens from anthropogenic matter. ▪ Destroy pathogens through ambient heat from enclosed chambers. ▪ Implementation is almost independent from income of users. ▪ Support of autonomous households. ▪ Improvement of nutrition. 	<ul style="list-style-type: none"> ▪ No contamination of ground and surface water with faeces. ▪ Does not use water nor sewerage infrastructure. ▪ Minimal amount of water just for hygiene purposes of the state of the toilet facilities. ▪ No unpleasant smells or odours. ▪ No flies. ▪ Recycling of bio-waste and dung to energy – fuel for cars, gas for cooking and electricity. ▪ Humus accumulation is possible soil fertilization. ▪ Retrieval of (phosphorus, ammonium sulphate) resources is possible for agricultural fertilizer. 	<ul style="list-style-type: none"> ▪ Reduction of rural exodus and therefore conservation of cultural diversity. ▪ Contribution to social health.
Negative	<ul style="list-style-type: none"> ▪ Income is possibly crucial for service and maintenance inequalities. 	<ul style="list-style-type: none"> ▪ Harmful residuals in faeces and lack of knowledge may impair quality of natural resources. 	<ul style="list-style-type: none"> ▪ Change of cultural habits is possibly required. ▪ Function of systems might be dependent of willingness of people to change attitudes or to overcome traditions possible effects of dry sanitation.

The above given figure shows the positive and negative aspects of dry sanitation technology option with regard to all MDGs and the general sustainability goals of the HGF concept.

Countries with limited water resources, developing countries and developed environmental conscious countries and cost conscious, can use dry sanitation technology to comply with MDGs and HGF's "concept for integrative sustainable technology".

Table 4 - Comparison between VIP and Enviro loo

	Ventilated Pit Latrine	Dry Sanitation		Dry Sanitation
Features:	VIP	Urine-diverting toilet		ENVIRO LOO
		Outdoors	Indoors	
▪ Smell?	Yes	No, if well Managed	No, if installed Correctly	No
▪ Flies and maggots?	When it fills up	No, if well Managed	No, if installed Correctly	No
▪ Control and security?	No	No	Yes	Yes
▪ Easy and safe to clean and maintain	Yes Emptying of pit Renewing of pit	No, since Outdoors Maintenance Collection of urine and faeces	Yes, if properly built Collection of urine and faeces	Yes
▪ Hand washing facility?	No	No	Yes	Yes
▪ Hygienic handling of urine & faeces?	Yes, If covered	Yes, but Unpleasant	Yes, if properly Designed	Yes
▪ Affordable to most residents?	Yes	Yes	Yes, an alternative for every pocket	Yes, an alternative for every pocket
▪ Space required indoor?	No	No	Yes	Yes (only for indoors)
▪ Degradation of the environment?	Yes, leak to groundwater and may overflow	No. Greywater treated on site	No. Greywater treated on site	No
▪ Resource saving?	No	Yes	Yes	Yes
▪ Allow for reuse of nutrients?	Yes, if pit is emptied or very shallow	Yes	Yes	Yes
▪ Flexible system?	No, permanent, Structure over pit Outdoors Temporary Shed outdoors	Yes, can be, moved Pre-fabricated chair or pan	Yes, can be moved, Pre-fabricated chair or pan	Yes, can be moved, Pre-fabricated chair or pan
▪ Potential reuse	Manure Plant tree on pit	Urine and dried faeces to garden	Urine and dried faeces to garden	
▪ Management	Household or utility	Household or community org	Household or community org	
▪ Costs	Costs more than Enviro Loo R 200 maintenance per anum	Lowest Capital costs No operation and maintenance costs	Lowest Capital costs No operation and maintenance costs	Lowest Capital costs No operation & maintenance costs
○ Capital				
○ Operation and maintenance				

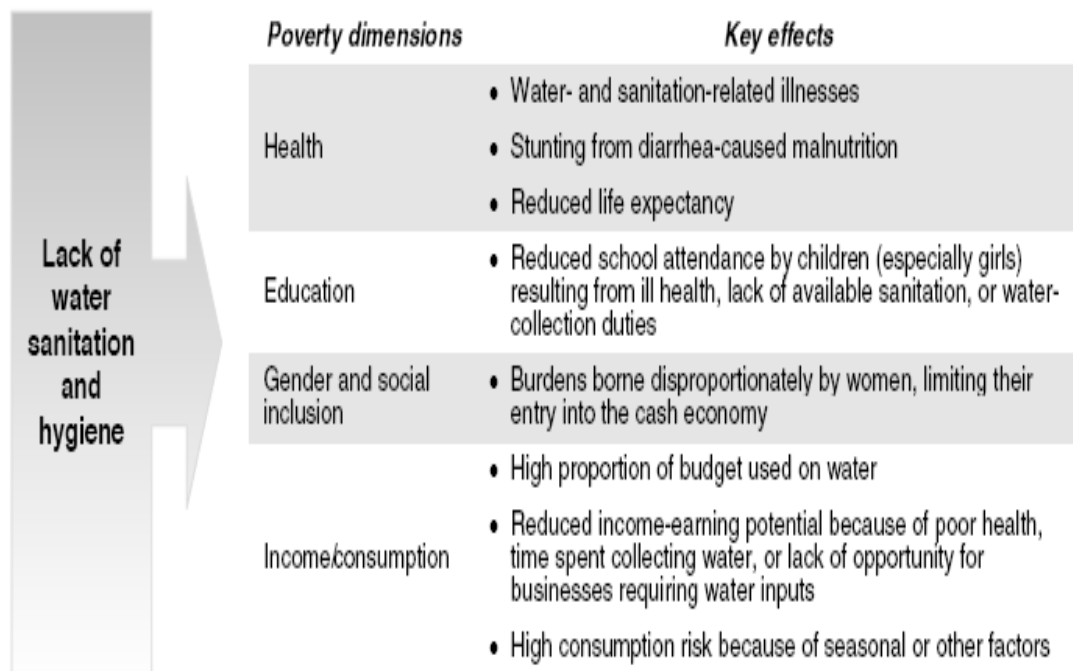
2.14 Linkages between Poverty and Water and Sanitation

There is a link between poverty and water and sanitation.

- The impact of inadequate water and sanitation services falls primarily on the poor.
 - The clear need for basic safe water and adequate sanitation services:
 - for the poor assumes even greater significance when the linkages with other dimensions of poverty are considered;
 - related sickness put severe burdens on health services and keep out of school.
 - limited and lack of convenient or affordable access to the poor people;
 - contributes to a national Poverty Reduction Strategy, and poverty status;
 - differently and varies from region and by rural, town, and urban status, in addition to gender, ethnicity, and depth of poverty;
 - is need for everyone, no matter what their poverty status, however the service levels vary tremendously, even within the broad category of the poor. Some differences in service levels, such as supply pressure, are matters of convenience, but others, such as pathogen loads in drinking water or latrines to isolate faces from human contact, fundamentally affect the health, education, and other attributes that exacerbate or ease poverty.
- Human waste poses a tremendous social cost through pollution of rivers and groundwater.

(Bosch, Hommann, Rubio, Sadoff and Travers, 2000: 373) in http://povlibrary.worldbank.org/files/13887_chap.23.pdf

Figure 1: Linkages between Poverty and Water and Sanitation



Bosch, Hommann, Rubio, Sadoff and Travers (2000: 373)

The above figure is self-demonstrative in showing the linkages between poverty and water and sanitation.

2.15 Lack of water, sanitation and hygiene; and poverty

Poverty:

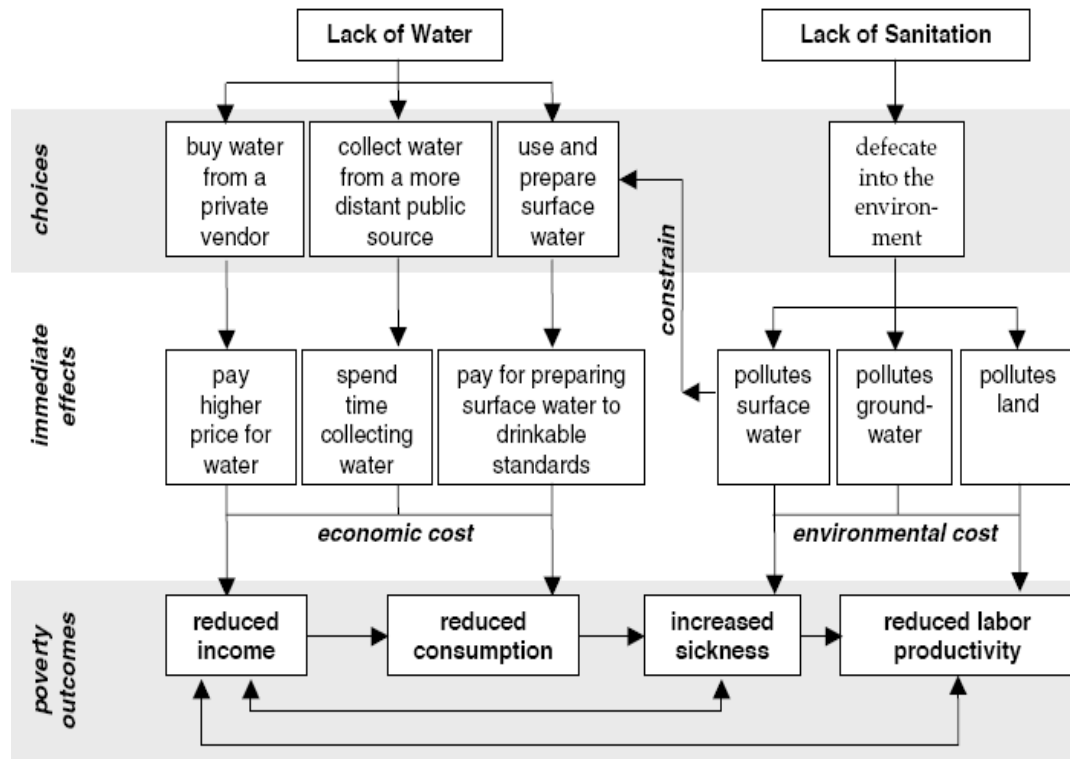
- limits easy and less costly access to safe water resources. Although both poorer and higher income segments of population may face the same polluted resources or inadequate services, higher income households can afford private solutions to these problems – solutions too expensive for the poor population. (Bosch, Hommann, Rubio, Sadoff and Travers, 2000: 373, 374) in http://povlibrary.worldbank.org/files/13887_chap.23.pdf

Lack of, inadequate water services, and poor sanitation services:

- to the poor increase their living costs, lower their income earning potential, damage their well-being, and make life riskier.

- is reflected by continuing, nearly universal deterioration of the surface and underground water sources on which people survive means that water and sanitation pressures will simply become worse in the future. (Bosch, Hommann, Rubio, Sadoff and Travers 2000: 375) in http://povlibrary.worldbank.org/files/13887_chap.23.pdf
- accounts for nearly 30 percent of diarrhoea of the burden of childhood communicable disease, with an estimated 2.2 million child deaths annually and a much larger number of children (and adults) suffering from illness. Repeated bouts of diarrhoea contribute to malnutrition. Water and sanitation – and hygiene- are intimately related to diarrhoeal diseases. The interactions are complex, but adequate quantities of water, even low-quality water, are necessary if people are to adopt the hygienic habits needed to break the disease transmission pathway.
- increases high risk and vulnerability for the poor and exposure to communicable diseases due to use of public sanitation because of lack of private toilets, unlike households who can afford private toilets and adequate water resources.
- slows other health improvements. With regard to sanitation, women often have different privacy requirements than men. When the absence of latrines forces them to use public spaces, they can do so only in the shelter of darkness, during early morning and late evening hours. One response is urine retention, which leads to health problems. From the community perspective, the adequacy of drainage plays a large role in health outcomes. Pit Latrines do not have drainage system. (Bosch, Hommann, Rubio, Sadoff and Travers, 2000: 377) in http://povlibrary.worldbank.org/files/13887_chap.23.pdf

Figure 2. Consumption and income effects



(Bosch, Hommann, Rubio, Sadoff and Travers (2000: 373) in http://povlibrary.worldbank.org/files/13887_chap.23.pdf

2.16 Case Studies on Sanitation Delivery in South Africa

It is very important to evaluate the delivery of adequate sanitation services in South Africa to ensure that lessons can be drawn in terms of the impact of sanitation services in the context of MDGs and HGF concept of integrative sustainable development. These lessons are essential especially to inform, empower and influence the decision making by all stakeholders in sanitation services to avoid any solution, which does not provide long-term and immediate benefits in regard to integrative sustainable development.

Three award winning innovation projects have been chosen from a database that contains 1 000 examples of alternative approaches to service delivery, as well as poverty alleviation from Impumelelo Innovations Award Trust as Case Studies. The database includes nominations as well as approximately 120 award winners from the first five years (1999 - 2004) of the awards programme. Another project was drawn from Invula Trust, which demonstrates sustainability of dry sanitation and re-utility of greywater within an urban environment at Bellevue in Johannesburg.

These projects highlight some important lessons for municipalities in areas where flush toilets are feasible over the short term and not feasible over the short term. Below are some of the highlights concerning case studies as also observed by Centre for Public Service Innovation (CPSI):

- Case studies have been chosen because they cover areas similar also to Eisleben and or worst case scenarios;
- Highlight some key policy issues that arise from these case studies;
- Alternative sanitation technologies have been used that are cost effective in terms of operating and maintenance costs, unlike the sewer system that also causes large-scale pollution from overflowing sewer systems. Amongst other alternative sanitation will be VIPs and dry sanitation to demonstrate their sustainability and compliability to MDGs and HGF's concept of "Integrative Sustainable Development";
- Case studies highlight the importance of working closely with representatives of households who need better sanitation, the importance of educating users about the problems that cause blockages and system failures; and
- The importance of planning ahead so that the long-term requirements for maintenance and sustainability are factored in from the start.

Below are summaries of the Case Studies that will afterwards be evaluated:

- **Mosvold Hospital Sanitation Programme** - a rural community sanitation improvement programme ran as an integral part of a broader primary health programme and facilitated by community health workers attached to the hospital.
- **Northern Cape Household Sanitation Programme** - a provincial programme that brought government departments and municipalities together to build a common vision for integrative sustainable sanitation in the small towns of the province.
- **The eThekweni Water and Sanitation Programme** - providing an integrated water and sanitation 'package' for peri-urban and rural settlements that is affordable and simple to maintain over the long term.
- **Dry Sanitation and the recycling of greywater Programme in Bellevue East, Johannesburg** – to demonstrate that it is possible to utilise the programme and incorporate into an urban home; and still maintain a high standard of living whilst keeping monthly municipal services costs to a minimum.

2.16.1 Case 1 - Mosvold Hospital Sanitation Programme

Mosvold Hospital, based at Ingwavuma in rural KwaZulu-Natal, is a provincial hospital with the capacity of 246-beds faced with alarming societal and health challenges that include poverty-stricken communities, endemic diseases such as malaria and cholera, including HIV Aids. The hospital has over the years conducted and promoted primary health care projects that deal with nutrition, gardening, and sexual and reproductive health care. The hospital has also trained 140 community health workers - 'onompilos' – to support primary health improvement through promoting health and hygiene awareness and early recognition of diseases from the Department of Health's funding (Centre for Public Service Innovation (CPSI), December 2004) (cps@seta.co.za).

The hospital embarked on Inqalabutho Sanitation Programme and received funding from AusAid and assistance from the Mvula Trust in 1996, to encourage communities and subsidise the building of sturdy, hygienic VIP toilets in 13 of Ingwavuma region's 51 districts, with the aim of improving the health of the community through the reduction of water- and sanitation-related diseases. However, the project became integrated with educating communities on construction, proper usage of toilets, organic waste management (constructing garbage pits), safe storage and use of water, and the promotion of healthy methods of food preparation and storage. When the project commenced, a subsidy of R700 was granted but reduced in later phases to R600, based on the emerging sanitation programme funded by DWAF to householders. Householders were responsible for all other costs over the subsidy, digging the pit for toilet based on specifications, collecting water, building materials for toilet construction, and helping the builder with construction. Project funds subsidised essential building materials only such as cement, vent pipes, seats, etc (Centre for Public Service Innovation (CPSI), December 2004) (cpsi@seta.co.za).

