Critical assessment of right to safe water and sanitation in a South African informal settlement: A Case Study of Marikana, Cape Town

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DECLARATION

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DEDICATION

To my father, Brownlee Sikhululo Danti, thank you for believing in me.

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Finally, to God be the glory, for there is nothing I can do without Him, and there is nothing I have without Him.

ABSTRACT

The Bill of Rights in the Constitution of South Africa mandates the promotion of human dignity, equality, and freedom. To attain these three mentioned aspects, the Bill of Rights stipulates that every person has the right to safe water and sanitation and this is done to improve the welfare of every citizen.

South Africa has approximately 13% (7.27 million) of its population staying in informal settlements. Most of these informal settlements were formulated during the land invasion and so on and has since been increasing throughout South Africa. This study sought to assess whether informal dwellers have access to safe water and sanitation, what is the state of the water and sanitation facilities. The assessment was conducted in terms of the Bill of Rights in the Constitution of South Africa and WHO. Marikana informal settlement in Cape Town was used as a case study.

Safe water and sanitation to all remain a challenge in South Africa, notwithstanding the commendable efforts since 1994, to provide access to safe water and sanitation as a right to all people. Based on empirical findings and analysis of relevant documents, the study views the water and sanitation in SA informal settlements as unsafe. The sanitation facilities are inadequate thus contributing to existing open defecation. The coverage of the water and sanitation facilities is not enough, therefore, compromising the right to access safe water and sanitation. The findings show evidence of non-operational water supply infrastructure. The uncleanliness of the existing sanitation facilities contributes to health issues like water-borne diseases. The sanitation facilities lack the human right factor, for an example, facilities are not designed to accommodate the elderly and physical disable people. Though South Africa made commendable progress in providing access to water and sanitation nationally, the inequality in the provision of safe water and sanitation exists; there is lack of freedom due to the poor safety of public facilities and overcrowded settlements, and the protection of human dignity is still an issue in informal settlements.

In general, while the study identifies the existence of comprehensive national legislative and policy frameworks in support of providing safe water and sanitation in informal settlements, there are various challenges such as availability of land, inadequate housing, policy implementation, infrastructure maintenance and so on, that hinder the right to safe water and sanitation and has a possibility to hinder the fulfillment of South Africa’s vision 2030 goal to provide access to piped water and flush toilets by all people.

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Terms and Definitions

The Compulsory National Standards Regulation 3 state that “the minimum standard for **basic water supply services** is -

a. the provision of appropriate education in respect of effective water use; and
b. a minimum quantity of potable water of 25 litres per person per day or 6 kilolitres per household per month -
    - at a minimum flow rate of not less than 10 litres per minute;
    - within 200 metres of a household; and
    - with an effectiveness, such that no consumer is without a supply for more than seven full days in any year.”

Compulsory National Standards Regulation 2 state that ‘the **minimum standard for basic sanitation services is -**

a. the provision of appropriate health and hygiene education; and
b. a toilet which is safe, reliable, environmentally sound, easy to keep clean, provides privacy and protection against the weather, well ventilated, keeps smells to a minimum and prevents the entry and exit of flies and other disease-carrying pests”.

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Acronyms

BNG	Breaking New Ground
CBD	Central Business District
CoCT	City of Cape Town
CoGTA	Cooperative Governance and Traditional Affairs
CS	Community Survey
DWA	Department of Water Affairs
FY	Financial Year
IDP	Integrated Development Planning
IS	Informal Settlement
JMP	WHO/UNICEF Joint Monitoring Programme for water supply and sanitation
MDG	Millennium Development Goals
MFMA	Municipal Finance Management Act
MSA	Municipal Structures Act
NDP	National Development Plan
NGDB	National Groundwater Database
NWA	National Water Act
PFMA	Public Finance Management Act
RDP	The Reconstruction and Development Programme
SA	South Africa
SAHRC	South African Human Rights Commission
SANS	South Africa National Standards
SDG	Sustainable Development Goals
SDI	Slum Dwellers International
StatsSA	Statistics South Africa
UCT	University of Cape Town
UISP	Upgrading of Informal Settlements Programme
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children’s Fund
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organisation
WSA	Water Services Act

1. INTRODUCTION

1.1. Overview of the right to safe water and sanitation

After all the commendable progress in providing access to water and sanitation, UN-Habitat (2016) globally estimated that over 1.1 billion individuals still lack access to water from a clean, safe source, and over 2.6 billion people do not have access to toilets and other adequate sanitation facilities. Approximately 24% of the world's urban population live in unplanned settlements, and by 2030, about 3 billion people will need proper housing (UN-Habitat, 2016).

The genesis of water and sanitation as a human right, globally, can be traced as far as 1977 (Murthy, 2013). Agenda 21 of UN (1992) recognized access to drinking water in quantities and of quality as a human right. In 1992, the Water & Environmental Conference at Dublin recognized the right to access clean water and sanitation. In 2000, the United Nations adopted Millennium Development Goals (MDGs) to reduce indignity and poverty in their nations. The UN leaders declared to reduce the number of people without access to safe water by 50% (UN-Habitant). In 2002, the commitment to safe water was renewed and expanded to include safe basic sanitation (UN Millennium Project). The Constitution of South Africa (1996), section 27 (1) (b) state that "everyone has the right to have access to sufficient food and water" with an aim to improve and respect human rights. Water, much the same as air, is a fundamentally essential for all forms of life and sustenance of wellbeing (Oyeniyi and Oloyede, 2016). Water is life (DWA, SA). Safe water improves health and welfare of people (Gogoi, 2016). The cycle of water usage by people results in sanitation. McFarlane et al., (2014) state that "sanitation is a critical constitutive part of how every day becomes possible". Therefore, safe water and sanitation are core and critical for human survival. Furthermore, safe water and sanitation are critical for social-economic development and they are an indicator of the country's development and progress.

This study did not argue the human right to safe water and sanitation but rather focused on the safety of water and sanitation in South African informal settlements. The assessment conducted is in terms of the Bill of Rights in the Constitution of SA and in terms of WHO and UNICEF (2006) Joint Monitoring Programme (JMP). The study critically assessed the right to safe water and sanitation through focusing on physical accessibility (coverage - distance and time); safety of water (water quality); sufficiency (adequate quantity); acceptability (human dignity – gender, privacy, culturally requirements) and affordability. Additionally, the study focused on water and sanitation system's function and how lack of safe water and sanitation influence the everyday quality of life in informal settlements. The international standards referencing was used because SA is a member of organizations such as WHO, UN etc. The SA informal settlements problems are mainly common but differ in some cases due to geographical, political and economic reasons. To avoid generalizing the South African informal settlement challenges, Marikana informal settlement in Cape Town was used as a case study to assess the right to safe water and sanitation in a South African informal settlement.