Sanitation Project Steering Committees (SPSC), which included local traditional leaders, local councillors from each of the 13 participating settlement, were established to visit registered households and advise them on the layout of toilets, check that the pit dug met specifications, arrange for collection of building materials, supervise builders, check the lab and superstructure, and arrange for payment of builders. The first target of 1 968 toilets was completed by mid-1998, a year ahead of schedule due to strong support on the ground. An additional 720 toilets were completed from additional funding granted by AusAid. Funds shortages delayed the completion of the project until the District Municipality gained the authority and subsidies from its annual budget from the treasury.

Postscript

The successful implementation of the Inqalabutho project served as a benchmark to KwaNyawo, an area of Ingwavuma. African Medical Research Foundation (Amref), an NGO partner of Mosvold, provided the funding to replicate the sanitation project at KwaNyawo. Detailed evaluations of this project in 2002 and 2003 affirmed the value and social impact of the integrated sanitation project. The Amref project evaluation reported one very sobering finding, namely: "*Without a significant improvement in the quality and quantity of water, and the care of people living with HIV/AIDS and HIV prevention, the gains made by the provision of sanitation will not reflect an improved overall health status of the community*" (Tyers and Zondi, 2003:80). The provision of adequate sanitation does not, however, prevent HIV/AIDS related chronic diarrhoea, but it reduces the risk of opportunistic infections that relate to hygiene and also water-related diseases.

Lessons

The project to provide toilets became integrated during its implementation to include creating good hygiene and sanitation awareness and practices; empowering and teaching the households with knowledge and expertise in agricultural, construction, water, social, and health issues beyond the provision of toilets, although it was initially intended to be a health improvement project.

There is also a need to involve and engage parents on how to guide their children with regard to toilet usage and the importance of ensuring that they can live hygienically and healthy. There is a need to consider public-private partnerships so as to ensure that there can be shared objectives and shared and complementing financial resources to avoid projects being stalled, and for the projects to benefit all communities with regard to adequate sanitation services, instead of abrupt ending as it happened with the Mosvold project. The project has managed to alleviate, on a short-term basis, the sanitation challenges facing the communities at Ingwavuma and KwaNyawo, respectively.

However, there are problems that accompany short-term solutions such as VIP sanitation technology since that does not address integrative sustainable development because when the VIP fills up, another digging will be required and so other costs incurred, but there is also seepage waste that will contaminate underground water.

2.16.2 Case 2 - The Northern Cape Household Sanitation Programme

The premier of Northern Cape, Manne Dipico, played a significant role in creating stakeholder partnerships that included DWAF, the Office of the Premier, the Department of Health, municipalities, housing and local government, the District Councils of Diamantveld and Bo Karoo, the Mvula Trust (a major NGO), to address the problems of delivery and improvement of:

- sanitation services,
- health education and
- community development in rural communities through project implementation teams, from crude pit toilets, nothing, and municipal bucket system to more than a third of the population of the Northern Cape Province.

Benchmark was made based on the lessons learnt from the Mosveld project - where the Mvula Trust also played a role. The unique situation with Northern Cape is that it has a rocky environment that is difficult makes it difficult to dig deep enough pits for the purpose of VIP toilets. As such a different option was considered, taking also into consideration protection of underground water from contamination and Ecosan - dry sanitation technology which uses urine diversion chamber and a chamber for faeces was considered.

Participation in this project was opened to all interested individuals and parties to elect a committee to oversee and administrate the projects. The committee members were capacitated with suitable skills and competencies for project administration and finances to ensure that they are able to carry their functions without compromising the projects.

Three consulting firms were, as a result, established to provide valued work to the previously unemployed local community members.

The implementing agents supported the committee and embarked on a campaign to inform the households and communities, including schools, with regard to the project; provide basic health and hygiene knowledge; and build several demonstration toilets for houses and school so as to gain buy in from the end users. DWAF provided a subsidy of R600 per household. Community members were trained as fieldworkers and hygiene promoters. Households and local residents were engaged through interactive methodology such as PHAST (Participatory Hygiene and sanitation), to identify health and sanitation problems in their communities that they could change. The result of the projects caused the Premier, Manne Dipico, to endorse dry sanitation, including urine diversion toilets and thus also became the first to launch bucket eradication programme in South Africa, and the province was well on target to eradicate all buckets by 2006. Through this programme, Farm Dweller Sanitation Pilot project was launched, which provided adequate sanitation for over 3 000 families through the involvement of environmental health practitioners.

Postscript

The Northern Cape continues to drive its provincial programmes using its stakeholders for municipal sanitation programmes, working closely with DWAF and the Department of Housing and Local Government, with regard to the adequate integrative sustainable sanitation services and adequate water services projects that are funded through Municipal Infrastructure Grants.

Through this programme, municipalities have forged appropriate mechanisms that enable them to advise and support each other in the resolution of practical problems including care and maintenance of the toilet technologies and bio-management of organic wastes so as to avoid contamination of the environment

Lessons

This case study demonstrates beyond reasonable doubt that dry sanitation:

- is not just an alternative; and should not be just used as an alternative; but,
- should be used as the primary sanitation technology in South Africa because of its low costs, as compared to ventilated pit latrines (VIPs) and sewerage systems, and because of its reliability in terms of protection of the environment against contamination from urine and excreta, using drinking water responsibly.

The Northern Cape Province has set a benchmark of provision and maintaining adequate integrative sustainable sanitation services and water services for other provinces in South Africa to emulate. It has also taken the lead to set up a strong network of stakeholders who closely cooperate, coordinate, facilitate and build a coherent vision of sanitation programme that complies with MDGs and HGF's "concept of integrative sustainable development". Finally, environmental health practitioners (EHPs) can play a decisive role in strengthening the health and hygiene impacts of a sanitation programme. In fact, EHPs now play a leading role in sanitation improvement in the province's Kgalagadi District Municipality (The Mvula Trust, Case Study Series, 7).

2.16.3 Case 3 - The eThekwini Water and Sanitation Programme

eThekwini is well organized administratively and also continuous innovative with regard to integrated sustainable adequate water services and adequate sanitation services in terms of the programmes that produce - straddling new technologies, user education programmes, project implementation and management systems, and support to emerging contractors. Two examples are highlighted here.

The eThekwini Sewage Education Programme

The challenge that eThekwini experienced with regard to reticulated waterborne sanitation, which equally applies to any type of toilet system, is the good use to avoid systems failures and good hygiene and health practices to combat and prevent diseases.

To deal with this challenge, eThekweni's Sewage Education Programme was introduced, which won an Impumelelo Award. The programme campaigned among the users using street theatre, posters, school visits and community meetings, to build an understanding of how sewer systems work, how to avoid blockages, and keep the system working. eThekweni's approach contributed to a massive cost savings over time, and less time and money fixing blockages and spills.

Affordable water and sanitation in eThekweni's peri-urban and rural settlements

eThekweni has a steep challenge with regard to the provision of adequate sanitation services to all urban settlements, both formal and informal, which, can take years to be achieved if sewer system is pursued due to:

- the practical demands of infrastructure of wastewater treatment;
- connectivity to sewer systems and households;
- reliable and sufficient supplies of water;
- servicing and maintenance capacity;
- billing and administrative systems; and
- secure funding for ongoing operation and maintenance.

The Bester's Camp experience

Due to unaffordable costs for households for ongoing monthly costs of water, treatment and system maintenance, eThekweni embarked on piloting VIP toilets in the 1990s at Bester Camp settlement on the edge of Umlazi Township after extensive consultation with the residents who chose VIPs based on running costs and reliability. VIPs became a cost challenge because they filled up and had to be dislodged by the municipality as there was no more space to dig replacement pits due to:

- growth in settlement density,
- few roads,
- narrow roads,
- paths and stairway,

- full pits could not be accessed by vacuum tankers. This raised complex questions on how to ensure integrative sustainable sanitation in this dense settlement.

One thing became obvious that infrastructure provision is the beginning of integrative sustainable service provision. eThekweni had to abandon the usage of VIPs for alternative technology on its operation and maintenance requirements, not its capital cost.

2.17 Applying the lessons of experience beyond 'the waterborne edge'

eThekweni Unicity's provision of water and sanitation services to the peri-urban and rural settlements had to be reviewed due to the following situations:

- Sanitation technology should be of such a design that it must promote hygienic conditions and also destroy the pathogens that are responsible for contamination, creating a breeding ground for bacteria, parasites and diseases such as cholera;
- Sanitation technology option should not promote waste water that will require costly treatment that households cannot afford to pay ;
- Sanitation technology should be onsite and should be serviceable by the communities without being exposed to the dangers of contamination and infections since pathogens are destroyed and the excreta are dried up. To this end, eThekweni Unicity approved a design that used composting dry sanitation technology, which collect deposited excreta in a shallow bin beneath the pedestal, soil is added to promote dehydration of moisture from excreta. Dried excreta are in a form resembling that of cow manure and are odourless. Users are responsible for removing and burying dry odourless faeces. The introduction of the new technology was preceded by extensive consultation and information sharing with councillors, ward representatives, traditional leaders and residents. Waste removal takes place every nine months and communities are satisfied. Through this solution, the Unicity will be able to meet its 2010 targets;

- Sanitation technology should promote MDGs and HFG's "concept of integrated integrative sustainable development". The decision by all stakeholders involved in sanitation under eThekweni Unicity for a composting dry sanitation technology with urine diversion has enabled compliance with both the MDGs and HFG's concept, and this resulted in:
 - the establishment of Technical Steering Committees,
 - training of educators to teach households on hygiene;
 - how to remove waste and dispose of it;
 - utility of the sanitation technology and maintenance;
 - construction;
 - brick manufacturing; and
 - compliance with quality standards.
- Technical interventions need to be planned and implemented within a broader understanding of the requirements for sustainability;
- Service provision must be informed by a frank assessment of what both households and the municipality can afford. This includes capital costs as well as long-term operation and maintenance costs;
- Provision of basic-level water and sanitation services in a single programme allows for greater project efficiency and social impact;
- Community members should be generally pragmatic and willing to accept innovative technologies and approaches when their needs and aspirations are acknowledged, and when they are given an opportunity to engage in informed discussion around their options. Close interaction between the programme team and local leaders is necessary to build this trust and understanding;
- Ongoing monitoring and evaluation are needed to assess user satisfaction and highlight issues and problems that need to be addressed. This, in turn, leads to further refinements and strengthening of the overall programme;
- Long-term planning is essential to provide a coherent and consistent approach. It also allows an appropriate time frame to build understanding on the grounds of the project's objectives;

- eThekweni has also adopted a strategy to deliver basic water and sanitation as a single package, and not be installed separately. This allows more cost-efficient delivery and ensures that water installations are compatible with on-site sanitation; and
- A comprehensive health and hygiene education programme is able to leverage the benefits of both water and sanitation provision.

Ongoing refinements

The Water and Sanitation Programme has been refined extensively thus:

- All projects are initiated and implemented using standardised procedures: a structured methodology for prioritising projects, an implementation protocol, standardised enquiry documents for geohydrological and institutional and social development (ISD) consultants, standardised education material for user education and health and hygiene, independent auditing of all aspects of delivery and acceptance by households;
- Projects are planned, approved and scheduled far in advance of work on the ground. This allows for comprehensive consultation and preparation long before construction begins, and pre-empts most of the problems that slow delivery costs;
- Costs are minimised through internal project management, and by restricting the use of consultants to specialist geohydrological, ISD and auditing services;
- Bureaucracy is minimised by preparing an overall business plan for the whole water and sanitation programme, with funding applications for specific projects limited to essential project data only; and
- Data collection, and progress and financial reporting are limited to essential data only.

2.18 The Use of Dry Sanitation in an Urban Environment - Urine Diversion in a suburban bathroom 2

The success of dry sanitation solution and the commitment of Premier Manne Dipico in the Northern Cape Water Services Programme, and the initiative of the communities of Namaqualand and Weiler's Farm in Johannesburg, inspired the technical Manager of the Mvula Trust, Richard Hold, to convert the sewerage system in his house, at Bellevue East, Johannesburg, to dry sanitation. He was determined to prove that within a city it is possible to have a high standard of living without the need for municipal sewers and high monthly municipal service costs.

Thus, in January 2001 a Greywater recycling system was installed, followed by the removal of the en-suite flush toilet. It was replaced with a dry sanitation system in February 2001.

2.19 Reuse of Greywater - To demonstrate that a municipal sewer connection is not required

The first stage was to separate the black-water from the grey-water. The outlet pipes from the kitchen and the main bathroom, collecting approximately two thirds of the household consumption, were led to a sump. A simple submersible pump with float control pumps was attached to a normal garden sprayer to irrigate the garden. Spraying the water aerates it as well as distributing it enough to prevent damage to the vegetation from the soaps and fats. Spraying also ensures that the combination of evaporation, transpiration and permeation prevents saturation of the ground.

The result is a green garden without the use of municipal water. The only effort required is the cleaning of the filter every second week, and moving the sprayer around the garden. The water could also be re-cycled through flush toilets for additional water savings. The cost of the installation was approximately R1, 000. This could have been lower, and the whole house could have been put on the recycling system, if the installation was planned when the house was built. Unfortunately, the house was built in 1910, thus precluding this technology.

The cost saving depends on the block tariff that a consumer is paying, but payback should be between one and two years.

2.20 Composting Dry Sanitation

If one is prepared to handle desiccated faeces, then a dry sanitation system offers enormous advantages over waterborne sewage in terms of capital investment, service costs and risk of pollution. To anyone who is prepared to participate in faecal waste management, a dry sanitation system is a viable and attractive alternative. The use of dry sanitation, together with recycling of greywater , removes the need for a municipal sewer connection.

The design of the dry sanitation technology adopted involved the use of a fibreglass mould into which a sand cement mixture is cast; urine diversion piping to lead urine into a container, while a special chamber is provided for the depositing of faeces. After finishing and painting, the toilet looks no different from a ceramic pedestal. The cost, if made by one, is R30. To dehydrate the faeces, a mixture of ash and soil is thrown down the pit to kill off the pathogens and dehydrate the faeces.

Even if it is made commercially, the production is so simple it can be made within a community, thus promoting local economic development. Urine is removed once a week and is poured into the compost heap and around the garden to enrich the compost with nitrates. Dried faeces are removed every six months from the rear of the toilet-a simple 15-minute job. The dried desiccated faeces are mixed with compost heap to ensure destruction of remaining pathogens. The faeces are totally inoffensive and odourless. This system was chosen as it can be built inside the house, and is easy to maintain.

Compost heap ensures destruction of the more hardy pathogens such as worm eggs. The compost (mixed with urine and desiccated faeces) and greywater can be used for crop production with huge benefit. Poor people can use the compost if they are not offended traditionally. Dry sanitation and recycling of greywater can produce a capital savings of R 5, 000 with a reduction in monthly service costs of R100 per month if included for new residential construction since there are costs for sewer system, water, treatment and maintenance. Although some of the capital cost is offset by the need for the pump, the cost saving is still in the order of R4, 000. This can benefit many households in both upmarket housing and RDP housing.

2.21 Conclusion

The decision by a household on whether to install wet or dry sanitation depends on a number of factors. These are the following:

- 1) Whether the household is prepared to be involved in the maintenance of the system;
- 2) If the system involves outside maintenance, whether they can and are prepared to pay for this;
- 3) Whether there is the institutional capacity to support the chosen system; and
- 4) If water is required, whether or not there is a sufficient supply.

The literature study has demonstrated the seriousness with which the South African government, after 1994, has approached, through its policies, its commitment to integrative sustainable adequate water services and integrative sustainable adequate sanitation services towards better life for all and in compliance with MDGs and HFG's "concept of integrated integrative sustainable development".

Literature study has also exposed the limitations of VIP with regard to the South African water and sanitation policies, MDGs and HFG's "concept of integrated integrative sustainable development"; and the various alternatives of dry sanitation and its relevance to South African government policies for water and sanitation services, MDGs and HFG's "concept of integrated integrative sustainable development".

Case Studies demonstrated that VIP is not an option that should be considered as it does not comply with MDGs and HFG's "concept of integrated integrative sustainable development". Dry sanitation, on the other hand, demonstrated to comply with all environments (urban, peri-urban and rural) and comply with MDGs and HFG's "concept of integrated integrative sustainable development".

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides information on the research methodology used in the study or an evaluation of the patterns of the development, appropriateness and effectiveness of VIPs at the Eisleben village in the Limpopo Province. The research methodology engaged in the quantitative and qualitative approach of collection of data.

The quantitative approach involved data collection procedure of interviews based on questionnaires from a random sample drawn from the community of Eisleben. The qualitative approach involved data collection procedure based on field surveys from the community of Eisleben, open ended questions directed to the Capricorn District Municipality, the Molemole Municipality, Chief Ramokgopa and the headman of Eisleben community. Other sources of qualitative data used include the Integrated Development Plan of the Capricorn District Municipality, Department of Water Affairs and Forestry and Department of Welfare services.

The research methodology was conducted under strict ethical considerations to ensure that the respondents were treated with confidentiality and their privacy is protected. Appropriate written permission was sought and granted to conduct the research by the Capricorn District Municipality, the Molemole Municipality, and verbal permission from the Chief Ramokgopa and headman of the Eisleben village to ensure that its validity cannot be questioned due to lack of recognition.

3.2 Research Design

In this study, qualitative and quantitative designs were used because the study is more of survey and case study. In terms of the research strategies in the qualitative research, the approach was phenomenological since it aimed to understanding and interpreting the meaning that subjects give to their everyday lives. The information collection strategies of qualitative research included interviews.

3.3 Area of Study

Eisleben village is situated about fifty kilometres north of Polokwane. Eisleben falls under the greater area of Botlokwa ruled by Kgoši Ramokgopa. Molemole Municipality is responsible for service delivery in this village. Illiteracy, unemployment and poverty are rife in this village. The only source of drinking water at Eisleben village is from wells from under ground water sources. See the map attached from the appendix and DWAF Report (from pages 116 to 130). The majority of people in the village cannot afford even basic rural sanitation and as a result, VIP latrines were installed for their use. The qualification to get VIP the households have to fit the criteria of being:

- unemployed;
- poor;
- a recipient of social welfare grants; and
- being old.

Households that afford are left to organise for themselves pit latrines of their own choice.

3.4 Target Population

The study targeted only all recipients of the VIP latrines at the Eisleben village for study. This includes officials of the Molemole Municipality in key strategic positions, and key stakeholders such as, namely, the headman, the Project Steering Committee and the civic formed part of the population.

3.5 Evaluative Approaches Considered for this study

The researcher applied the consumer-oriented and connoisseur evaluative approaches outlined in table below. The table summarizes each approach in terms of four attributes—organizer, purpose, strengths, and weaknesses. The organizer represents the main considerations or cues practitioners use to organize a study. The purpose represents the desired outcome for a study at a very general level.

Strengths and weaknesses represent other attributes that were considered in deciding upon the approach used for this particular study. The following narrative highlights differences between approaches grouped together.

<i>Summary of approaches for conducting evaluations</i>				
<i>Approach</i>	<i>Attribute</i>			
	<i>Organizer</i>	<i>Purpose</i>	<i>Key strengths</i>	<i>Key weaknesses</i>
Consumer-oriented	Generalized needs & values, effects	Judge the relative merits of alternative goods & services.	Independent appraisal to protect practitioners & consumers from shoddy products & services. High public credibility.	Might not help practitioners do a better job. Requires credible & competent evaluators.
Connoisseur	Critical guideposts	Critically describe, appraise, & illuminate an object.	Exploits highly developed expertise on subject of interest. Can inspire others to more insightful efforts.	Dependent on small number of experts, making evaluation susceptible to subjectivity, bias, and corruption.

Note. Adapted and condensed primarily from House (1978) and Stufflebeam & Webster (1980).

3.6 Evaluation methods and techniques

Evaluation methods and techniques applied in this study were methodologically diverse and included both qualitative methods and quantitative methods, including case studies, structured interviews, assessments, survey research, statistical analysis, sampling, environmental scanning and policy analysis, and cost benefit analysis.

3.6.1 Assessment

Assessment is the process of gathering and analysing specific information as part of an evaluation. In this study, the researcher applied assessment technique in regard to gathering and analysing data relating to previous cases where VIPs and dry sanitation technologies were used.

3.6.2 Data Collection Procedures

The goal of the data collection was to produce a formal document of the process followed to engage all stakeholders, the actual research and the results of the research conducted from all stakeholders involved with Eisleben community. Useful published and well researched data was not available in relation to sanitation related health problems affecting the villagers, scientific evaluation of the impact of VIPs to the health, water resources, environment and sustainable development of the communities from Department of Water and Forestry, Department of Health and Department of Environment in Limpopo and Nationally. Data that was collected includes,

- permission was sought from the Capricorn District Municipality (Annexure A).
- The Capricorn District Municipality gave permission for the study (Annexure B). In addition, permission was verbally sought from Molemole Municipality and the Eisleben village headman, and it was granted. All these authorities were consulted in the process of gaining access to the community of Eisleben. This also maximised co-operation and mutual understanding.
- There was no data available from Department of Water and Forestry relating to the safety of drinking water and ground water from faecal contamination and pollution, since tests are not conducted to monitor the state of drinking water at Eisleben village.
- There was no data available from Department of Health relating to the health problems and diseases linked with drinking of contaminated and polluted water from the clinic at Eisleben village. There is no data relating to also the infant mortality rate at Eisleben as a result of drinking contaminated water.
- There is no data available even from the Department of Statistics in the National government about the type of diseases affecting the villagers at Eisleben which are related to drinking of contaminated water.

3.6.3 Scenario Analyses

The latter source comprises a detailed examination of the envisaged activities. Scenario analysis was used in this study because it defines, principally, the inputs and outputs of the application's functions of the VIP and Dry Sanitation and their impact to Eisleben community. Scenario analysis is thus a deeper examination of the relationships among objects in the function of and the impact of sanitation management to Eisleben community.

3.6.4 Interviews

Interviews were conducted in order to target stakeholders such as the municipality, the tribal authority and the Project Steering Committee. Interviews covered issues on rural sanitation delivery at the Eisleben village. Interviews lasted for about two hours per respondent.

3.6.5 Questionnaires

Questionnaires were administered to respondents currently using VIP latrines to complete them in a group or on individual capacity. Each respondent was motivated to complete his/her own questionnaire or their questionnaire without discussing with each other or one another member of the group. Since the questionnaires are in English, those who are illiterate or do not understand English were assisted by the researcher and three trained assistants to complete their questionnaires according to the indications of those particular individuals in the group.

3.6.6 Literature Search

A literature search focussed on documents, general reports, published papers and books that produced findings and elaborated on VIP, pit latrines and dry sanitation of Ecosan and Eviro Loo. This enables the researcher to make the best use of previous work in the field of water and sanitation and the impacts to be expected for Eisleben village under investigation, and hence to learn from the experiences, findings and mistakes of those who have previously carried out similar or related

work. The literature search provided invaluable insight into the study and Eisleben programme of sanitation during the early phase of the study.

The second area examined through a literature search included specific studies in the area of interest, including past evaluations. This involved compiling and summarizing previous research findings. This information served as input into various components of the evaluation study of a rural sanitation solution at Eisleben village.

3.6.7 Data Collective Methods

There are several ways used to collect data. The methods used to collect data for this study at Eisleben village involved the following:

- *quantitative* and *qualitative* data. **Quantitative data** are numerical observations. **Qualitative data** are observations related to categories;
- *objective* data - observations based on *facts* in relation to VIP and Enviro Loo at Eisleben village which is both qualitatively or quantitatively measured; and
- Finally, the researcher used both **primary and secondary data** approach to collect data. The researcher trained the assistant researchers how to interview, observe, collect and record the data and practise confidentiality and integrity in their conduct with the respondents and data collected. The researcher collected data whilst supervising the assistant researchers in data collection.

3.6.8 Observations

The researcher used field observation by visiting the sites where VIPs and Enviro Loo were installed to also gather evidence of the status of how both these technologies were and experienced using them. The researcher randomly selected sites which were observed. This observation gave insight to the responses that the villagers provided during the interviews, rather than accepting responses from villagers without physical verification.

The observation method also permitted the researcher to understand VIP and Enviro Loo technologies better; create a complete picture of these technologies; and how the technologies function. This direct observation permitted the researcher to move beyond the selective perceptions gained through interviews. The researcher was also able to gain information that might otherwise be unavailable.

3.6.9 Surveys

The researcher used primarily surveys to collect the primary data – both quantitative and qualitative from villagers of Eisleben village. The researcher drew up random sample to select a portion of the target population of Eisleben, so that each member of the population had an equal chance of being selected. A list of the research population, namely those who received VIP latrines were identified with the assistance of the Eisleben village headman.

Numbers were assigned to every person in the population. The size of the population was determined, and based on the size of the population the number of digits was used from the random table. The size of the population was two thousand. All names that fell on even numbers were selected to form a sample. The desired size of the sample of hundred (100) respondents was achieved by marking every even number from the selected column.

The researcher identified precisely the information to address the evaluation of sanitation solution for rural areas in particular to Eisleben village, developed the questionnaires for the survey and conducted a pre-test on the assistant researcher in order to:

- Ensure clarity of the questions
- Test the response rate
- Measure the time and length
- Survey the interview method

The researcher and the assistants used a personal interview approach based on standard format questionnaires

3.6.10 Case Studies

The researcher used case studies in combination with the survey, literature review and observation method for ensuring that the study should be supported by facts and in-depth investigation by experts of how the VIPs and Enviro Loo / or dry sanitation solutions (e.g. Ecosan) performed and are likely to perform in regard to adequate sustainable integrated sanitation.

The researcher examined a number of specific cases or projects, through which the researcher hoped to reveal information about the previous experiences in regard to the application of VIP and Enviro Loos in South Africa. The cases selected for this study, were selected because of their relevance and how they impacted the various populations and the society in relation to sustainable adequate water and sanitation. In fact, case studies were used for the following purposes:

- to explore the manifold consequences of a program;
- to add sensitivity to the context in which the program actions are taken;
- to identify relevant “intervening variables”; and
- to estimate program consequences over the long term

3.7 Findings

- Lack of total quality management and controls on rural sanitation management hence systems and technologies that are used are not evaluated accordingly to determine their compliance to integrative sustainable development.
- There are no scientific researches conducted to validate and justify the policy by the government that promotes usage of VIPs as a sustainable sanitation management technology for rural development.
- There are also no scientific reports reflecting the justification of implementing VIPs at Eisleben or any rural environment by Department of Water and Forestry and its relevance to the policies that promotes health and sustainable development.

- There is also no scientific reports that justify the implementation of VIPs at any part of South Africa and its relevance to biodiversity and prevention of pollution and contamination of the environment.
- There is lack of integrative sustainable development approach in respect of sanitation management and environment management with reference to the implementation of VIPs anywhere in South Africa and notwithstanding rural areas.
- There is lack of integrative sustainable development approach in respect of sanitation management and health management with reference to the implementation of VIPs anywhere in South Africa and notwithstanding rural areas.
- There are no researches conducted to study the correlation and also evaluate the extent of pollution, contamination and health impacts in relation to the rural sanitation management solutions in Eisleben village and other rural environment that use VIP and Dry Sanitation.
- There are also no proper published records by Department of health in relation to the impact of sanitation related diseases affecting communities in rural areas including Eisleben village in order to challenge the sanitation technologies and systems that contaminate and pollute the environment as already demonstrated in the literature study in relation to VIP and Dry Sanitation.

3.8 Limitations of the study

The study is limited to the evaluation of rural sanitation management. The study could not cover the correlation of sanitation management and disease prevention due to lack of statistics from the Department of Health in relation to the general data of health problems affecting people in Eisleben village, notwithstanding people in a greater Molemole Local Municipality under which Eisleben village resides. As such the impact of the sanitation management in Eisleben village people's health could not be determined due to lack of scientific data.

The study did not cover the reports on the tests on the impact of the contamination and pollution of water resources at Eisleben village as DWAF could not provide, since the tests are expensive. Thus, it was difficult to test scientifically and to determine the implications of the sanitation management systems implemented to the health of the Eisleben villagers.

The study did not cover the reports relating to unsafe drinking water related diseases from Department of Health in relation to Eisleben village since data was not available.

3.9 Ethical Considerations

All respondents were treated with confidentiality and respect, to ensure that their privacy was not violated, their anonymity was protected and were not victimised physically or emotionally during the process of the study. Informed consent was secured from the respondents to ensure willing participation. Thus, all possible or adequate information on the goal of the investigation, the procedures that were followed during investigation, the possible advantages, disadvantages and dangers to which respondents may be exposed were disclosed to the potential respondents or participants.

Unethical tactics such as intimidation, deception, incorrect information or withholding important information in order to secure participation from the respondents were not used.

3.10 Applications of the Study

The present study focuses on the evaluation of the VIP ablution system with regard to rural sanitation at the Eisleben village. The findings are, however, not limited to the Eisleben village, but they do impact on some places in the Limpopo Province with regard to integrated integrative sustainable development in the provision of adequate sanitation services, not only in rural areas but also urban areas.

3.11 Conclusion

While the study focussed specifically on the Eisleben village, the research methodology applied is, however, not limited to this study area but rather is of such a nature that it can universalise the findings to apply on a broader scale to all areas in South Africa and other developing countries with similar challenges as Eisleben. In this study, questionnaires, surveys and fieldwork were used to understand the impact of VIP to the rural Eisleben village and increase knowledge on and exposure to the sanitation technologies that are suitable to drought environment with limited water resources.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

In this study, all data was systematically collected from organised interviews, and completed questionnaires from Chief Ramokgopa, headman of Eisleben, and from the sample of 100 household respondents of the population of Eisleben. The data from the questionnaires constitute quantitative information, which is essential to determine the existing attitude based on the background of all the respondents in the sample, their knowledge about VIP, their experience about VIP, and their influence in the choice of VIP as an adequate sanitation technology.

Qualitative data was collected and analysed from:

- the field reports and observations
- the field visits to the sites where VIPs were constructed
- amongst the households in the sample already using VIP
- observing the status and the kinds of the services the households of Eisleben received from VIPs;
- the case studies of similar studies conducted of:
 - Mosvold Hospital Sanitation Programme,
 - Northern Cape Household Sanitation Programme,
 - the eThekweni Water and Sanitation Programme and Dry Sanitation, and
 - the recycling of greywater Programme in Bellevue East, Johannesburg; and from the surveys conducted from the Capricorn District Municipality and the Molemole Municipality, which are both responsible for the provision of adequate sanitation for the community of Eisleben village.

4.2 Demographic Characteristics

Under this topic, ages, gender, employment status and income are analysed

Tables 1: Gender

N = 100

Gender	N	%
Male	23	23
Female	77	77
Total	100	100

The data in Table 1 indicate that male respondents from Eisleben Village that were interviewed were 23, forming 23% and the female respondents interviewed from Eisleben village 77, forming 77%. The municipality's criteria for beneficiaries granted VIPs was for people:

- who cannot afford to build themselves a toilet,
- who were unemployed,
- who received social grants, and
- who were pensioners.

The age of respondents, however, was found to be all in the category above 55 years old. The income of respondents is less than R 50 000.00 per annum, since these RDP toilets for poor people, low income, if any, was important to qualify for the VIP.

4.3 Quantitative Analysis

The researcher analysed the survey questionnaire data from interviews conducted with:

- the kgoši Ramokgopa,
- the headman of Eisleben, and
- the households constituting the sample identified from the target population of Eisleben village to establish:
 - their knowledge, experience, effectiveness of the VIP toilets in providing integrative sustainable adequate sanitation,
 - the involvement of the households in the choice of VIPs and if the villagers

would want an alternative sanitation technology besides VIPs.

4.3.1 Statistical findings

The age bracket of respondents interviewed from Eisleben village who qualified for VIPs were between 55 and 64, but also had to be unemployed, qualify for social service grant and poor.

a. Involvement of the Chief in the Sanitation services and implementation process	YES	93	93%
	NO	0	0%
	NONE	7	7%

Out of 100 respondents interviewed from Eisleben village 93% believed that kgoši or traditional leader was consulted and involved in the VIP project, while 7% is doubtful about the involvement of kgoši.

b. Involvement of the headman in the sanitation services and implementation process.	YES	97	97%
	NO	0	0%
	NONE	3	3%

Ninety seven percent of the respondents interviewed from Eisleben community believe that the headman was consulted and is involved in the VIP sanitation development. Only 3% is not sure of the involvement of the headman.

c. Are the VIP toilets a health hazard?	YES	11	11%
	NO	89	89%
	NONE	0	0%

In terms of the VIP, as to whether they are a health hazard, 11% is of the idea that they are a health hazard. On the contrary, 89% of respondents interviewed from Eisleben village find the VIP to be posing no health hazard at all.

d. Are VIP toilets your choice?	YES	86	86%
	NO	14	14%
	NONE	0	0%

In response to the question as to whether or not the VIP toilets were the respondents' choice, the understanding of 86% of the respondents interviewed from Eisleben community is that the VIP is their choice. In response to the same question, 14% of the respondents interviewed from Eisleben community have a different view that the VIP is not its choice.

e. Do you need alternative sanitation toilets besides VIPs?	YES	34	34%
	NO	66	66%
	NONE	0	0%

An inquiry was made as to whether an alternative to VIP should be made or not. 34% (Thirty four percent) of the respondents interviewed from Eisleben community holds the view that an alternative should be sought. In response to the same question, 66% of the respondents interviewed from Eisleben community feel that there is no need to look into alternative toilets.