1.2. Problem statement and research questions

South Africa (SA) in the Sub-Saharan and a member of United Nations (UN), sought to reduce poverty and inequalities since 1994 by providing basic services such as water, electricity, sanitation, and housing. As per 2016 Community Survey (CS) conducted by Statistics South Africa (StatsSA), 74.4% of SA households access piped water inside their yards and dwellings, while 15.5% have shared access points outside their yards and 10.1% have no access to piped water (CS, 2016). Proportionally to SA population, the households with no access to piped water increased from 8,8% to 10.1% between the year 2011 and year 2016 (StatsSA, 2011; CS, 2016). The provision of flush toilets to the SA households improved compared to a provision of access to piped water. As per 2016 Community Survey, 60.6% of SA households have access to flush toilets connected to sewerage as compared to 57% in 2011. Total of 39.4% does not have flush toilets connected to the sewerage. The 39.4% comprises of chemical, ecological, bucket toilets; pit toilets with and without ventilation etc. Out of the 39.4% households, 2.4% do not have toilets facilities at all and 4.9% toilets are located outside the yards of households (CS,2016). From the Community Survey findings, there are households that do not have piped water to their households or yards and there are households that do not have flush toilets connected to the sewerage. The unavailability of basic services to households resulted in protest in various areas of South Africa. South Africa informal settlements protested most.

Service delivery protest in informal settlements escalated since 2004 (Alexander, 2010 and Hart, 2013). There have been recurrent ‘toilet wars' in Cape Town and various areas of SA. For an example, in 2010, Makhaza in Khayelitsha residents protested because of un-enclosed toilets. In 2013, protestors dumped buckets of human waste at Cape Town International Airports' entrance. Similarly, in 2013, the Ses'khona People's Rights Movement protestors dumped human waste on the doorstep of Western Cape legislature while on numerous occasions the Sannicare janitors, blocked parts of the N2 highway with burning tyres, and dumped human waste on the road. The protestors demanded flush toilets instead of portable toilets. Records of detailed protests mentioned above, and more sanitation issues and cases are available in the Southern African Legal Information Institute (SAFLII) website; GoundUp agency and Abahlali baseMjondolo website; and SA media articles. On a different incident from the protest, SA experienced the death of a 6-year school child from Chebeng Village in Limpopo who fell into a pit toilet in 2014 (SAHRC).

Most of the reported protests are from the informal settlements where an estimated 13% of South African citizens live (CS, 2016). SA has a population of 55.91 million (StatsSA, 2016) which is 8% increase from the 51.8 million population recorded in 2011. Improvements of safe water and sanitation are linked to the eradication of informal settlements through the provision of housing or/and improved planning of rapid settlements (Oyeniyi and Oloyede, 2016). The informal settlements exist in SA and continue to increase instead of decreasing. More than 2700 estimated informal settlement exist in South Africa. On that note, the study sought to assess the right to safe water and sanitation in informal settlements using the below research questions:-

- Due to various reasons e.g., population increase; existing socio-economic constraints; and so on, the illegal land invasion remains to be a challenge in SA. So, after the illegal land occupancy, do the informal dwellers get access to safe water and sanitation?

- The municipalities provide informal dwellers with basic needs that include safe water and sanitation, however, considering the unplanned informal settlement sometimes formed on wetlands with no engineering services; and on private land that cannot be developed until it is procured by the municipality, are the informal dwellers provided with safe water and sanitation?

- Due to high levels of inequality and poverty and other various reasons, the StatsSA through census and community survey findings shows that the unimproved sanitation systems exist e.g. Pit toilets with no ventilation and bucket systems. Through these unimproved systems, people risks raw human waste exposure. Shared water and sanitation facilities exist in informal settlements, so, what is the state of and access to safe water and sanitation in South African settlements water and sanitation services?

- Service delivery protests resulted from portable toilets usage took place and continue in some informal settlements, what is the state of and access to safe water and sanitation in the Southern African informal settlements?

1.3. Objective of the study

The study main objectives were as follows;

- To assess the water and sanitation facilities and its maintenance regimes, thereby identify the problems and challenges related to safe water and sanitation if any;
- Aim to show the status of water and sanitation in a South African informal settlement; thus, in summary,
- To critical assess the right to safe water and sanitation in a South African informal settlement as per the terms the Constitution of South Africa (1996) bill of Rights and as per the terms of WHO and UNICEF (2006) Joint Monitoring Programme (JMP).

1.4. Justification of study

The Constitution of South Africa Act 108 of 1996, Chapter 2 (11) state that "everyone has the right to life". Water sustain life hence the saying "Water is Life". Water is a limited and irreplaceable resource and fundamental to human well-being (UN Water, 2015). Water Services Act 108 of 1997, Chapter 1 (3) state that "everyone has the right of access to basic water supply and basic sanitation".

Water is the most valuable resource and a gift to man while sanitation plays an important role in our lives daily. Safe water and sanitation crucially limit the health Hazards of poor water and

sanitation and hygiene. Drinking contaminated water or/and poor sanitation cause water-borne diseases to households. All major initiatives to improve global health depend on basic WASH services (WHO and UNICEF, 2015). The mentioned recurrent protests in informal settlements justify a research to describe and show the state of and access to safe water and sanitation in a South African informal settlement.

In 2001, SA government adopted a policy of providing free basic services to all targeting the poor households because most people could not afford to pay rates for water, electricity, sanitation, and waste solid management. The formulation and implementation of water and sanitation policies continue. Therefore, the policy-makers, different organisation and individuals working towards the fulfilment of the right to safe water and sanitation will benefit from this research.

1.5. Outline of the study

The study is divided into the following sections:

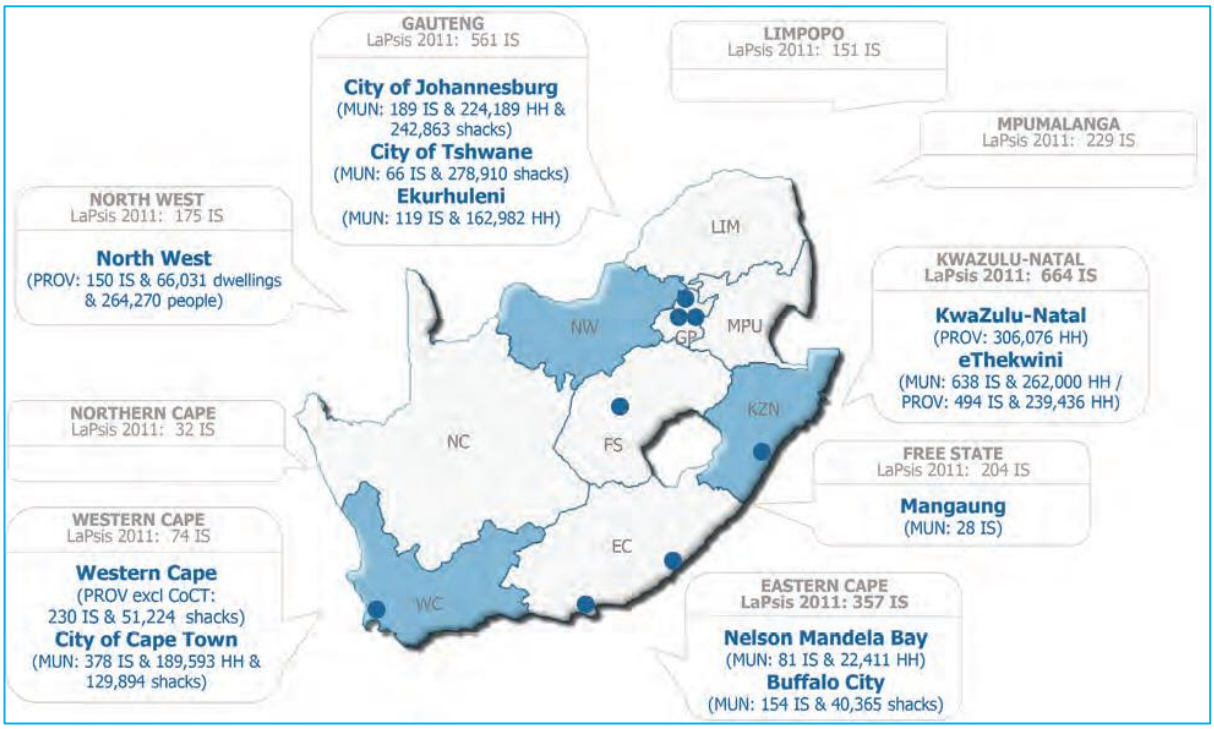
- Introduction – This section outlines the background to safe water and sanitation and informal settlements in South Africa. The objective of the study. The brief history of SA water and sanitation that justifies this study;
- The motivation and description of the study area;
- Literature review – this section summarizes previous research that was conducted on assessment of safe water and sanitation to all including informal settlements dwellers. SA policy, frameworks, and legal context review. Contextualizing access to water and sanitation in SA;
- Research methodology – specifies the steps undertaken for data acquisition and data collection methods;
- Research findings – this section covers the analysis of the data and discussion of the findings from the study; and
- Conclusion – summarizes the study and its findings.

2. MOTIVATION OF THE STUDY AREA

2.1. Overview of informal settlements in South Africa

Informal settlements are widely located throughout SA. An estimated 13% of South African citizens living in informal settlements (CS, 2016). These settlements exist due to various reasons that include post-apartheid, socio-economic pressures (SDI, 2012), migration to urban areas for employment opportunities and so on. In 1994 there was approximately 300 informal settlement; 2700 informal settlement in 2012 (Topham, 2011 and Khan, 2014;). Due to the rate of population increase, unemployment increases and so on, during the study, South Africa had more than 2700 estimated informal settlement.

Figure 1: Lapsis estimated number of Informal Settlements in 2011



Source: Lapsis (2011), Provincial and Municipal data.
IS = Informal Settlement

There has been an ongoing formulation of legislative and policy frameworks relevant to housing in SA. The Housing Act 107 was formed in 1997 and the National Housing Code was later formed in 2001. There have been various housing assistance programmes since 1994. These programmes include Reconstruction and Development programme (RDP) in 1994; the Breaking New Ground (BNG); A Compressive Plan for the Development of Sustainable Human Settlement in 2004 and Upgrading of Informal Settlements Programme (UISP). Considering that the provision of water and sanitation in informal settlements is a challenge to municipalities, UISP funds municipalities for upgrade informal settlements in situ, provides tenure and improved access to services in collaboration with communities. Additionally, the National Upgrading Support Programme (NUSP) was introduced in 2010 to support the National Department of Human Settlement (NDHS) in its implementation of the UISP with an objective of

eventually upgrading all informal settlements in the country. However, SA still has non-upgraded informal settlements. Ferguson (2015) suggest that in Southern Africa a class of landless and jobless people is here to stay. In 2006, 25% of Cape Town population resorted to overcrowded informal settlement or backyard shacking or land invasions (Borrainne et al., 2006). Affordable land for landless and jobless people is scarce. The set National Development Plan and SA municipal Integrated Development Plans (NDP and IDPs) relating to safe water and sanitation heavily rely on the availability of land for housing development plans thus upgrading informal settlements.

2.2. Marikana settlement

Marikana's history started from November 2012 where land invasion took place, but it was legally destroyed. The wave of invasion took place again on the 27th of April 2013, which is the same day South Africans celebrate Freedom Day. The settlement is named after the Marikana miner's strike. So, the Marikana informal settlement was established on the 27th of April 2013. Marikana is in Ward 35. It is situated in one of the largest township known as Philippi East in Cape Town. Marikana is approximately 7kms away Cape Town international airport and 20kms from the city of Cape Town CBD. The settlement is a home to a multi-racial community and it is located on private land. The history of Marikana settlement is complex. For an example, during the study, the court case of illegal invasion filed by the private land owners was still open; many people and households could not be relocated or evicted; and the CoCT provided temporary services as it could not permanently provide services on private land. The study did not focus on the in-depth Marikana history complexities.

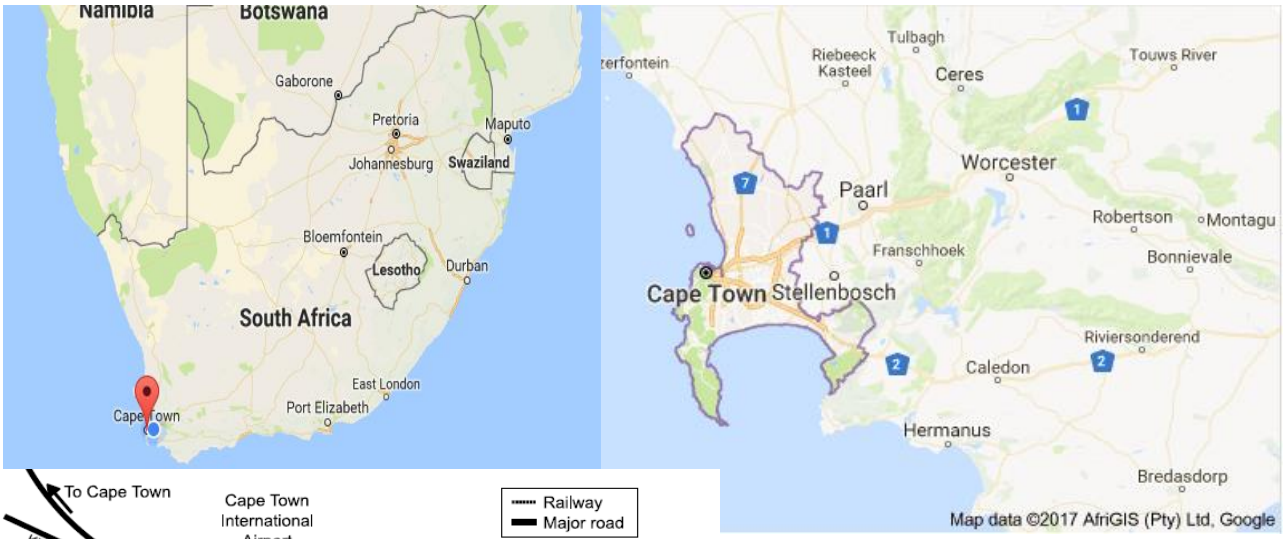
The Marikana informal settlement has approximately 8000 households and 60000 residents as per the Cape Town High Court Report of February 2017. It has an estimated area of 62.66ha with 128 households per ha. Since Marikana was formed in 2013 after the 2011 census, the in-depth population characteristics i.e. age, gender, employment, and education levels, demographics and precise population size and projection could not be found. During the study, the settlement had a total number of 48 standpipes, each standpipe having 2 taps and a total number of shared 386 toilets.