4.4 Qualitative Analysis

Interviews were conducted at the Capricorn District Municipality, the Molemole Municipality and different structures of the community, particularly at the Eisleben Village. Observation or field trips were also taken to check the sanitation facilities, their state and how they are constructed. Lessons from other case studies of previous sanitation programmes conducted in other places in South Africa also contributed in terms of the quantitative analysis approach.

The primary quantitative analysis of the data focuses on the questionnaires, surveys, field trips and reference was made on other case studies conducted in South Africa in response to integrative sustainable adequate sanitation. Below is the analysis of data:

a. Biographical Data of the Respondents interviewed from Eisleben Village

The underlying factor of all the respondents who are recipients of VIPs is that they are illiterate, old, poor heads of their households, which consists of their children who are unemployed and also grandchildren, some have orphans remaining and they earn social grants pension. These data show that these are vulnerable people who are subject to manipulation in terms of choices for sanitation solutions and who cannot afford medical costs to access better health treatment. Hence, Eisleben has a clinic that is poorly resourced and it always refers severe cases to Botlokwa Health Centre. To get to this Health Centre costs about R300 per trip if it is at night, while there is a severe challenge in terms of public transport during the day. This means that whatever sanitation technology that is provided to these people should not add to their miseries, which is not so in regard to VIPs.

b. The Quality of Sanitation Delivery by VIPs

Aspects covering the development of rural sanitation development are covered and analysed including parts of the questionnaires that were not covered in the quantitative analysis.

The Project Steering Committee in the village feels that the size of the VIP structure is small and it inconveniences the positioning of the door. The inside of the door is outside and unacceptable. Despite this disadvantage the local leadership in the village sincerely believe that VIP is good based on the information they received from the municipality. This belief is prompted by lack of information.

c. Consultation of Participants

Concerning participation, the municipality, the chief, and the headman feel that the participants were well consulted. The Project Steering Committee feels contrary to that due to insufficient and sometimes non-existent participation, consultation and feedback. The committee feels that the chief, headman, committee and participants

are sometimes ignored by the municipality to achieve certain goals and it speeds up the projects for political reasons.

The households and/or the community do(es) not actually own the sanitation services as they are not fairly engaged in matters that affect their quality of life. Thus, the project fails to address matters of integrative sustainable development.

d. Contamination of underground Water by the use of VIPs

With regard to the underground contamination of water with the use of VIP toilets, the municipality maintains that they build the wall around the pit and cement the pit floor to prevent any seepage.

The claim that VIP toilets prevent seepage still needs to be validated. There is no studies that has demonstrated the validity of this kind of claim. However, contrary situations have been established as demonstrated in literature review in chapter two.

In fact, there is an overwhelming evidence from research and studies including that of eThekweni Unicity study that VIP is not an option to be considered for integrative sustainable adequate sanitation because it contribute to health hazards. VIP is not an option that supports Local Economic Development approach and the compliance to MDGs in terms of integrative sustainable development.

e. VIP Low Cost Sanitation technology

The Municipality, the Chief, Headman, Project Steering Committee and the respondents all agree that the VIP is for the poor who cannot afford to build themselves a toilet. The unemployed and predominantly the elderly do qualify for the VIP toilets.

However, that VIP is low cost that is challengeable since it retains the sludge which produces unpleasant smell of decomposing faeces mixed with urine, and which also breeds worms and dangerous parasites unsafe for hygiene and health overtime; and to remove this sludge is a costly exercise.

VIP is not only costly but also poses a serious health hazard to the households. Hence, 11 % of the people who have experienced VIP confirm that it is a health hazard, unlike the 89% who had not had an experience of using VIP at the time the study was conducted. The only safer way to remove the sludge from the pit requires sludging technology that sucks the waste. This technology is not only expensive to acquire but also costly to maintain.

Hence, there are increasing numbers of VIPs that are already becoming full by days, and those that are full are not serviced since the municipality cannot afford the costs and the households cannot afford to pay. If the approach of emptying the pit takes place, it will not be different from the accelerated bucket system. Otherwise, if VIP is full, records show that you can't get another replacement. Indeed it is low cost in construction but in the long run it becomes unpleasant burden to the house users since it is not emptied, and if emptied it would be costly. VIP is an undetermined huge cost in terms of the contamination of the environment and the potential health hazards to be borne the households and the taxpayers in regard to the health, hygiene, treatment of contaminated water and the high mortality rate of children.

f. Slow Delivery of sanitation services

Slow delivery ablation is the results of a number of things. The municipality feels that the procedure of digging a pit hole by the recipient sometimes delays the process. The financial systems and the protocol which involves the municipality and the consultant also delay the project. The municipality also finds procurement of building material to be causing delays sometimes. The Project Steering Committee finds that sometimes the project is delayed by natural conditions like when it rains.

g. Waterborne Sanitation is not an Option to Rural Eisleben

All stakeholders, the municipality, the chief, the headman, the Project Steering Committee and participants agree that waterborne sanitation is unthinkable at Eisleben Village. The Village is struggling to find mere water to drink.

h. The Quality of Enviro Loo Composting Latrines Longevity

Regarding Enviro Loo Composting Latrines, the municipality, the chief, the headman, the Steering Committee, the schools, the clinics and some villagers who use the schools and clinics' sanitation facilities, agree that it has stood the test of time and prove integrative sustainable in the long term. The municipality maintains that in the Capricorn District Municipality, the Department of Education and the Department of Health in the Limpopo Province, in conjunction with the Department of Public Works, agreed to provide Enviro Loo Latrines to schools and clinics, particularly when they build schools and clinics.

i. Sceptic Tanks Used in Conjunction to Flush Water Toilets

In the Molemole Local Municipality, the LED is involved. All projects financed by the LED have toilets. These are projects that include gardening, Botlokwa SMME, bakery, dressmaking and welding. Septic Tanks are used where flush water toilets are used.

j. Educating the Communities in regard to sanitation and hygiene

One can raise awareness of health issues and sensitise the community with regard to rural sanitation issues. The municipality says it established Awareness Campaigns that are trained by either the Capricorn District Municipality or the local clinic. Awareness Campaign is part of the Project Steering Committee. However, the study conducted at Eisleben reflects lack of information and knowledge about the overall integrative sustainable integrated approach to health in compliance to the MDGs.

k. VIPs and Enviro loos regarded best Solution for Sanitation

Not all stakeholders agree that the VIPs are the best solution to the rural sanitation problem as already reflected in the quantitative research data. However, Enviro Loo toilets have not disappointed the users as a solution for sanitation at the Eisleben Village.

4.5 Conclusion

In this chapter, I dealt with data analysis and interpretation. In the study, a random sample of hundred respondents participated in the research. However, the number of female participants exceeded that of their male counterpart. On the one hand, a table of attitude was dealt with in a quantitative analysis. On the other hand, qualitative analysis concerned itself with the interviews conducted at the Capricorn District Municipality, the Molemole Municipality and the Eisleben Village.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Sanitation is a worldwide problem that needs urgent attention. The present study, however, focuses on the challenge of rural sanitation, especially at the Eisleben Village in the Limpopo Province. Shortage of water to drink makes it even unthinkable about waterborne sanitation at the village in question. Poverty and sanitation challenges necessitate the present study.

This study investigated the patterns and extents of the development of rural sanitation. The study also analysed the ablution system at the Eisleben village, and finally, the solution of the problem of rural sanitation at the Eisleben village.

The demand for adequate water services and adequate sanitation services remains a sore point to South Africa. Municipalities who are now the principals of provision of these services have a daunting task and need to carefully identify solutions that should comply with MDGs and HFG – concept of integrated integrative sustainable development rather than short-term and un-integrative sustainable solutions that in the long run be a burden, costly and have the potential to contaminate the environment. There have been many developments in the water and sanitation sector since the case studies described in this study. It is therefore important that further researches be conducted to apply the scientific tests for water and health related problems from drinking water at Eisleben village to determine the status and reliability of water from faecal contamination and pollution of underground water. Further research should be done to determine the kind of diseases at Eisleben, in particular from cases that receive services from the clinic to establish if they are related to drinking water. Review of VIP programmes need to be reviewed because there is a lot of evidence to prove that it does not comply to Millennium Development Goals.

In Chapter one, the introduction of the study was made. Problem statement introduced pertains to rural sanitation particularly at Eisleben village. The motivation of the study was the involvement with sanitation developers, reports such as the Mvula Trust Review of Rural Sanitation, and the presence of Enviro Loo system and its recommendation by the Department of Education in the Limpopo Province. Aims, objectives and definition of concepts were dealt with in this chapter.

Literature review formed chapter two. This was the synopsis of different viewpoints on rural sanitation and integrative sustainable adequate development of sanitation. Reports by the Department of Water Affairs and Forestry and Non-Governmental Organizations were reviewed. Rural sanitation review was analysed. The relevance of sanitation to MDGs and HFG-concept of integrative sustainable development was reviewed. Sanitation technology options were studied. Reference was also made of the protocol to manage the potential of ground water contamination from site rural sanitation. Of importance, the study looked into basic household sanitation, the development of sanitation policy, national health and hygiene education strategy, and sanitation programme in Limpopo for schools and clinics. Finally, review of case studies of projects relating to sanitation with reference to how they relate to Eisleben was done.

Chapter three dealt with research methodology for the present study. Qualitative and quantitative research designs were used. The area of study is Eisleben village under Molemole Municipality, which is part of the Capricorn District Municipality in the Limpopo Province. Target population are recipients of VIP latrines and a sample is drawn from the population. Interviews and questionnaires were used for data collection. In this study, ethical considerations were observed.

Chapter four dealt with data analysis and interpretation. A random sample of hundred respondents participated in the study. Demographics characteristics showed that females were more than males. In the quantitative analysis, a table of attitude was analysed. Qualitative analysis concerned itself with interviews conducted at the

Capricorn District Municipality, the Molemole Municipality and different community structures and the Eisleben village. Based on the critical issues raised, the following recommendations are drawn:

5.2 Recommendations

The following recommendations need to be pursued in order to provide adequate sanitation that complies with integrative sustainable development and the MDGs:

5.2.1 Community Driven Development:

Since sanitation straddles several sectors, i.e., housing and settlement development, water services, local economic development, municipal finance, and so on, it is, therefore, important to approach its delivery and maintenance through an integrated and integrative sustainable pragmatic approach and methodology that should involve all stakeholders, coordination, facilitation, project administration, planning, implementation, monitoring and evaluation.

To achieve a pragmatic approach from stakeholders, the strategy should involve mobilisation, information communication and participation; provide or initiate participatory mechanisms for community control and stakeholder involvement. The Eisleben community must have ownership of the project with information, knowledge, control and authority over decisions and resources throughout all phases from project inception.

Addressing service backlogs is an urgent priority. However, the sustainability of those services is critical. Without user acceptance, and user understanding of the vulnerabilities of the toilet systems installed, user maintenance, the benefits of municipal investment in sanitation improvement will be short-lived. The provision of sanitation technological solutions should not be about statistics but quality.

5.2.2 Health, Hygiene and Education for Water and Sanitation

There is an urgent need for the application of the vision at Eisleben: A clean and healthy South Africa free from the burden of disease in relation to water and sanitation. To carry out this vision will require communication strategy, which will utilise various communication mechanisms such as pamphlets, media, communal meetings, workshops and even facilitate programmes that promote environmental management and resources; and also efficient and effective health and hygiene education through schools and also ABET training.

5.2.3 Design and invention of dry sanitation technologies that adopt integrative sustainable development and the MDGs

Since, quality is paramount the challenge for municipalities is to benchmark on the available best technologies and avoid recurring use of technologies such as VIPs which do not empower communities and will continue to involve costs to service and maintain them. A Special Municipal Innovation Fund (SMIF) has been launched to encourage innovation in the municipal sphere. This initiative falls within the Municipal Infrastructure Grant (MIG) programme of the Department of Provincial and Local Government (DPLG), and it is managed and supported by the Centre for Public Service Innovation (CPSI). The CPSI can provide the resources necessary to test ground-breaking initiatives; particularly those that adopt an integrated approach to service delivery, or that promote and encourage local economic development.

Capricorn District Municipality (CDM) should consider dry sanitation such as Enviro Loos and Ecosan or any design that applies the similar methodology to:

- comply with achievement of the MDGs, and
- fulfil a multitude of additional sustainability-criteria that are defined within the HGF-concept for an integrative sustainable development; not only in water scarce regions but also all environments (peri-urban, rural and urban) in its jurisdiction. CDM can also modify dry sanitation technologies to accommodate those who are culturally sensitive to the technology.

However, the implementation of (dry) toilet systems requires mutual agreement. On the one hand people possibly have to change attitudes or to overcome inhibitions.

Finally, it should be noted that urine diversion systems require the co-operation and acceptance of users. They are not culturally acceptable to everyone, particularly where people have had bucket toilets in the past. However, urine diversion system (UDS) toilets offer at least three important benefits. Firstly, the separated faeces dry rapidly and are odourless, and so the toilet can be installed inside the house. This offers greater privacy, convenience and safety. Secondly, UDS toilets can be installed in areas where it is not possible to dig a deep pit because of rock or a high water table. Thirdly, the dried excreta are easy to remove regularly, and so emptying the waste bin is far simpler than desludging a pit.

5.2.4 Review of Sanitation strategy and benchmark against best practices from other studies and programmes already implemented in South Africa

Based on the research conducted, the Capricorn District Municipality should review its approach to sanitation services and also embark on a strategy that will be based on best practices of the provision of sanitation such as Northern Cape Province and eThekweni Unicity models. Northern Cape has environments that are similar to those of the Capricorn District Municipality and specifically those under Molemole and Eisleben. Thus, the case studies should be able to convince the Capricorn District Municipality to also stop the usage of VIPs and also to convince other stakeholders based on the resounding evidence and the commitment to comply with the MDGs.

Cape Town is now planning to pilot of a similar system in areas where a high water table and dense settlement rule out VIP toilets. Significantly, it plans to provide a municipal collection service, so that households do not have to remove and bury their waste themselves.

In view of the multiple benefits and development potential dry sanitation appears to be an adequate technology to meet the requirements for environmental sustainability. In this reference, VIP is excluded based on the evidence of its cost burden in regard to service and that it cannot be easily maintained. VIPs will require disludging equipment and this operation is like an advanced bucket system, which is disgusting.

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ANNEXURES

Annexures A and B

These annexures comprise a copy of the questionnaire that the research participants were subjected to and the interview questions used to conduct interview sessions.

Annexure C

Annexure C is a letter of approval from the Capricorn District Municipality to conduct research on the impact of VIPs at the Eisleben village under the Molemole Municipality. The Capricorn District Municipality is interested in the study and the findings thereof.

Annexure D

This annexure shows a serious picture of concern with regard to the unavailable adequate water services and adequate sanitation services in the areas under Chief Ramokgopa, which includes the Eisleben village as outlined by DWAF Scheme summary reports.

- There is poor access roads;
- access and support services do not exist for the villagers from the municipality;
- there is lack of personnel and the existing personnel is not competent with regard to water and sanitation services;
- electrical failures occurs every month;
- water is not chlorinated at all;
- sometimes diesel fuel for diesel generators / pumps is available;
- there is also vandalism, illegal connections and water leakages.

This is the current state of affairs. With the inclusion of VIPs that are not dislodged currently, the verdict is that they would not be dislodged in the future. Thus, serious hygiene and health threats are in the pipeline.

Annexure D Scheme no. NC2/2A_A_SCH provides a summary report on Batlokwa-Ramokgopa Regional Water Scheme, which issues out the following findings:

- There is no water treatment works, Pump Station, on site Sanitation, Bulk Sewer and Sewage Works;
- The Reservoirs and Reticulation are low refurbishment required on 1;
- Ground water also requires some refurbishment;
- There is also a record of more than 20 days average on reticulation system that does not work;
- Spares are sometimes available, maintenance is done on reactive basis and the quality of maintenance is average;
- There is also a severe shortage of human resources skills in terms of administrative line functions, artisan and support, engineering related support, human resource and support, information technology, management and general support and natural science, to provide effective and sufficient services for water and sanitation; and
- The technologies for borehole water listed on the scheme asset register are very old, dated 1993 and some of the equipment do not even have a date.

Annexure D Scheme no. NC2/2A_B_SCH provides a summary report on Batlokwa - Ramokgopa Regional Water Scheme on the latest technology present and not available, which issues out the following findings:

- There is water treatment works, pump station, on site sanitation, bulk sewer and sewage works;
- There is 50% of house connections only in towns and not rural areas, which are in poor condition and also require refurbishment of reservoirs. Reservoirs experience breakages of the average of 13 per year, reticulation experience breakage on the average of 4 per year and also an average of 20 times in a year in an unworking condition;
- Ground water also requires some refurbishment;

- There is also a record of more than 20 days average on reticulation system that does not work;
- Spares are sometimes available, maintenance is done on reactive basis and the quality of maintenance is average;
- There are also about 11 reservoirs that lack maintenance;
- There is also a severe shortage of human resources skills in regard to administrative line functions, artisan and support, engineering related support, human resource and support, information technology, management and general support and natural science, to provide effective and sufficient services for water and sanitation; and
- The technologies for borehole water listed on the scheme asset register is very old dated 1993 and some of the equipment does not even have a date.

Annexure E

Annexure E provides detail information about alternatives of dry sanitation and pit latrines and VIPs. From this detailed data, the various technologies of dry sanitation listed have been proven effective internationally and are always under continuous improvement to increase their efficiency and effectiveness. However, the pit latrines and the VIPs cannot be regarded as the technologies that comply with MDGs and fails to promote the policies of water and sanitation that are promoted by the South African government.

Annexure F

Under Annexure F is a detailed report on the priority table of water and sanitation under the Capricorn District Municipality, including the Molemole Municipality. The report from this table demonstrates that the Molemole Municipality is the least serviced municipality concerning water and sanitation services. It is estimated that 75% of the rural settlements in the Molemole Municipality is without adequate sanitation services and of that, only 25% has proper sanitation and only three towns use waterborne and the rest of the villages use the infamous pit latrines and VIPs. 75% is the highest percentage under the Capricorn District Municipality.

Eisleben is amongst those who are being serviced by the VIPs that do not provide adequate sanitation services.

Annexure G

Annexure G provides a detailed report of the amounts of investment for VIPs (or accelerated bucket system) that will ultimately become a problem with regard to dislodging the pits from the sludge. This amount could be spent in providing other available suitable integrated adequate integrative sustainable dry sanitation technologies, which will not require dislodging and are cost effective.

Annexure H

The annexure is a copy of the editor's letter of confirmation that a final copy of this research thesis has been professionally edited.

Annexures A: Sanitation Delivery Questionnaire at Eisleben Village

Instructions: Please put a (√) mark in the appropriate box.

There is no correct or incorrect answer.

1. Name _____

2. Gender
Male
Female

3. State your age:
Less than 25 years
25 – 35 years
36 – 44 years
45 – 54 years
55 – 64 years

4. Indicate your employment status
Formally employed
Unemployed
Employed (Self)

5. What income do you receive per annum?
Less than R 50 000.00
R 50 000.00 – R 70 000.00
R 80 000.00 – R 99 000.00
R 100 000.00 – R 119 000.00
Over R 120 000.00

6. How would you rate the quality of VIP sanitation delivery?

Very Good	<input type="checkbox"/>
Good	<input type="checkbox"/>
Not Sure	<input type="checkbox"/>
Poor	<input type="checkbox"/>
Unacceptable	<input type="checkbox"/>

7. How would you rate your involvement and participation with regard to VIP sanitation planning and implementation?

Very Good	<input type="checkbox"/>
Good	<input type="checkbox"/>
Not Sure	<input type="checkbox"/>
Poor	<input type="checkbox"/>
Unacceptable	<input type="checkbox"/>

8. Is the chief involved in the sanitation services and implementation process?

Yes	<input type="checkbox"/>
No	<input type="checkbox"/>

9. Is the headman involved in the sanitation services and implementation process?

Yes	<input type="checkbox"/>
No	<input type="checkbox"/>

10. Do you need alternative sanitation toilets besides VIPs?

Yes	<input type="checkbox"/>
No	<input type="checkbox"/>

11. How would you rate the VIP toilets delivered?

Very Good	<input type="checkbox"/>
Good	<input type="checkbox"/>
Not Sure	<input type="checkbox"/>
Poor	<input type="checkbox"/>
Unacceptable	<input type="checkbox"/>

If poor, what is the problem? _____

12. The toilets are health hazard.

Yes

No

Motivate your answer _____

13. Are the toilets your choice?

Yes

No

14. Must an alternative be sought?

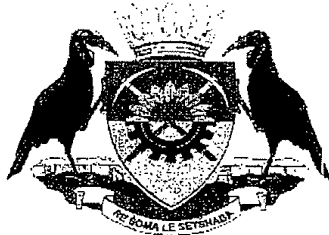
Yes

No

Annexure B: Interview Questions

1. Is the VIP hygienic vis-à-vis the use of borehole?
2. To what extent was the community consulted and participated about VIP and alternative dry sanitation technologies?
3. What patterns were used for the development of rural sanitation at Eisleben village?
4. Why is there a slow delivery of VIP ablution?
5. To what extent is waterborne sanitation out in rural areas?
6. Can the Enviro Loo Composting Latrines stand the test of time and improve integrative sustainable in the long term?
7. Why is Enviro Loo rural sanitation services only available for schools and Clinics in Limpopo Province, particularly in the Capricorn Municipality?
8. To what extent is the Limpopo Local Economic Development Programme involved in rural sanitation development, particularly in the Molemole Local Municipality LED unit?
9. How can awareness of health issues and sensitive hygiene and sanitation issues be raised with the community?
10. How can one contribute to the resolution of the problem of rural sanitation at the Eisleben village?

**Annexure C: Letter of Approval to conduct research at Eisleben granted by
Capricorn District Municipality**



**CAPRICORN
DISTRICT MUNICIPALITY**

41 Biccard Street
PO Box 4100
POLOKWANE
0700

Tel: (015) 294 1000
(015) 294 1261
Fax: (015) 291 5697
e-mail: development@cdm.org.za

Reference no: **14/1/1**

Enquiries: WB Hlabangwane/NB Thobela

07 July 2006

PO BOX 46061
ORANGE GROVE
2119

Attention: M B Molopa (Cell: 0825465411)

REQUEST TO DO RESEARCH IN CAPRICORN DISTRICT MUNICIPALITY.

Your letter dated 06 July refers.

Your application to research in the area of Capricorn District Municipality in particular Molemole Municipality at Eisleben village on rural household sanitation under the supervision of Dr. M.H.Kanyane who is the manager for public administration program at Turfloop Graduate school of leadership, Edupark, is approved.

Your research on the evaluation of development of rural sanitation at Eisleben village in Limpopo Province is an interesting one and the District will like to share with your self the final research findings and you are therefore requested to furnish the District Municipality with a copy of your research upon conclusion thereof.

It is hoped that the above is in order.

Yours faithfully,

**MM THINDISA
ACTING MUNICIPAL MANAGER**

CC: Municipal Manager

Molemole Local Municipality

P.O.Box 46061
Orange Grove
2119
06 July 2006

The Manager
Infrastructure Development and LED
Capricorn District Municipality
41 Biccard Street
Polokwane
0700

REQUEST TO DO RESEARCH IN CAPRICORN DISTRICT MUNICIPALITY

Dear Sir/ Madam

I hereby humbly request to do research in your District at Molemole Municipality, at Eisleben village.

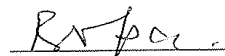
The Title of my research is "An evaluation of the development of rural sanitation at Eisleben village in Limpopo Province". The research is a partial fulfillment of the course requirement for Masters in Development at the University of Limpopo. The proposal for the research is already approved by the Research committee of higher learning at the University of Limpopo.

My student number is 9513265. My supervisor for this research is Dr. M.H. Kanyane who is currently manager for Masters in Public Administration Programme at Turfloop Graduates School of Leadership, Edupark.

It is my earnest and sincere desire that this research should contribute positively to our rural sanitation development.

Your help in this regard will be greatly appreciated.

Yours Faithfully



M.B Molopa
Turfloop M.Dev Student
Cell: 082 5465411

Annexure D: Batlokwa-Ramokgopa Regional Water Scheme - DWAF Scheme Summary Report

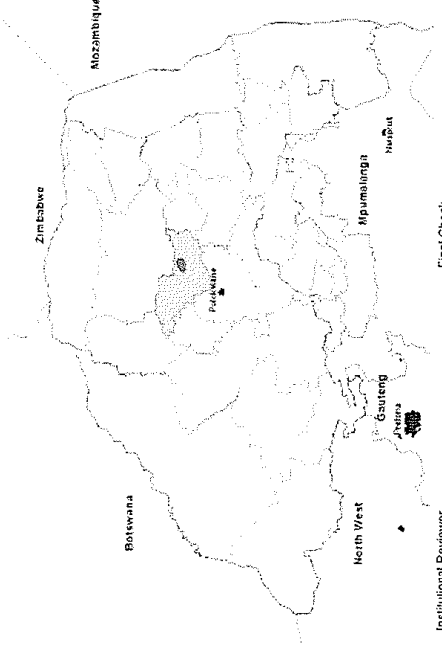
Scheme Identification:

Item	Details
Scheme Reference Number	NC2/ZA_B_SCH
Scheme Name	Batlokwa-Ramokgopa Regional Water Scheme
Province	NP
District Municipality	Capricorn
Local Municipality	Molemole Municipality
Scheme Type	Water
Scheme Extent	
Current Scheme Operator	DWAF

Summary information:

People Served (DWAF Database)	33,000
Communities Served	4
Average Age of Scheme (Years)	8.7
Water Sources (GW, SW or both)	Ground Water
Water treatment or disinfection (Y/N)	No
Billing System currently in use	None
Calculated Replacement Cost	R 9,304,360
Calculated Refurbishment Cost	R 1,180,072
Calculated Maintenance Cost (R per annum)	R 251,083

Locality map:



Introduction and background:
 The Department of Water Affairs and Forestry is currently acting as Water Services Provider (WSP) for many of Water Services (WS) schemes inherited from the previous self-governing administrations and independent states.
 DWAF being required to act as custodian and regulator of the Water Services Sector, as required by Water Services Act has consequently initiated a programme to transfer Water Services Infrastructure from Central Government to Appropriate Authorities thus ensuring that central government will only be involved in governance, while local government will be responsible for the provision of water services.

Purpose of this document:
 This report was compiled after the functional assessment as outlined above. It is therefore directed towards providing an overall assessment at a scheme level. The detail per scheme should be collated to a district level and eventually to a Provincial and National level.

Contact Details

Name	Organisation	Telephone
G. TSOLO	PALACE ENG SERVICE	0152915538
ER STEYN	AFRICON	0155162027

Signed off by:

Water Treatment Reviewer	Technical Reviewer	Financial Reviewer
Sign	Sign	Sign
Date	Date	Date

Institutional Reviewer
 Sign _____ Date _____
 Final Check
 Sign _____ Date _____

SCHEME TECHNICAL ANALYSIS

Scheme No. **NC2ZA_B_SCH**

	Ground Water	Surface Water	Water Treatment	Pump Station	Bulk Distribution	Reservoirs	Retiulation	On-Site Sanitation	Bulk Sewer	Sewage Works
Capacity										
Total Capacity (kl per day) excluding non-DWAF infra.	284			incl. booster pumping	45%	2,073	Sum of avg size & no. of tanks & etc. 3,555			
% of Available Capacity in Use (subjective field assessment)				0%	100%	63%				
% Spare Capacity (calculated from above)				100%	0%	36%				
Age										
Average Age (years)	10			2	10	8	10			
Years after Recent Upgrade										
Effective Average Age considering recent upgrade (years)	10			1	7	11				
Life Expectancy (years)	50				50	40	30			
Remaining Service Years	40				43	29	30			
Condition										
No. of Components with condition of										
Not Working	0	0	0	0	0	3	0	0	0	0
Poor	0	0	0	0	0	0	4	0	0	0
Average	20	0	0	0	1	2	0	0	0	0
Good	0	0	0	1	0	8	0	0	0	0
Effective Condition	Average	Average	Good	Good	Average	Average	Poor			
Refurbishment										
No. of Components requiring										
Civil	2				1	18	7			
Mechanical	1									
Electrical	1				1		8			
Pipelines	4	0	0	0	2	28	15		0	0
Count of Refurbishment Types										
System Analysis										
Components limiting System Performance										

Recommendations	Component	Conclusions & Recommendations
	Ground Water	All in good condition
	Surface Water	
	Water Treatment	
	Pumps Stations	
	Bulk Distribution	
	Reservoirs	
	Retiulation	50% loose connections - poor condition - refurbishment required & not working - requires refurbishment
	On-site Sanitation	
	Bulk Outfall Sewer	
	Sewage Treatment	
	General Comments	
	NOTE : Comparison of component capacities (second row from the top) does not balance where some components are not owned by DWAF	

SCHEME OPERATIONAL ANALYSIS

Scheme No. **NC272A_B_SCH**

	Ground Water	Surface Water	Water Treatment	Pump Station	Bulk Distribution	Reservoirs	Retiulation	On-Site Sanitation	Bulk Sewer	Sewage Works
Breakages	Burbbats Combined			1	1	13	4			
Total number of Components	2			0	1		20			
Avg no. of Physical/mechanical infrastructure breakages per year	6			0	1					
Avg no. of times per year it was not working for a period of more than 2 days (physical and any other reasons)										
Effective breakage risk										
Availability of Spare										
No. of components with	Never available									
	Sometimes			1	1					
	Always / mostly									
Effective access to spare parts										
Maintenance										
Type of Maintenance :	None					11				
	Reactive	1		1	1	2				
	Proactive									
	Poor			1		4				
Quality of Maintenance :	Average					7	4			
	Good	1			1	2				
Effective Quality of Maintenance										
Operational Problems										
No. of Re-ubishment reasons	vandalism & abuse									
	foundation set problem	1			1		4			
	excessive water to soil									
	lack of maintenance				1	11				
	structural cracking					1				
	normal ageing									
	faulty design				1	3	4			
System Analysis										
Component linking System Performance due to operational problems										

Analysis of Operations:

What Logical Problems are there?	personnel & skills
Do these assets to support services (customer help)	Interir
How frequent are electrical power failures	Monthly
% of water chlorinated	0%
Is demand not available for demand generation plants etc?	Sometimes
Security problem	1 of 7 Components
Illegal connections	4 of 4 Components
Obvious water leakage	4 of 14 Components
Is water quantity metered	1 of 1 Components
Is water quality metered	1 of 1 Components
Are there Pathogen sources directly affecting the water quality?	0 of 1 Components

Conclusions + Recommendations

Blank Update to be implemented
Some illegal connections and water leakage to be addressed

SCHEME FINANCIAL ANALYSIS

Scheme No.