Marikana was selected as a case study because it resulted from invasion of private land; it reflects the infrastructure and service delivery challenges experienced by the settlement dwellers. There has also been a rapid expansion of the area and its population continues to grow. The settlement is on non-surveyed and non-residential area. It has dense shacks that are difficult count. The settlement has a non-zoned physical layout and environmental pollution. In terms of the UISP in the National Housing Code (2009) the following basis such as informality; inappropriate locations; restricted, and private sector investment; poverty and vulnerability; and social stress qualify the area as an informal settlement. Marikana`s general characteristics have similarities with other informal settlements in SA.

The physical location of the study area is shown in figure 2 and 3

2.3. Description of the study area

Figure 2: Location of study area in its national and reginal context



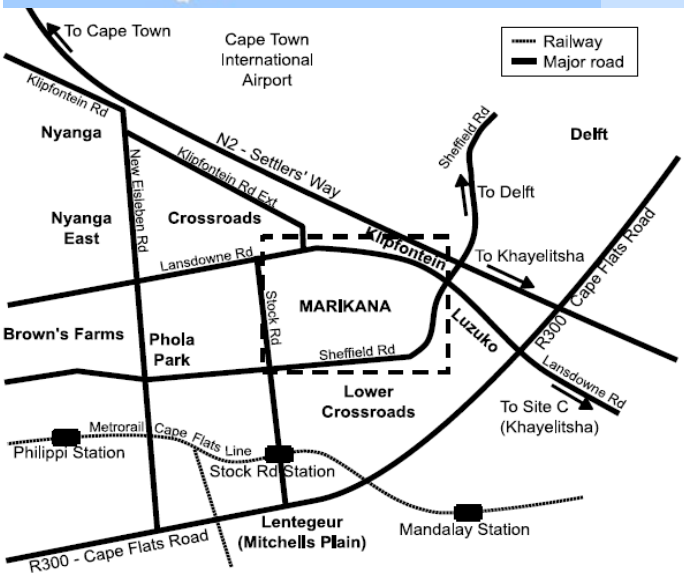


Figure 3: Schematic map of Marikana and surrounding by Teo (2015)

Marikana in the dashed box is to the south of the Cape Town International Airport and west of Khayelitsha. Its boundaries follow along Lansdowne road (now Govan Mbeki road) with Sheffield road as its south boundary, and the Stock road to the west (Teo, 2015).

3. LITERATURE REVIEW

To proceed, this chapter explains why safe water and sanitation are a statutory right to all people; provide various interpretations of safe water and safe sanitation, and provide South African legal context with respect to right in safe water and sanitation. The chapter further provides reviews on SA vision 2030; governmental roles and responsibilities; maintenance and sustainability of infrastructure and lastly contextualize access to water and sanitation in South Africa.

3.1. Statutory right to safe water and sanitation

“The human right to water entitles everyone to sufficient, safe, acceptable, physically accessible, and affordable water for personal and domestic uses” (UN, 2002). Water is required for each personal or domestic use. The “quality and availability of the water services are of extreme importance for the quality of human life and living standards” (CS, 2016). Human beings cannot survive without water. As stated in this study, “the cycle of water usage by people results in sanitation”. Therefore, safe water and sanitation are core and critical for human survival. Safe sanitation is interconnected to safe water and refuses removal. Refuse removal is the removal of ‘domestic waste’ called ‘refuse’ in SA policies. Refuse removal contributes to the public environment state. Cleanliness of the environment is important to the country as it contributes to public health. Unsafe water and sanitation cause health issue such water-borne diseases etc. Public health is a governmental responsibility. Safe sanitation is, therefore, a key component of public health. The integration of safe water, safe sanitation and refuse removal is critical for social-economic development and they are an indicator of the country’s development and progress. The South Africa legal context related to the statutory right to safe water and sanitation is elaborated in this study.

3.1.1. What is safe water

Hrudey et al., (2012) interpret safe drinking water as “water of such consistent quality, posing no significant health risk, that a reasonable, accurately informed consumer need have no health concerns sufficient to justify seeking alternatives”. Martin (2011) defines safe water as “water that will not harm you if you encounter it”. Martin (2011) further state that “the water must have sufficiently low concentrations of harmful contaminants to avoid sickening people who use it”.

“Safe water” quality is defined by country’s national standards which also assess the colour, odour and taste of the water. Most global standards state that safe water must be free from micro-organisms and hazardous chemicals that pose a threat to person’s health. Some countries like SA has joined international bodies to benchmark their water quality standards. The World Health Organization (WHO) “international norms on water quality and human health” guides on the basis for the development of regulation and water quality standards globally.

These guidelines have a possibility of ensuring safe water and sanitation if they are implemented properly.

WHO (2011) state that “safe drinking water, is water that does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages.” WHO and UNICEF (2006) further defines the “improved access” to water and sanitation as a representation of a “households that obtain water from sources that are superior to traditional. Sources that meet the definition of improved water include a household connection, borehole, protected dug well, protected spring, or rainwater collection”.
Martin (2011) points out that the safe water levels differ to individuals meaning that “water that is safe for one person may be unsafe for another”. The term ‘safe water’ mostly applies to drinking water, but it could also apply to water for swimming or other uses. Right to safe water in informal settlements goes beyond the household needs and means accessibility to water for emergencies e.g. fire outbreak. Urbanised areas have fire hydrants, roads for fire trucks when there are fire outbreaks whilst, informal settlements do not.

3.1.2. What is safe sanitation

WHO and UNICEF (2011) defines improved sanitation as “connection to a public sewer or septic system or use of ventilated pit latrines and some simple pit latrines qualify as improved sanitation”. Public or Shared toilets and bucket latrine are defined as unimproved sanitation facilities.

Sanitation can be defined as the promotion of hygiene through the prevention of human contact with hazards of waste especially faeces by proper treatment and disposal of the waste, whilst (Dictionary, 2017) defines sanitation as “the development and application of sanitary measures for the sake of cleanliness, protecting health, etc. and the disposal of sewage and solid waste”. WHO defines sanitation as what “also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal”. Safe sanitation relies on water supply. Water is used for hand washing and hand washing is important for health and hygiene. The National Sanitation Policy (1996) and White Paper on Basic Sanitation (2001) defines sanitation as “the principles and practises relating to the collection, removal or disposal of human excreta refuse and wastewater, as they impact upon users’ operators and the environment”. NSP (1996) further define adequate sanitation as “the provision and ongoing operation and maintenance of a system of disposing of human excreta, wastewater, and household refuse, which is acceptable and affordable to the users. The system must be structurally safe, hygienic and easily accessible. **Each household should have access to its own facilities**. Furthermore, it should be accompanied by correct hygienic practises and does not have an unacceptable impact on the environment”.