NC22A_B_SCH

Financial Information

Calculated Value of Scheme	R per hh	Rand
Replacement Cost (calculated)	R 1,269	R 6,394,340
Present Value (calculated)	R 997	R 6,576,684
Reburbishment Cost	R 161	R 1,189,072
Calculated Operating Cost	R per hh	R per year
Annual Operating Cost (excl. cost of billing system)	R 105	R 767,699
Annual Maintenance Cost	R 24	R 251,043
Annual Bulk Water Purchase Cost (1.55c per l)	R 19	R 139,026
Total Calculated Operating Cost	R 148	R 1,158,108

Historical Operating Finances

Item	R per year	Actual Cost
Operating cost for last year	R 0	
Income / Revenue for last year	R 0	
Subsidy for last year (balance)	R 0	
Number of households served	7,333	
Effective Subsidy per household served	R 0	

Historical O&M Cost Breakdown

Item	R per year
Personnel	
Admin	
Inventories	
Equipment	
Land & Buildings	
Professional Services	
Miscellaneous	
Transfer & Special Services	
Total	

Financial Modelling (typical scenario)

Typical Tariff Structure of VSA	R per Month	R per M
Base Fee per household per month (Rand per month)	R 9.00	
0 to 6 M Tariff		R 0.71
6 to 20 M Tariff		R 1.00
21 to 60 M Tariff		R 1.45
> 60 M Tariff		R 2.05
Typical Water Use (excluding losses) per tariff block	M per year	
0 to 6 M Tariff (first 25 kcs of all users)	123,837	
6 to 20 M Tariff (incremental use of yard and house connection)	267,667	
21 to 60 M Tariff (incremental use of house connection (incl. above))	535,333	
Total	926,837	

Typical Income per Year

Typical Income per Year	R per year
Base Fee per month	R 66,000
0 to 6 M Tariff	R 0
6 to 20 M Tariff	R 55,642
21 to 60 M Tariff	R 405,841
Total	R 507,483

Possible Financial Balance

Historical	Calculated
Income per year	R per year
R 0	R 507,483
Costs per year	R per year
R 0	R 1,158,108
Possible Shortfall	R per year
R 0	R 598,624
Number of Indigent Households served	0
Requirement Item: Equitable Share (R/ha/photomonth)	N/A
Total DORA Allocation to VSA	
R 0	
Ratio of Possible Shortfall over DORA allocation	

Financial Indicators

Billing System in Use	Notes
Are there basic book-keeping records?	Yes
What billing system is used?	None
How frequent are accounts issued?	Never
Total amount of accounts issued per year	N/A
Percentage of accounts paid	N/A

Capital Cost Ratios	Benchmark
Ratio - Present Value to Replacement Cost	71%
Ratio - Maintenance to Replacement Cost	2.7%
Ratio - Reburbishment to Replacement Cost	13%
	< 40%

Operating Cost Ratios	Target
Ratio - Actual Income to Actual O&M Cost	0.0%
Ratio - Calculated Income to Calculated O&M Cost	48.6%
	Target > 50%
	Target > 60%

People served Indicators	Benchmark
Estimated average water used per person per day	77
Operating Cost per person served per month	R 3
Maintenance Cost per person served per month	R 1
	> 25 l/p/d
	Subject to affordability

Conclusions & Recommendations
Average water supply on high side

SCHEME PERSONNEL ANALYSIS

Scheme No. NC22A_B_SCH

Personnel Profile (effective full-time involvement)

Post Description	Covered workers		Skilled workers		Highly skilled workers		Total Personnel	
	DWAF	Benchmark	DWAF	Benchmark	DWAF	Benchmark	DWAF	Benchmark
Administrative Line Functions							0	0
Artisan & Support		4.8					0	5
Engineering Related & Support							0	0
Human Resource & Support							0	0
Information Technology & Related							0	0
Management & General Support				1.0			0	1
Natural Science & Related							0	0
Total effective full-time personnel							0	6

DWAF Personnel Cost Breakdown	Ann. Cost	Ratio %
Administrative Line Functions		
Artisan & Support		
Engineering Related & Support		
Human Resource & Support		
Information Technology & Related		
Management & General Support		
Natural Science & Related		
Total:	R 0	

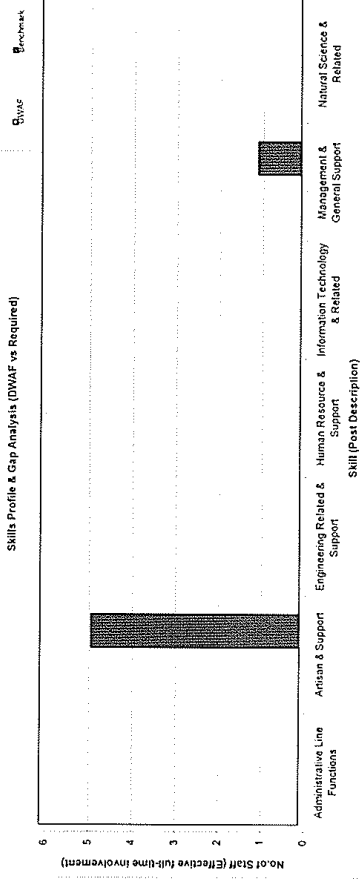
DWAF Personnel Involvement	No. of Staff	%
Staff with > 75% commitment to this scheme	0	
Staff with < 25% commitment to this scheme	0	
Staff with 25% to 75% commitment to this scheme	0	
Total number of staff involved full & part time	0	

Gender Profile of DWAF Personnel	No. of Staff	%
Men	0	
Women	0	
Total (full & part time)	0	

Affirmative Profile of DWAF Personnel	No. of Staff	%
Affirmative Categories	0	
Non-Affirmative Categories	0	
Total (full & part time)	0	

Age Profile of DWAF Personnel	No. of Staff	%
> 65 years	0	
60-65 years	0	
55-60 years	0	
25-55 years	0	
< 25 years	0	
Total (full & part time)	0	

Service Years of DWAF Personnel	No. of Staff	%
< 5 years	0	
5-10 years	0	
10-20 years	0	
> 20 years	0	
Total (full & part time)	0	



Personnel Indicators	Benchmark
Personnel per 1000 M water treated per month	17/1000 M
Personnel per 1000 M water raised per month	17/1000 M
Personnel per 1000 households	0
Personnel cost per M treated per month	R 0.60
Personnel cost per M raised per month	R 0.60

Conclusions & Recommendations

Information available at scheme level

SCHEME ASSET REGISTER

Location			Structure										Status				Annual Operating	
ID	Name	Location	Location	Structure	Area	Construction	Age	Yearly	Estimated	Life	Condition	Replacement	Present	Annual	Annual			
		Code	Code	Type	Size	Date	Yrs	Interest	Value	Span	Code	Cost	Value	Cost	Value			
1774	MAJESTIC	1774	23021	Concrete	30	1993	28	7.0	205,375	25	Good	811,666	811,666	815,905	815,905			
1775	MAJESTIC	1775	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1776	MAJESTIC	1776	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1777	MAJESTIC	1777	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1778	MAJESTIC	1778	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1779	MAJESTIC	1779	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1780	MAJESTIC	1780	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1781	MAJESTIC	1781	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1782	MAJESTIC	1782	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1783	MAJESTIC	1783	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1784	MAJESTIC	1784	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1785	MAJESTIC	1785	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1786	MAJESTIC	1786	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1787	MAJESTIC	1787	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1788	MAJESTIC	1788	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1789	MAJESTIC	1789	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1790	MAJESTIC	1790	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1791	MAJESTIC	1791	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1792	MAJESTIC	1792	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1793	MAJESTIC	1793	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1794	MAJESTIC	1794	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1795	MAJESTIC	1795	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1796	MAJESTIC	1796	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1797	MAJESTIC	1797	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1798	MAJESTIC	1798	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1799	MAJESTIC	1799	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			
1800	MAJESTIC	1800	23021	Concrete	30	1993	28	7.0	205,375	25	Average	811,666	811,666	815,905	815,905			

SCHEME PERSONNEL REGISTER

Scheme No.

NC21A_B_SCH

Personal No.	Surname	Initials	Gender	Age	Service Years	Post Description	Skill Level	% of Time working on this scheme	No. of other schemes involved

CONCLUSIONS & RECOMMENDATIONS

Scheme No. NC2/2A_B_SCH

Issue	Description	Recommendation:
Technical :	Good to average condition - reticulation in poor condition	
Operational	Some problems with leakages and illegal connections	
Financial	Billing system to be implemented	
Personnel :		
Institutional:		
General Comments & Recommendations :	Good to average condition - reticulation requires attention	

DRAFT

SCHEME SUMMARY REPORT

Scheme No. NC2/2A_A_SCH

Scheme Identification:

Item	Details
Scheme Reference Number	NC22A_A_SCH
Scheme Name	Balokwa-Ramakoppa Regional Water Scheme
Province	NP
District Municipality	Capricorn
Local Municipality	Molemole Municipality
Scheme Type	Water
Scheme Extent	
Current Scheme Operator	DWAF

Summary information:

People Served (DWAF Database)	903
Communities Served	1
Average Age of Scheme (Years)	9.8
Water Sources (GW, SW or both)	Ground Water
Water treatment or disinfection (Y/N)	No
Billing System currently in use	None
Calculated Replacement Cost	R 593,054
Calculated Refurbishment Cost	R 74,115
Calculated Maintenance Cost (R per annum)	R 13,896

Introduction and background:

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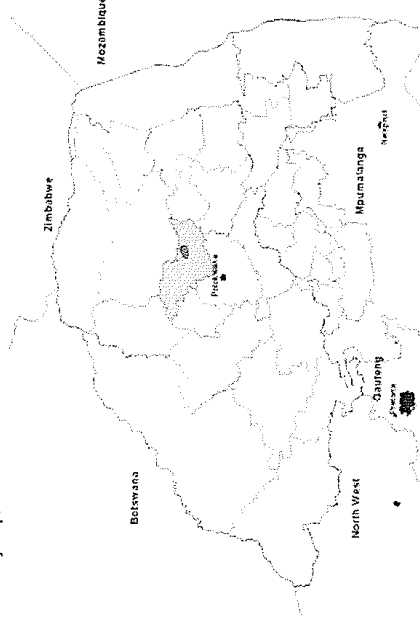
Contact Details

Name	Organisation	Telephone
G TSOLO	PALACE ENG	0152915538
ER STEYN	AFRICON	0155165027

Signed off by:

Water Treatment Reviewer	Technical Reviewer	Financial Reviewer	Final Check
Sign	Sign	Sign	Sign
Date	Date	Date	Date

Locality map:



SCHEME TECHNICAL ANALYSIS

Scheme No.

NC2/ZA_A_SCH

	Ground Water	Surface Water	Water Treatment	Pump Station	Bulk Distribution	Reservoirs	Reticulation	On-Site Sanitation	Bulk Sewer	Sewage Works
Capacity										
Total Capacity (lit per day) excluding non-DWAF infra.	206			10	5.045	150	95			
% of Available Capacity in Use (subjective field assessment)					100%	60%				
% Spare Capacity (calculated from above)					0%	40%				
Age										
Average Age (years)	10				10	10	10			
Years after Recent Upgrade										
Effective Average Age (including recent upgrade) (years)	10				12	10				
Life Expectancy (years)	50				50	40	30			
Remaining Service Years	40				38	30	30			
Condition										
No. of Components with condition of										
Not Working	0	0	0	0	0	0	0	0	0	0
Poor	0	0	0	0	0	0	0	0	0	0
Average	1	0	0	0	0	1	1	0	0	0
Good	0	0	0	0	0	0	0	0	0	0
Effective Condition										
Average					Poor	Average	Average			
Refurbishment										
No. of Components requiring						2				
Civil							1			
Mechanical										
Electrical	1									
Pipelines										
Count of Refurbishment Types										
Civil	1	0	0	0	1	2	3		0	0
Mechanical										
Electrical										
Pipelines										
System Analysis										
Components limiting System Performance										

Recommendations	Component	Conclusions + Recommendations
	Ground Water	spans to be kept - requires some refurbishment
	Surface Water	
	Water Treatment	
	Pumps, Stations	
	Bulk Distribution	poor condition
	Reservoirs	low refurbishment required on 1
	Reticulation	low refurbishment required on 1
	On-site Sanitation	
	Bulk Outfall Sewer	
	Sewage Treatment	
	General Comments	
	NOTE: Comparison of component capacities (second row from the top) does not balance where some components are not owned by DWAF	

SCHEME OPERATIONAL ANALYSIS

Scheme No. **NC2ZA_A_SCH**

	Ground Water	Surface Water	Water Treatment	Pump Station	Bulk Distribution	Reservoirs	Retreatment	On-Site Sanitation	Bulk Sewer	Sewage Works
Breakages	Boreholes Combined									
Total Number of Components										
Avg no. of physical/mechanical infrastructure breakages per year	0						20			
Avg no. of times per year it was not working for a period of more than 2 days (physical and any other reasons)	0									
Effective leakage risk										
Availability of Spares										
No. of components with:										
Never available										
Sometimes	1									
Always / mostly										
Effective access to spare parts										
Maintenance										
Type of Maintenance:										
None										
Reactive	1									
Proactive										
Poor										
Average										
Good	1									
Effective Quality of Maintenance										
Operational Problems										
No. of Rehabilitation actions										
varication & abuse	1									
foundation no problem										
corrosive water or soil										
lack of maintenance										
inconsistent tracking										
normal seeping										
lumpy design										
System Analysis										
Components limiting System Performance due to operational problems										

Analysis of Operations:	Conclusions + Recommendations
What logical problems are there?	
Is there access to support services (e.g. site rep.)?	Poor access to site
How frequently are electrical power failures?	Never
% of water chlorinated	Monthly
Is disinfectant available for level 1 operations (e.g. 1)?	0%
Security problem	Symptoms
Illegal connections	1 of 1 Components
Obstructed walkways	1 of 1 Components
Is the water quality monitored?	3 of 2 Components
Are there Pollution sources directly affecting the water quality?	1 of 1 Components
	1 of 1 Components
	0 of 1 Components

SCHEME FINANCIAL ANALYSIS

Scheme No: NC2/ZA_A_SCH

Financial Information

Calculated Value of Scheme	R per hh	Rand
Replacement Cost (calculated)	R 2 955	R 593,054
Present Value (calculated)	R 2 199	R 434,737
Rebushment Cost	R 269	R 74,115
Calculated Operating Cost	R per hh	R per year
Annual Operating Cost (excl. cost of billing system)	R 151	R 30,381
Annual Maintenance Cost	R 69	R 13,936
Annual Bulk Water Purchase Cost (15c per l)	R 18	R 3,708
Total Calculated Operating Cost	R 239	R 48,025

Historical Operating Finances

Item	R per year
Operating Cost for last year	R 0
Income /Revenue for last year	R 0
Subsidy for last year (balance)	R 0
Number of households served	201
Effective Subsidy per household served	R 0
Historical O&M Cost Breakdown	R per year
Item	Actual Cost
Personnel	
Admin	
Investment	
Equipment	
Land & Buildings	
Professional Services	
Miscellaneous	
Transfer & Special Services	
Total	

Financial Modelling (typical scenario)

Typical Tariff Structure of WSA	R per Month	R per year
Basic Fee per household per month (Rand per month)	R 9,00	R 108
0 to 6 Ml Tariff		R 0,71
6 to 20 Ml Tariff		R 1,00
21 to 60 Ml Tariff		R 1,45
> 60 Ml Tariff		R 2,95
Typical Water Use (excluding losses) per tariff block	Kl per year	Kl per year
0 to 6 Ml Tariff (est 25 l/cd of all users)		4,944
6 to 20 Ml Tariff (incremental use of yard and house connection)		6,592
21 to 60 Ml Tariff (incremental use of house connection after above)		13,184
Total		24,720
Typical Income per Year	R per year	R per year
Basic Fee per month	R 1,080	R 12,960
0 to 6 Ml Tariff	R 0	R 0
6 to 20 Ml Tariff	R 2,355	R 28,260
21 to 60 Ml Tariff	R 8,872	R 106,464
Total	R 14,033	R 170,084
% Cost Recovery		
Basic Fee per month	0%	
6 to 20 Ml Tariff	50%	
21 to 60 Ml Tariff	75%	
Total		

Possible Financial Balance

Item	Historical R per year	Calculated R per year
Income per year	R 0	R 14,033
Costs per year	R 0	R 48,025
Number of Indigent Households served	0	R 31,992
Requirement from Equitable Share (R/household/month)	N/A	N/A
Total DORA Allocation to WSA		
Ratio of Possible Shortfall over DORA Allocation		

Financial Indicators

Billing System in Use	Are there basic book-keeping records?	Yes
What billing system is used?	None	None
How frequent are accounts issued?	Never	Never
Total amount of accounts issued per year	N/A	N/A
Percentage of accounts paid	N/A	N/A
Capital Cost Ratios		Benchmark
Ratio - Present Value to Replacement Cost	73%	> 40%
Ratio - Maintenance to Replacement Cost	2,3%	2% to 4%
Ratio - Rebushment to Replacement Cost	12%	< 40%
Operating Cost Ratios		
Ratio - Actual Income to Actual O&M Cost	0,0%	Target > 60%
Ratio - Calculated Income to Calculated O&M Cost	29,2%	Target > 60%
People served Indicators		Benchmark
Estimated average water used per person per day	75	> 25 l / d
Operating Cost per person served per month	R 4	Subject to affordability
Maintenance Cost per person served per month	R 1	
Conclusions & Recommendations		

CONCLUSIONS & RECOMMENDATIONS

Scheme No. **NC2/2A_A_SCH**

Issue	Description	Recommendation:
Technical :		
Operational		
Financial		
Personnel :		
Institutional:		
	<p>General Comments & Recommendations - spares to be kept on GW, diesel supply requires further investigation - vandalism/abuse of land theft requires attention - billing system to be implemented</p>	

Annexure E: Dry Sanitation

a. Solarsan

<http://www.solarsan.co.za/waterless-toilet-information.php>

SolarSan waterless toilet separates the urine from the faeces and dries the faeces with the aid of wind and sun.

Our Waterless Toilet System

No Water
No Chemicals
No Odours
No Septic Tanks
No Reticulation
No Mess
No pollution of the ground water
SABS tested for 50,000 cycles; that is over
20 years of use for a family of 6

High Quality Design Elements:

Modern and functional design
Robust
Manufactured of high quality materials
(LLDPE roto moulding)
Easily transportable
Light weight
Low maintenance
Easy Assembly
Easy installation
Affordable

1.1 Sump Operation

For a family of six, the bag in the sump of the dry sanitation system will take 4 to 6 months to fill with dry and odourless waste. Large objects such as cans or anything of that size, which are dropped down the toilet bowl, will not block the dry sanitation system. Large objects that do not block the dry sanitation system will accumulate in the bag. If it blocks, it will occur at the bowl where it can easily be retrieved. The dry waste can be added to compost, disposed via municipal waste services, burned or buried.

1.2 Assembly & Movement

The circular housing in the dry sanitation system is only a 160mm deep and 1.8m in diameter. The sump is attached to the bottom of the dry sanitation housing and is only 600mm long, 600mm deep and 340mm wide, which requires less than 0.2m³ of excavation. The system is completely sealed which means that no fluids can get in or escape from the system. Waste falls through the toilet chute onto the floor of the circular housing. Each handle movement moves the waste with scrapers inside the housing. After a full circular movement, dry odourless waste falls into the bag fitted in the sump.

1.3 Urine Diversion Operation

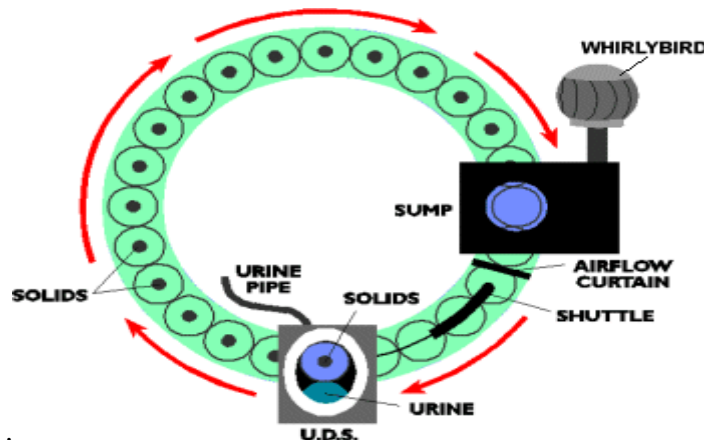
Urine is diverted via a urinal and a Urine Diversion System (UDS) inside the bowl of the dry sanitation system. A kiddy seat is fitted to ensure that small children do not soil the Urine Diversion System. Urine Diversion ensures quicker drying of solids, and prevents potential odours in the dry sanitation system.

1.4 Drying Process

Urine is diverted in the dry sanitation system from solids and discharged into a soak away. Our Whirlybird eliminates and discharges all odours by creating a constant flow of air down the toilet bowl. The air-flow evaporates all moisture from the solids and toilet cleaning fluids. Solar heating of the round housing assists with evaporation and drying of solids in the dry sanitation housing unit. Heating of the solids contributes to the elimination of most pathogens.

1.5 Urine Diversion Advantages

Urine diversion ensures quicker drying of solids, and prevents potential odours in the dry sanitation system



1.5.1 Urine Diversion Systems Advantages

- Can be installed in areas with a high water table.
 - Can be installed above ground where there are too many rocks.
 - Dry sanitation means water and chemical free operation.
 - Enables the user to use the diverted urine as a valuable and free fertilizer, if so desired.
 - Our Urine Diversion Systems means that pathogens are safely contained.
 - No contamination of soil or groundwater.
 - Can be installed into existing or new houses. Can be installed as an outhouse if it is preferred.
- More humane.

- No smell.
- Can be kept hygienically clean with normal household disinfectants.
- Can be used for temporary or permanent installations.
- Can be uplifted and repositioned elsewhere.
- Ideal replacement of VIP's.
- Can be installed in an existing VIP.
- Our waterless toilet saves water and protects our environment.

1.6 Final Dry Sanitation Waste Product Can Be

- Buried
- Burned
- Composted
- Landfilled

SolarSan Dry Sanitation systems offer a waterless toilet and a urine diversion system that is easy to install.

Dry Sanitation Components



Sump



[Indoor Housing](#)



Outdoor Housing



Toilet Rings



[Urine Diversion System](#)



[Whirlybird](#)

Dry Sanitation Installation



Level Area



Dig a hole 1m x 60cm x 70 cm deep



Place housing and pedestal over sump



Seal sump



Cover soak away



Erect hut around pedestal and attach urinal

Operation



Service Requirements and User Operation [of the waterless toilet system.](#)



Step 1



Step 2

Cleaning The Sump



Remove filled bag from sump



For example: BURN solids



Replace clean bag into sump

Indoor Dry Sanitation System





Outdoor Dry Sanitation System



Burning of a six-month-old sample of dried out solids.
Sample ignited without any artificial additives.
Dried out solids are highly combustible.
The sample was incinerated to only ashes within 15 minutes.
The fire generated intense heat.
Six months of “sewage” reduced to a small heap of ashes.

b. Ecosan Waterless Sanitation Systems

2.1 About Ecosan

The Ecosan waterless toilet system as it is known today was developed in the late 1990's and was field-tested for 18 months. Since the launch of the toilet in December 2002 many units have been sold locally and in neighboring countries. During 2003 significant inroads were made in the International market and interest worldwide is continuing to grow.

2.1.1 Ecosan comments

- **Must be a waterless toilet**

The Ecosan toilet does not require any water, plumbing or electricity to function. Apart for a small amount of water required for cleaning, no other water is required.

- **Must not contaminate water resources**

The toilet is a completely sealed unit that prevents any leakage of hazardous waste into the ground.

- **Must be easy to install**

The Ecosan toilet is completely assembled at the factory and installation can be done in approximately 40 minutes if the groundwork has been one beforehand.

- **Must be easy to operate**

Operation of the toilet is very simple. The toilet is "Flushed" every time the lid is lifted and closed. VIP is not only costly but also poses a serious health hazard to the households. Hence, 11 % of the people who have experienced VIP confirm that it is a health hazard, unlike the 89% who had not had an experience of using VIP at the time the study was conducted. The only safer way to remove the sludge from the pit requires sludging technology that sucks the waste. This technology is not only expensive to acquire but also costly to maintain.

Must be suitable for installation inside a house

The Ecosan toilet can be installed in homes, schools and also in a toilet hut outside. The toilet is suitable for normal use by 8 to 10 persons per day.

- **Must be easy to maintain**

The toilet has very few moving parts and apart from normal cleaning and periodic removal of the waste (3 - 6 months) requires no ongoing maintenance.

- **Must be able to re-use urine**

The toilet is supplied with a small male urinal as standard. Female urine will still go through the toilet system because a certain amount of liquid is required

to assist with the evaporation process. The male urinals can be linked to a central collection tank for irrigation use.

2.2 The organic waste must be safe and re-usable

The Ecosan is not a "composting toilet" as such. It goes one step further by drying out the organic waste completely. The end product is completely dry when it ends up in the waste bag and it can then be used as compost. If the waste is to be used for compost a further (approx. 2 week) treatment is required by exposing it to direct sunlight to ensure that it is completely dry. The project must create jobs for the unemployed. There are many job creation opportunities when implementing a Ecosan toilet system.

- Orientation Teams will be required to train users in the waterless toilet concepts, maintenance and operation of the toilets.
- Installation requires relatively low skilled workers which can all be from the local community.
- Maintenance and waste removal teams also require low skilled workers which can also be from the local community. **Capacity building** [Capricorn Fire & General](#) through Ecosan will provide personnel to train all persons involved in a implementation project to a level that it can be self sustainable. These will include officials, consultants, community training officials, installation and maintenance teams.

2.3 The Benefits

- Improved sanitation for households and schools
- Improved living conditions for the community
- Improved groundwater quality and safety
- Better utilisation of already scarce water resources
- Job creation opportunities
 - Orientation teams introducing the waterless sanitation concept
 - Installation teams
 - Maintenance and support teams
 - Waste removal and disposal / recycling teams

2.4 The Beneficiaries

- Households
- Schools
- Unemployed

2.5 The Ecosan Waterless / Dry Sanitation Toilet System

The Ecosan Waterless Toilets have been designed and are manufactured in South Africa. This unique design enables the product to be used in areas where:

- There is a chronic shortage of water, which makes the utilization of water borne sanitation an unrealistic option.
- The capital cost required for wall to wall sanitation is prohibitive
- Regular operating and maintenance costs of sanitation systems such as buckets, septic tanks, chemical and water borne toilets are high

- There is a risk of contamination of valuable ground water resources

The Ecosan is a Waterless Dehydration / Evaporation system that provides a safe, non polluting, cost effective solution to the worldwide sanitation problem and offers a standard of respectability and convenience comparable to a water borne system yet without the prohibitive costs and obvious contamination of precious water resources. The system has been tried, tested and evaluated in the field since 1997. The evaluation period involved scientific health as well as community tests and feedback. Widespread experience with this system in South Africa and neighbouring countries has demonstrated that it is a cost effective, respectable, hygienic and environmentally friendly system that satisfies the dignity of all users.

2.5.1 Main Features

- Ecosan Toilets are relatively lightweight and easy to move into position during installation
- The unit does not require any type of water flushing mechanism, eliminating the risk of mechanical failure
- It uses no water so no plumbing is required
- It has no plumbing connections
- It is ideally suited for both city and rural homes
- It has a modern and functional design and is easily transportable
- It uses no chemicals
- It is odourless
- It is environmentally friendly and does not contaminate underground water sources
- The evaporated dry product can be used as a fertilizer

2.5.2 Limitations

The Ecosan toilet was designed for normal use by 8 to 10 persons per day. It is not intended to be used as a public toilet. The Ecosan Waterless Toilet has many applications for:

- Domestic, both urban and rural
- Informal settlements
- Refugee camps
- Farms
- Government buildings such as schools, clinics
- Underground mining
- National Parks
- Eco Tourism locations
- Manufacturing industry

2.5.3 Models

Apart from the standard model two variations of the Ecosan toilet are available.

2.5.3.1 Mine toilet / high volume toilet

This toilet was designed after a need for high volume use in South African underground mines was identified. The waste bag is replaced by an easily removable drum with a lid so that the human waste can be removed from the work area. Although the waste is not a completely dry end product, it can still be safely removed and disposed of elsewhere. This model is suitable for areas where high usage is expected i.e. public toilets. Due to the additional procedures required for the handling of the waste, this particular model will not be considered for this proposal unless specific

2.5.3.2 Asian / Muslim toilet

In many countries there is a large demand for toilets that fit in with the Muslim traditions. The basic functioning of the toilet is the same, the toilet bowl design is slightly different and when installed is close to floor level.

2.6 Product Specification Sheet

Product name	Ecosan waterless dry sanitation toilet system
Dimensions	2450mm (L) 800mm (W) 750mm (H above ground)
Material	Low Density Poly - Ethylene (LDPE)
Total weight	100 Kg
Standard toilet	Complete toilet as pictured above Ventilation pipes Waterless urinal Wind turbine Waste bag
Optional extras	240 / 110 Volt electric motor Solar fan
Website:	http://www.capricornfire.co.za

2.6.1 Toilet bowl colours

Various colours available of which the following are the most popular

2.6.1.1 Features

- Requires no water, sewer connections or plumbing
- Modern and functional design
- Robust
- Easily transportable
- Lightweight
- Low maintenance
- Easy installation
- No chemicals
- Factory assembled
- Tested by South African Bureau of Standards (SABS)
- Certified by the Council for Scientific and Industrial Research. (CSIR)

2.7 How Does the Ecosan Toilet Work

The human excrement falls down a vertical chute (2) and into one end of a specially designed helical screw conveyor (3). Every time the toilet lid (1) is lifted, a mechanism rotates the conveyor. With each rotation the human excrement slowly moves along, taking approximately twenty five days before falling into a reusable collection bag (4). It takes six months for the bag to fill with dry and odourless waste.

Through the uniquely designed ventilation pipe (5), adequate airflow is provided for the dehydration / evaporation, deodorising process. Human excrement consists of roughly 95% moisture. As the solids dry in the conveyer the urine and moisture is vented into the atmosphere. The solid waste then dries into a compost-like material, roughly 5 - 10% of its original mass.

The dry waste is manageable and can be processed in the following ways.

- Use it in the making of compost
- Dispose of it by using municipal waste services
- Use it as a source of fuel

Large objects like beverage cans, disposable nappies or other objects accidentally dropped down the chute will not block the system. It is however not advisable to do this

2.8 South African product

The Ecosan toilet is manufactured in South Africa, using local materials, labour and expertise. The Ecosan toilet was developed for South African conditions.

2.9 Accepted by Municipalities

The Ecosan toilet has already been accepted by South African municipalities.

- Ekurhuleni Metropolitan Municipality - 300 toilets
- Ganyesa Vryburg - 30 toilets
- Mafikeng - Health Clinic - 10 toilets
- Majuba Municipality (KZN) - 500+ toilets

2.10 Certification

The toilets have been tested and certified by the South African Bureau of Standards (SABS) for their mechanical functioning and by the Council for Scientific and Industrial Research (CSIR) for the safety of the organic waste.

2.11 Accepted by Health authorities in other countries

The Ecosan toilets have already been certified as being safe for use in the following countries:

- Western Australia
- Caribbean
- France (Pending)
- Netherlands (Pending)

2.12 Product quality / reliability

Our toilets are manufactured from extremely durable Poly-Ethylene and have very few movable parts, leading to no or very little maintenance.

2.13 COST

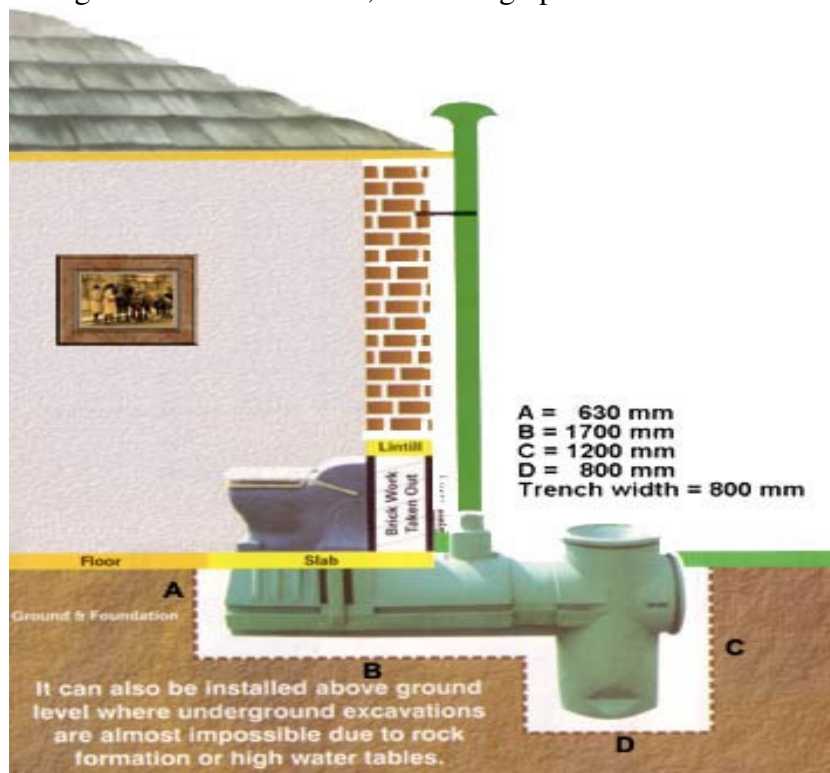
The current price of an Ecosan toilet is available on request and the complete package includes:

- The complete toilet
- Ventilation pipes
- Wind turbine or electric extractor motor
- Waterless urinal
- Waste bag

The toilet is factory assembled and no assembly is required on site. The specially designed Ecosan toilet hut is optional. Any toilet structure can however be used

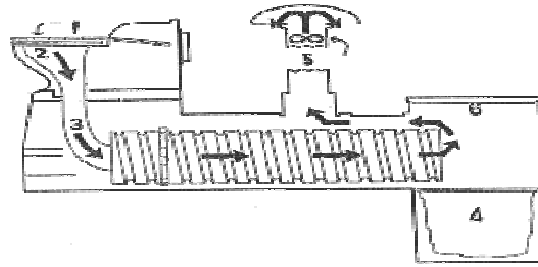
2.14 Installation Diagram

Installation is very easy. Once the trench is completed it is a matter of lowering the toilet into it, ensuring that the toilet is level, and filling up the trench with sand.