The right to sanitation is key. “Sanitation is dignity” (DWA, SA). SAHRC (2014) state that “dignity is the recognition of the inherent worth and value of every human being”. Safe sanitation is the cleanliness of the entire sanitation system. Therefore, the facilities and infrastructure (e.g. toilets) needed in the sanitation system need to be clean. Cleanliness of sanitation system, for

an example, public or shared toilets is important. Dirty toilets that justify unsafe sanitation are health risks to the users. Competence of cleanliness behavior by users of shared toilets improves safe sanitation thus prevents health and hygiene diseases. Access to safe water and reliable sanitation system through proper maintenance contributes to safe sanitation.

The cleanliness of water and sanitation heavily rely on a clean environment. If the environment is unclean, it contributes to the contamination of the household environment which can result in airborne diseases. In areas where there are no owned or shared waste bins and communal containers, groundwater and stormwater get polluted through seepage, run-off, and flood during heavy rains (Oyeniyi and Oloyede, 2016). There is a potential spread of diseases (Fawcett, 2011) in high dense informal settlements. Although, there are numerous interlinked issues in country' informal settlements e.g. water and sanitation that determine the country's development and human rights status, concurring with Gandhi (1925) "sanitation is more important than independence".

3.2. Legal context with respect to right to safe water and sanitation

There are various legislative frameworks pertaining to water and sanitation especially of water. The fundamental legislative for water and sanitation is Constitution of SA Act 108 1996, Water Services Act 108 of 1997, National Water Act of 1998, National Sanitation Policy (1996), White Paper on Basic Household sanitation and National Treasury that is the main source of funds for the all government spheres.

3.2.1. The Constitution of South Africa (Act 108 of 1996)

The Bill of Rights in the SA Constitution Chapter 2 promotes human dignity, equality, and freedom. These rights are the cornerstone of SA's democracy.

SA Constitution section 10 state that "Everyone has inherent dignity and the right to have their dignity respected and protected"

SA Constitution section 11 state that "everyone has a right to life". Life is sustained by many things that include water hence the saying "Water is Life" and Water is a finite and irreplaceable resource that is fundamental to human well-being (Un Water, 2015).

Chapter 2, section 24 state that "everyone has right to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".

SA Constitution, section 26 (1) state that “everyone has the right to have access to adequate housing”. Section 26 (2) state that “the state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realisation of this right”.

The Constitution of SA (1996), section 27 (1) (b) state that “everyone has the right to have access to sufficient food and water” and section 27 (2) state that “the state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realisation of each of these right”.

The Bill of Rights in the Constitution of SA has sections which overlap and support the right to water and sanitation. However, the constitution is not explicit about the **right to sanitation**. The stated rights to water and environmental have been associated with the right to sanitation. With the word ‘sanitation’ derived from the Latin word *‘Sanus’* meaning ‘safe’ safe sanitation is linked to safe environment and safe water.

The Constitution of SA further appoints state institutes to support constitutional democracy, for an example, the South African Human Rights Commission (SAHRC). As per section 184 of SA Constitution, SAHRC functions are “to promote respect for human rights and a culture of human rights; promote the protection, development, and attainment of human rights; and monitor and assess the observance of human rights in the Republic”. The stated sections confirm the statutory right to water and sanitation.

3.2.2. Water Services Act 108 of 1997 (WSA)

WSA chapter 1 (3) state that “everyone has a right of access to basic water supply and basic sanitation”. However, due to illegal informal settlements, it has been noted that after occupancy of land, the informal dwellers do not always have access to safe water and sanitation. The absence of access to safe water leads to unsafe water sources that have cause health issues in the past. Water Services Act (No. 108 of 1997) “provides a regulatory framework for water services institutes and water services intermediaries”. The frameworks set in WSA interconnect the spheres of SA government. National, Provincial, and Local government share the obligation of the right of access to a basic supply of water and basic sanitation.

3.2.3. National Water Act (NWA) No. 36 of 1998

National Water Act (1998) recognizes that “water is a natural resource that belongs to all people, the discriminatory laws and practises of the past have prevented equal access to water, and use of water resources” therefore ensures the necessary protection of the quality of water resources and their sustainability for the interest of all water users. Department of Water Affairs (DWA) is responsible for the setting of national policy frameworks and standards for the delivery of water services. DWA Assessment Guide (1998) defines the term “water quality” as a term used “to describe the microbiological, physical and chemical properties of water that determine its fitness for use”.

The delivery of water services to the community is shared through intergovernmental roles and responsibilities. These government are the Department of Cooperative Governance and Department of Traditional Affairs (CoGTA) which have its mandate stated in SA Constitution Chapter 3; a Provincial government that has its mandate derived from Chapter7; a Local government with a mandate instituted from Chapter 7 and Traditional Leaders with a mandate derived from Chapter 12 of the Constitution. Part of section 152 (1) (b) of the SA Constitution enjoins local government to “ensure the provision of services to communities in a sustainable manner” and to “promote a Safe and safe environment”.

3.2.4. National Health Act (NHA) 2003

The NHA (2003) state the services to be provided by municipalities. These municipal health services include “water quality monitoring; waste management; environmental pollution control” and so on. National, provincial, and local government share the health services. Section 32 (1) of the Constitution of SA state that “every metropolitan and district municipality must ensure that appropriate municipal health services are effectively and equitably provided in their respective areas. Though there are intergovernmental roles regarding water quality monitoring, the Act provides a framework for a structured uniform health system within South Africa.

3.2.5. National Environmental Management Act 107 of 1998 (NEMA)

NEMA makes provision for co-operative and environmental governance. NEMA defines ‘environment’ as the “surroundings within which humans exist and that are made up of the land, water and atmosphere of the earth”. The environment influences the human health and well-being. Therefore, safe environment is critical.

The Department of Environmental Affairs (DEAT) is responsible for the implementation and management of NEMA. DEAT has a mandate to “support municipalities with planning and implementation of solid waste management and monitor their performance and compliance”.

3.2.6. Housing ACT No 107 of 1997

The Housing Act provides sustainable housing development processes for housing development in all spheres of government. The Housing Act is derived from section 26 of the Constitution of SA stating the provision of adequate housing which is a right for everyone.

3.2.7. National Sanitation Policy (NSP) 2016)

Due to more work that needed to be done and clarified in the White Paper on Water Supply and Sanitation Policy published in November 1994, and the need to develop a national sanitation strategy, the National Sanitation Policy was formed in 1996. Sanitation challenges continued even after the White Paper on Basic Sanitation formed in 2001. To address the policy gaps and

challenges; and the country' new national and international and international development imperatives, the policy was reviewed and updated in 2016.

3.2.8. National Treasury of South Africa

The National Treasury is responsible to fund different departments and spheres of government. National Treasury is mandated "to facilitate the Division of Revenue Act, which provides for an equitable distribution of nationally-raised revenue between national, provincial, and local government; and to monitor the implementation of provincial and local budgets".

The National Treasury offers Human Settlement Development Grant (HSDG) which is administered by DHS. The HSDG's purpose is to provide funding for the creation of sustainable and integrated human settlements. There is also Urban Settlements Developments Grant (USDG) offered by National Treasury and administered by DHS. The USDG aim to assist metropolitan municipalities to improve household access to basic services through the provision of bulk and reticulation infrastructure and integrated urban development by supplementing the budgets of metropolitan municipalities. The grants from national treasury are not directly offered to local government.