EXTRACTOR FAN OPTIONS

- Wind Turbine
- Solar fan
- Electric fan



Ecosan outdoor toilet models

			
VIP 450 toilet installed in Ecosan toilet hut	VIP 450 Toilet	VIP 200 Toilet	VIP 200 Toilet on stand with drum

c. PIT TOILETS

3.1 Background

Pit toilets are in many cases considered as a "last resort" for solving the demand for sanitation. Because of the possibility of underground water contamination and other related health issues, governments and health organizations worldwide are discouraging the implementation of pit toilet systems. There is however, some situations where, due to cost and other considerations, pit toilets are still a viable option. In remote areas where there is no, or little, danger of water resources being contaminated the use of pit toilets can be a viable option.

3.2 Pit Toilet range

Two models of pit toilets are currently manufactured. A VIP200 and a VIP450, the main difference being the size of the exit hole at the bottom and the design. With these two toilets, the choice of the type of toilet hut is the client's. We also manufacture a toilet hut with a toilet bowl (pedestal) already installed.

3.3 Installation

Pit toilets are installed by simply digging a hole in a suitable location, placing a support structure over the hole that will support the toilet bowl and structure. After a period of use the toilet needs to be moved to another location and re-installed. The old hole needs to be filled up again.

3.4 Advantages

Mostly the lower cost

3.4.1 Limitations

Pit toilets need to be relocated once the hole is full and are a possibility of underground water contamination

3.4.2 Recommended areas of usage

To be used for areas where cost is an extremely limiting factor; and also low cost housing developments where installation will not cause water contamination or health issues.

d. VENTILATED VIP TOILET

4.1 Background

The Ventilated pit toilet is a more advanced version of the standard pit toilet. It uses the VIP200 toilet bowl but it has a ventilation adaptor onto which ventilation pipes are attached for removal of odours.

4.2 Product information

The ventilation VIP pit toilet is an easy to install toilet that is supplied as a complete kit.

4.2.1 Components:

- Pre-cast reinforced concrete wall and roof panels with fixing nuts and bolts
- Pre-cast reinforced concrete cover slab (Base)
- VIP200 toilet pedestal (bowl) with double flap toilet seat
- Galvanised steel door including latch
- 110mm Diameter ventilation pipe with Cowel and Fly screen

4.3 Principles & Operation

The ventilated pit toilet works on the same basis as the standard pit toilet i.e. a hole is dug into the ground and the toilet is placed over the hole. The side wall of the pit below the toilet can be strengthened by pre cast walls at an additional cost. This is referred to as a “Lined Pit”

4.4 Advantages over the standard toilet

Improved ventilation Structure (toilet hut) has a more appealing appearance and is better ventilated. Fly screen in ventilation pipes provides better control of flies and insects. Structure is made of concrete and is therefore more durable. WEB PAGE: www.capricornfire.co.za

e. **Enviro Loo**

5.1 **Waterless Toilets**

Due to a chronically shortage of water in many countries, waterborne sanitation is an unrealistic option for many people. Therefore, Enviro Options have patented a [water-free](#) sanitary solution, which is:

5.2 **The Enviro Loo solution:**

- The system does not require water
- The system does not use chemicals
- The system is completely odourless
- No expensive sewage treatment plants required
- No flies
- There is no power required
- Minimum monthly operating costs
- Indoor installation
- No effluent seepage into underground water reserves

The system should require minimal water usage and operate effectively.

5.2.1 **Waste Management System**

The system requires minimal water usage and operates as a [Waste Management System](#). Just as nature recycles garden refuse into compost, the Enviro Loo Dry Sanitation System provides the right environment for human waste, toilet paper and organic material to break down through a natural process into an inoffensive compost-like material, creating a **Waste Management System**.

5.2.2 **Dry Sanitation Systems**

If you are looking for [dry sanitation systems](#) (environmentally friendly toilet systems) that

- Does not use water, chemicals or power,
- is completely odourless,
- uses no expensive sewage treatment plants,

Enviro Loo dry sanitation systems was developed using bacterial and biological technology plus expertise gained in research and development of waste management.

5.2.3 Waterborne Sanitation System

If you are looking for [waterborne sanitation systems](#) (environmentally friendly toilet systems) that

- does not use water, chemicals or power,
- is completely odourless,
- uses no expensive sewage treatment plants,

Enviro Loo dry sanitation systems was developed using bacterial and biological technology plus expertise gained in research and development of waste management.

5.2.4 Groundwater contamination

Enviro Options developed and manufactures environmentally friendly outdoor toilets that are cost effective, respectable and hygienic dry sanitation system that satisfies the dignity of all users. The Enviro Loo was created to provide sanitation solutions where water is scarce, [groundwater contamination](#) poses a threat and where installation and maintenance costs need to be minimized. Applications of dry sanitation outdoor toilets:

- Domestic, both peri urban and rural.
- Holiday cottages.
- Farms.
- Schools.
- Clinics.
- Underground mining.
- Industry.

Just as nature recycles garden refuse into compost, the Enviro Loo dry sanitation outdoor toilet system provides the right environment for human waste, toilet paper and organic material to break down through a natural process into an inoffensive compost-like material.

5.2.5 Maintenance Costs

[Enviro Options](#) developed and manufactures environmentally friendly outdoor toilets that are a cost effective, respectable and hygienic dry sanitation system that satisfies the dignity of all users. **MAINTENANCE:** The Enviro Loo Toilets require minimal servicing for the first two years after installation. Applications of dry sanitation outdoor toilets:

- Domestic, both peri urban and rural.
- Holiday cottages.
- Farms.

- Schools.
- Clinics.
- Underground mining.
- Industry.

Just as nature recycles garden refuse into compost, the Enviro Loo dry sanitation outdoor toilet system provides the right environment for human waste, toilet paper and organic material to break down through a natural process into an inoffensive compost-like material. Enviro options introduce the **Enviro Loo**, a non-flush Dry Sanitation Toilet designed for the benefit of all communities.



To date **ENVIRO OPTIONS** have won many awards. And numerous patents have been registered worldwide.



5.2.6 Non-Flush Toilets

The system requires minimal water usage for hygiene purposes to clean the seat and operate as a [non-flush toilet](#) system. Enviro Options developed and manufactures environmentally friendly outdoor toilets that are a cost effective, respectable and hygienic dry sanitation system that satisfies the dignity of all users. The Enviro Loo solution is:

- The system does not use water.
- The system does not use chemicals.
- It is a closed circuit system.
- The system is completely odourless.
- No expensive sewage treatment plants required
- No flies.
- There is no power required.
- Minimum monthly operating costs.
- Indoor installation.
- No effluent seepage into under ground water reserves.

Just as nature recycles garden refuse into compost, the Enviro Loo dry sanitation outdoor toilet system provides the right environment for human waste, toilet paper

and organic material to break down through a natural process into an inoffensive compost-like material.

5.2.7 The Enviro Loo : Special Outdoor Toilets

Enviro Options developed and manufactures environmentally friendly [outdoor toilets](#) that are a cost effective, respectable and hygienic dry sanitation system that satisfies the dignity of all users. Applications of dry sanitation outdoor toilets:

- Domestic, both peri urban and rural.
- Holiday cottages.
- Farms
- Schools.
- Clinics
- Underground mining
- Industry

Just as nature recycles garden refuse into compost, the Enviro Loo dry sanitation outdoor toilet system provides the right environment for human waste, toilet paper and organic material to break down through a natural process into an inoffensive compost-like material.

5.2.8 Sanitation Solutions

Due to a chronic shortage of water in many countries, waterborne sanitation is an unrealistic option for many people. Therefore, Enviro Options have patented a water-free [sanitary solution](#) which is:

- Respectable,
- Hygienic,
- Pollution-free and
- Requires minimal water usage.



5.2.9 Waterless Toilets

The [Enviro Loo](#) was created to provide sanitation solutions where water is scarce, groundwater contamination poses a threat and where installation and maintenance costs need to be minimized. The Enviro Loo solution:

- The system does not require water
- **The system does not use chemicals**
- The system is completely odourless
- No expensive sewage treatment plants required
- No flies
- There is no power required
- Minimum monthly operating costs
- Indoor installation

- No effluent seepage into underground water reserves

The system is *completely chemical free* and operates effectively.

5.2.10 . Composting Toilet

The system requires minimal water usage and operates as a [composting toilet](#) system. Just as nature recycles garden refuse into compost, the Enviro Loo Dry Sanitation System provides the right environment for human waste, toilet paper and organic material to break down through a natural process into an inoffensive compost-like material.

5.2.11 . Free Standing Toilet

Enviro Options have created the ultimate [free standing toilet](#) solution for use outdoors. Examples of these *free standing toilets* can be found in the Kruger National Park and at Durban's Beach, or alternatively at our website.

5.2.12 . Odour Free Toilet

Enviro Options have created the ultimate [odour free](#) waterless toilet solution for use indoors and/or outdoors. Examples of and information on these *odour free toilets* can be found at our website.

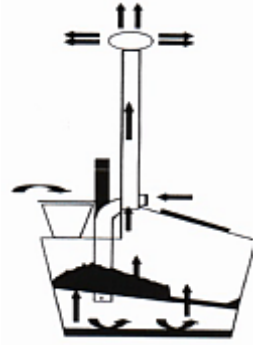
http://myweb.absa.co.za/ernstt/product_info.html * Domestic, both peri urban and rural

- * Holiday cottages
- * Farms
- * Schools
- * Clinics
- * Underground mining
- * Industry



Enviro-Loo Waterless Sanitation System:-

This is a waterless, zero discharge, and odourless toilet system. Totally environmental friendly, human waste is dehydrated through thermal heat produced in the system and is removed as a dry product. The nutrients thereof are returned to the soil as fertilizer for agricultural purposes. No chemicals are used at ALL. The end product is completely bio-degradable. Suitable for Schools, Game Lodges, Recreational Facilities, Public Conveniences, Homes, Hospitals/health Centres/Clinics. THE ENVIRO-LOO HAS received 5 WORLD AWARDS and is exported to 17 countries in the world. More information and technical data available on request.



Annexure F: Detailed Priority Issues per Local Municipality under Capricorn District Municipality

PRIORITY 1: WATER & SANITATION ISSUES	
Aganang Local Municipality	<ul style="list-style-type: none"> ▪ The main water source is the public tap. ▪ There is an uncontrolled extension of settlements, which poses as a main challenge towards water delivery, especially where water projects have been completed. ▪ Existing water schemes suffer from low pressure with the network as well as inadequate maintenance ▪ Provision of Free Basic Water has not yet begun. ▪ A high number of people have access to pit latrines, which are not within the RDP standards. ▪ Also a significant proportion of people have no access to any form of sanitation facilities.
Blouberg Local Municipality	<ul style="list-style-type: none"> ▪ A number of villages that have no access to clean drinking water are areas like Mosehleng, Silver Mine, New Jerusalem, etc. Pit toilets are mostly used in the area and the areas that has flush toilets is Senwabarwana and Alldays.
Lepelle-Nkumpi Local Municipality	<ul style="list-style-type: none"> ▪ A number of villages do not have access to clean drinking water. 60% of the population does not have access to adequate sanitation services in rural parts of the municipality. ▪ Only areas such as Lebowakgomo enjoy the luxury of water borne sewage system.
Molemole Local Municipality	<ul style="list-style-type: none"> ▪ Out of the 34 settlements, 25 settlements do no have access to clean drinking water. Approximately 75% of the rural settlements are without proper sanitary services. ▪ Pit latrines are commonly used. It is only in areas such as Dendron, Soekmekaar and Nthabiseng whereby waterborne type of sewage is used
Polokwane Local Municipality	<ul style="list-style-type: none"> ▪ 45,2% of all households receives water below RDP standards. ▪ Current bulk supply is insufficient to provide long term requirements for

	<p>large developments</p> <ul style="list-style-type: none">▪ Current supply is sufficient but steps needs to be taken to ensure the long term sustainability▪ Polokwane has adopted a FBS policy in terms of which all rural household water supply, up to minimum RDP standards (i.e. communal standpipe), is free▪ 72% of households in rural areas have sanitation below RDP standards
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Annexure G: Basic Services Cluster

Table: Water & Sanitation Projects

Project No.	Project	CAPITAL INVESTMENT PER FINANCIAL YEAR (R)					Total (R)	Source of funding	Responsible implementing agent
		2005/2006	2006/2007	2007/2008	2008/2009	2009/2010			
DISTRICT MUNICIPAL PROJECTS									
Molemole Local Municipal Area									
MWS – 01	Free Basic Water	850,000	500,000	350,000	0	0	1,700,000	CDM	CDM
	▪ Botlokwa RWS	1,550,000	0	0	0	0	1,550,000	MIG	CDM
MWS – 02	Ramakgopa / Eisleben villages	3,000,000	12,600,000	3,500,000	0	0	19,100,000	CDM	CDM
	Household Sanitation	3,625,900	4,000,000	4,500,000	0	0	12,125,900	MIG	CDM
MWS – 03	Wurtsdorp Regional GWS	2,300,000	0	0	0	0	2,300,000	CDM	CDM
	▪ Fatima – new bulk supply main								
	▪ General upgrading & cost recovery systems	0	0	0	0	0	0		
MWS – 04	Dendron Town								
	▪ Upgrade sewer reticulation X4	3,423,000	0	0	0	0	3,423,000	MIG	CDM
	▪ Retention dam	1,000,000	0	0	0	0	1,000,000	CDM	CDM
	▪ General upgrading & cost recovery systems	0	2,550,000	0	0	0	2,550,000		
MWS – 05	Nthabiseng/Soekmekaar								
	▪ Soekmekaar sewerage reticulation	1,380,000	0	0	0	0	1,380,000	MIG	CDM
	▪ General upgrading & cost recovery systems	0	2,500,000	0	0	0	2,500,000		
MWS – 06	Molemole West Individual GWS								
	▪ Bulk water infrastructure	0	3,020,000	0	0	0	3,020,000	MIG	CDM

Project No.	Project	CAPITAL INVESTMENT PER FINANCIAL YEAR (R)					Total (R)	Source of funding	Responsible implementing agent
		2005/2006	2006/2007	2007/2008	2008/2009	2009/2010			
	<ul style="list-style-type: none"> ▪ Makgalong Water Supply ▪ GaSako water supply General upgrading & cost recovery systems in 20 villages 	0	8,337,110	6,500,00	0	0	8,343,610	CDM	CDM
		0	0	0	0	0	0	MIG	CDM
		0	0	0	0	0	0	MIG	CDM
MWS - 07	Groundwater studies	0	150,000	0	0	0	150,000	DWAF/MIG	CDM
	TOTAL	17,128,900	33,657,110	8,356,500	0	0	59,142,510		

Annexure H: Editing Confirmation

To Whom It May Concern:

From: MM Mohlake
Centre for Academic Excellence
University of Limpopo
Turfloop Campus

Date: 28 March 2007

EDITING CONFIRMATION: Mr MB Molopa

I, MM Mohlake, write this letter to you to confirm that as a professional editor I have meticulously edited the dissertation of Mr MB Molopa (Student No. 9513265) entitled “An Evaluation of the Development of Rural Sanitation at Eisleben Village in Limpopo Province”.

As such, the readability rate of the work will be found to be of a high standard.

Any enquiries please contact me.

Yours faithfully

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