Department of Cooperative Governance and Department of Traditional Affairs (CoGTA) administers the Municipal Infrastructure Grant (MIG) that is offered to the municipalities to "provide specific capital finance for eradicating basic municipal infrastructure backlogs for poor households, micro enterprises and social institutions servicing poor communities". MIG requires municipalities to ensure appropriate programme and project planning and implementation readiness prior to the year of implementation and this must be informed by the IDP and three-year capital plan.

The funding to infrastructure developments; upgrades and improvements; and maintenance with one main goal to offer services to people is intergovernmental shared. Department of Human Settlement (DHS), Department of Water and Sanitation (DWS) and CoGTA have a mandate to ensure that there is no duplication of funding. The approval and allocation of funds are made through a joint committee. Additional, the Public Finance Management Act (PFMA), Municipal Finance Management Act (MFMA), Municipal Structures Act (MSA) guide the spheres on the management of funds. Though the local government get the funding from the national and provincial government, section 152 (2) of SA Constitution mandates the local government to strive to achieve the objects set in section 151 (1) within their financial and administrative capacity.

Having reviewed the statutory right to safe water and sanitation and the definitions to safe water and sanitation, the rest of the chapter will then review the other contributors to the right to safe water and sanitation such as SA NDP -Vision 2030; intergovernmental roles and responsibilities; infrastructure and sustainability; and lastly contextualize the state of access to water and sanitation.

3.3. South Africa Vision 2030 – National Development Plan

The SA National Development Plan implemented in 2013, is committed to achieving a minimum standard of living through a multi-pronged strategy. South Africa National Development Plan adopted the UN Agenda 2030 – Sustainable Development Goals. The SA NDP state that "before 2030, all South Africans **will have affordable, reliable access to sufficient safe water and hygienic sanitation**. Service provision arrangements will vary in different parts of the country, with different approaches adopted for densely built-up urban areas and scattered rural settlements. Local governments will retain responsibility for ensuring service provision in their areas and, in many cases, will continue to manage the services directly". The NDPs' Medium Term Strategic Framework (2014 – 2019) has 14 outcomes that include outcome 8 - sustainable human settlements and improved quality of household life. **Outcome 8 state that all households will have all basic services needed by 2030**. The NDP speak less of the action plans to be taken beyond year 2019. Who will assess the success of the Medium Term Strategic Framework? It is not clear if SA have the detailed program of action plans towards year 2030 or not. Meeting sustainable development goals rely on a program and action plans that can be monitored and evaluated when there is a need e.g. to factor changes like increase of population or/and economic constraints etc.

Goal 6 of the SDGs calls for universal and equitable access to safe and affordable drinking water for all and calls for universal access and adequate sanitation and hygiene for all and an end of open defecation, paying special attention to the needs of women and girls and those in vulnerable situations by 2030. In 13 years from the time of this study, the South Africa's NDP aims to eliminate poverty and reduce inequality. These goal 6 targets are not clear in the SA NDP. In the researcher's view it is not clear if SA will align vision 2030 goals to fulfill the NSP (1996) goal that defined adequate sanitation as "the provision and ongoing operation and maintenance of a system of disposing of human excreta, wastewater, and household refuse, which is acceptable and affordable to the users. The system must be structurally safe, hygienic and easily accessible. Each household should have access to its own facilities. Furthermore, it should be accompanied by correct hygienic practises and does not have an unacceptable impact on the environment". Will **all South Africans have access to clean running water (piped water) and flush toilets (connected to the sewerage) in their homes**? It also not clear if the shared facilities such as toilets, allocated at 200m away from households will remain as SA minimum national standards or will be eradicated considering the introduced UISP. Some urban municipalities comply with national minimum standards, it is not clear on how the NDP will target and achieve the provision of basic needs to the poor rural and peri-urban municipalities embattled by financial, capacity etc. constraints. The researcher note that through system thinking dynamics approach, vision 2030 goals can be achieved, however, that will be a challenge without clear action plans that can be implemented, monitored and evaluated.

3.4. Government roles and responsibilities

South Africa's intergovernmental system is complex. The behavior (functioning) of any activity of the system depends on how the functions interact with each other. South Africa has formulated legislation enforcing integration through the integrated development planning (IDPs). The national departments such as Department of Health, National Treasury, Department of Water Affairs, Department of Human Settlement and CoGTA are interconnected to the provision of water and sanitation. These national departments are interconnected towards the provision and sustainability of water and sanitation. Water and sanitation governance is broad. This section provides an overview of different government roles and responsibilities; and highlight the challenges experienced by these few players mainly focusing on the local municipalities.

South Africa has 278 municipalities comprising 8 metros, 44 districts, and 226 local municipalities. Simoen and Murray (2001) argue that multi-level governance has been a problematic arrangement in SA because "provinces and local government have weak political, administrative, and fiscal capacities". Prior 2004, it was noted that the provincial and national department were not fulfilling their constitutional duty to support local municipalities. Project Consolidate (Sonjica, 2005) was formed to address the intergovernmental relations between municipalities. Furthermore, in 2005, the Intergovernmental Relations Framework Act (Act No. 13 of 2005) was introduced to promote alignment of national, provincial, and local plans and expenditures. Local municipalities needed support to overcome the backlogs of service delivery and continuously need support implement the IDPs.

Even though there are developments made in building cooperation between national and provincial government, the coordination and integration of local government activities with other spheres are still limited and uneven (Tapscott, 2000). The MFMA (2015-16) reports that "a total 45 municipalities did not receive any support from the cooperative governance departments or any of the treasuries.

Local municipal by-laws are mandated to be aligned to the provincial and national legislation. By-laws not in alignment and conflicts with provincial and national legislation are invalid. Whilst section 152 (3) state "a municipality has the right to govern, on its own initiative, the local government affairs of its community", local government is still subjective to national and provincial legislation, as provided for in the Constitution. Meaning, though local government is mandated to provide water and sanitation to people, local government works through frameworks that do not have much flexibility to allow local government to improve water and sanitation services (CER).

From the reports of Auditor-General South Africa (AGSA) it is noted that the local government with a huge mandate to provide services to the communities do not "generate enough revenue to fund all its operations and capital projects" (MFMA 2015-16). For some municipalities, e.g. Mbhashe municipality in Eastern Cape, the less revenue generation results from the high unemployed people that fall under the Indigent Policy.

The grants provided by the national government to municipalities are for specific purposes. However, the MFMA (2015-16) reports that grant funding is not always used for its intended purpose, e.g. “Thaba Chweu (Mpumalanga): The total amount of R16 million in funding received for water infrastructure projects was instead used for road projects”.

The MFMA (2015-16) further reports that “over 50% of 278 of the municipalities responsible for providing water did not have the basic policies and plans in place to ensure that maintenance of water infrastructure took place”. Local municipalities have vacancies in key positions and have leadership issues. The report shows municipalities that received a disclaimer for the past three years. Instead of improvements from the 278 municipalities, 38 (13%) regressed (MFMA 2015-16) and 185 municipalities audit issues remained unchanged.

The effects of political changes are not set in alignment or favour of the legislative and policy frameworks related to infrastructure developments e.g. the impact caused by the political member’s approving the integration plans whereas they are elected to serve for five years is huge. The formed working relationships get affected whenever there is a change in political members. Effective water and sanitation needs sustained and meaningful political commitment over the relatively long-term span.

Although there are numerous challenges in municipalities, the mandated objectives are always expected. Local government is mandated to promote the Bill of Rights, which reflects the nation's values of human dignity, equality, and freedom; and uphold the principles enshrined in the Constitution. Local municipal reflects the South African society which has consistently shaped the design and impact of policies. Powell (2012) define local government as “mirror of the larger political and economic forces, cleavages, and problems that are shaping SA” (Powell, 2012). The failure to comply with the mandate requirements violates the right to human dignity, freedom, and security particularly for people living in informal settlements. Good governance is key, it is therefore that the IDP Format Guide state that good governance is about governing the area and its citizens in accordance with the spirit of the Constitution of SA.

Although the study did not thoroughly criticize the intergovernmental challenges impacting on the right to safe water and sanitation, with evidence, there are issues affecting the provision of safe water and sanitation to people as their human right. Meadows (2001) mentions that “pretending you are in control even when you aren’t is a recipe not only for mistakes but for not learning from mistakes”. Through a full in-depth thesis, the intergovernmental challenges impacting the right to safe water and sanitation can be unpacked.

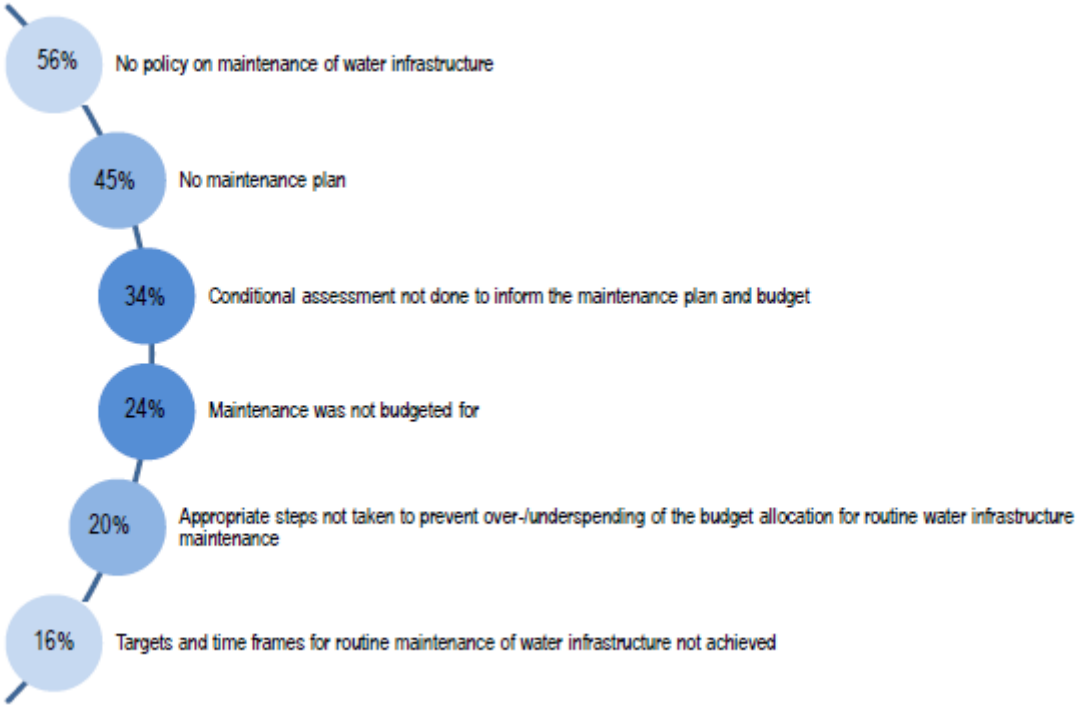
3.5. Maintenance and sustainability of infrastructure

SA National Infrastructure Maintenance Strategy (NIMS) state that “service delivery needs to be universally understood as embracing not just constructing the infrastructure, but the appropriate operation and maintenance thereafter, for the whole design life of the asset”. Therefore, infrastructure maintenance is key, and it must be ongoing.

Jackson (2014) asks “who maintains the infrastructures within and against which our lives unfold?”. Poor infrastructure maintenance raises economic concerns, safety concerns, health concerns, environmental concerns that can lead to death. Maintenance of municipal infrastructure benefits social life; protects the environment; contributes to economic growth as it creates jobs thus alleviating poverty and maintained municipal infrastructure by **local government** improves service delivery to local communities.

Infrastructure is a public asset which is also the second pillar indicator used for judging a country’s development and competitiveness. Therefore, the obligation to service delivery should go together with maintenance of infrastructure. Having said that, UNDP (2015) report that 30 to 50 percent of water and sanitation programs fail to bring sustainable benefits to the people they seek to serve. Research has shown that after two to five years projects fail due to sustainability issues resulting from lack of good governance (UNDP, 2015). Optimally designed and well-managed infrastructure is the key to meet the demand for safe water and sanitation in informal settlements (Bentley). The MFMA (2015-2016) also report various maintenance challenges on SA water infrastructure (Refer to figure 4).

Figure 4: Findings on maintenance of water infrastructure



Source: MFMA 2015-16 report (148 SA local municipalities audited in 2015-16FY)

SA is a committed member of all significant regional, continental, and multilateral institutions, for economic and benchmarking interest. SA is a member of UN, WHO etc. SA committed to international obligations on water and sanitation such as Millennium Development Goals prior 2015. In 2015, SA reduced the number of people without access to water and sanitation thus achieved the target that was set (MDG: Country Report, 2015). SA is also committed to the post-MDGs sustainable development goals. The SA National Development Plan (NDP) vision

2030 is aligned to SDG's. SA is also under Global Competitiveness Index, ranking 68 in 2nd pillar: infrastructure and ranks 126 in 4th pillar: health and primary education (Global Competitiveness Index, 2015-2016). These commitments have the potential to improve infrastructure maintenance regimes and provide sustainable infrastructure.

3.6. Contextualizing access to water and sanitation in SA

"Prior to the advent of democracy, there was no reliable information available about South Africa as a whole" (StatsSA). The post-apartheid SA conducted its first population census in 1996. Other censuses were conducted in 2001 and 2011 with a (StatsSA) "aim to provide comprehensive data for improved planning and to aid development". Recently SA conducted Community Survey (CS) in 2016 which was a large-scale survey with an objective to "provide population and household statistics at municipal level" and "to support planning and decision making" (CS 2016). Extract of the census and community survey are presented below to show the state of access to water and sanitation in SA.

3.6.1. The state of access to water in SA

SA government have made commendable progress to provide access to water for its people. CS (2016) shows that there are improved sources of drinking-water in SA. Improved sources of drinking water are defined as piped water into dwelling, piped water to yard/plot, public tap, or standpipe, protected dug well and bottled water (WHO and UNICEF, 2006).

Table 1: Distribution of households with access to piped water

Access to piped water	Census 1996	Census 2001	Census 2011	CS 2016
Inside the dwelling	3 976 855	3 617 603	6 684 621	7 511 853
Inside the yard	1 491 228	3 253 861	3 918 480	5 081 255
Access point outside the yard	1 765 945	2 594 904	2 581 146	2 625 645
No access to piped water	1 773 520	1 739 337	1 265 915	1 704 556
Total	**9 007 548**	**11 205 705**	**14 450 162**	**16 925 325**

Source: Community Survey 2016 – P0301

Table 1, shows that households with no access to piped water decreased from 19.7 % in 1996 to 10.1% in 2016. 1 773 520 out of 9 007 548 households had no access to piped water in 1996 and as per the last survey 1, 704 556 out of 16 925 325 households had no access to piped water in 2016. Additionally, there is continuous progress in water access inside the yard and progressive decrease of access point outside the yard.

Table 2: Distribution of households by province and access to piped water

Province	Inside dwelling	Inside yard	Access point outside the yard	No access to piped water	Total
Western Cape	1 487 774	224 317	201 963	19 822	**1 933 876**
Eastern Cape	592 428	318 877	419 922	442 167	**1 773 394**
Northern Cape	154 529	118 603	60 276	20 301	**353 709**
Free State	357 926	499 067	53 589	36 056	**946 638**
KwaZulu-Natal	1 076 667	828 016	552 667	418 493	**2 875 843**
North West	300 221	496 725	278 021	173 799	**1 248 766**
Gauteng	2 972 973	1 472 450	380 771	124 943	**4 951 137**
Mpumalanga	359 033	550 353	181 507	147 969	**1 238 862**
Limpopo	210 302	572 846	496 929	321 006	**1 601 083**
South Africa	**7 511 853**	**5 081 254**	**2 625 645**	**1 704 556**	**16 923 308**

Source: Community Survey 2016 – P0301

The Compulsory National Standards Regulation 3 state that "the minimum standard for basic water supply services is –

a. the provision of appropriate education in respect of effective water use; and
b. a minimum quantity of potable water of 25 litres per person per day or 6 kilolitres per household per month –
    i. at a minimum flow rate of not less than 10 litres per minute;
    ii. within 200 metres of a household; and
    iii. with an effectiveness, such that no consumer is without a supply for more than seven full days in any year."

3.6.2. The State of access to sanitation in SA

Although poverty and inequality challenges exist in SA, SA municipalities continue to provide access to sanitation for households. Access to sanitation is a human right. Access to safe sanitation improves quality of human life. The survey of types of sanitation systems used in SA (National Sanitation Policy, 1996) state that unimproved pits (traditional) and bucket system do not provide adequate sanitation.

Table 3: Distribution of households with toilet facilities

Toilet facilities	Census 2001		Census 2011		CS 2016	
	N	%	N	%	N	%
Flush toilet (connected to sewerage)	5 500 012	49,1	8 242 924	57,0	10 260 829	60,6
Flush toilet (with septic tank)	312 986	2,8	442 481	3,1	461 934	2,7
Chemical toilet	218 387	1,9	360 703	2,5	713 856	4,2
Pit toilet with ventilation (VIP)	635 957	5,7	1 266 102	8,8	2 063 128	12,2
Pit toilet without ventilation	2 557 476	22,8	2 786 068	19,3	2 315 279	13,7
Ecological toilet	0	0,0	0	0,0	49 277	0,3
Bucket toilet	457 376	4,1	297 847	2,1	377 231	2,2
Other	-	0,0	305 444	2,1	271 895	1,6
None	1 523 512	13,6	748 592	5,2	409 881	2,4
Total	**11 205 705**	**100,0**	**14 450 161**	**100,0**	**16 923 309**	**100,0**

Source: Community Survey 2016 – P0301

Table 3 shows that 60,6% of households in 2016 had access to flush toilets connected to sewerage system as compared to 57% in 2011. There is a decline of household using pit toilet without ventilation and decline of households with no toilets. As of 2016, only 2.4% have no toilet facilities as compared to 13.6% in 1996. It is mandated by local government to ensure that all households in SA have access to decent toilets.

The location of toilets is very important for various reasons that include physical safety from crime, considering all people, especially children and those that are physical disable; physical safety from walking at night in the dark considering that there are no street lights in the informal settlements, it is therefore required that sanitation must be within 200 metres of each household as stated by the Compulsory National Standards Regulation 2.

Table 4: Distribution of households by location of toilets and type of the main dwelling

Toilet location	Formal dwelling		Traditional dwelling		Informal dwelling		Other		Total	
	N	%	N	%	N	%	N	%	N	%
In the dwelling	7 319 207	55,4	32 412	3,0	136 544	6,6	30 818	23,1	**7 518 981**	**45,6**
In the yard	5 724 289	43,3	951 805	88,5	1 400 167	67,8	89 752	67,3	**8 165 993**	**49,5**
Outside the yard	177 250	1,3	91 611	8,5	528 295	25,6	12 866	9,6	**810 022**	**4,9**
Total	**13 220 726**	**100,0**	**1 075 828**	**100,0**	**2 065 007**	**100,0**	**133 436**	**100,0**	**16 494 996**	**100,0**

Table 4, indicates that 49.5% of toilets facilities are in the yard while the 45.6% is inside the dwelling/house. In the informal dwelling, 25,6% of toilets are located outside the yard. This is highest compared to formal dwelling, traditional dwelling, and others.

The Compulsory National Standards Regulation 2 state that “the minimum standard for basic sanitation services is -

a. the provision of appropriate health and hygiene education; and
b. a toilet which is safe, reliable, environmentally sound, easy to keep clean, provides privacy and protection against the weather, well ventilated, keeps smells to a minimum and prevents the entry and exit of flies and other disease-carrying pests”.

3.7. Summary

The right to safe water and sanitation literature has various interpretations but they are relevant to the study. The literature review shows that the interpretations of safe water are derived from one or more of the following parameters: - accessibility, sufficiency, quality of water, acceptability, and/or affordability. The literature review lacks definitions of safe sanitation. The South African legal context to safe water and sanitation exist, however, there is no explicit definition of safe sanitation. Safe sanitation is associated with a safe environment with no

pollution. This chapter reviewed the definitions of safe water and sanitation in the view of other authors.

From the reviews, it is evident that water and sanitation are interrelated. Additionally, sufficient provision, thorough monitoring, and ongoing maintenance of water and sanitation infrastructure are key to safe water and sanitation. The Acts related to safe water and sanitation and the Bill of Rights in the Constitution of SA are commendable and in-line with the United Nations water and sanitation declarations. However, though SA have comprehensive plans, programmes, strategies, frameworks, policies, the data contextualizing access to water and sanitation in SA shows that there are people that still have and use unimproved water and sanitation systems and some people do not have access to water and sanitation. Though SA has Intergovernmental Relations Framework Act, IDPs etc there is evident of governmental challenges impacting safe water and sanitation.

Due to many interpretations that have commonalities but have no specific definition of what is safe water and safe sanitation, the researcher derived the safe water and sanitation assessment criteria from the Bill of Rights in the Constitution of SA and from the WHO standards (Refer to Table 5 and Table 6) in the research methodology chapter. The assessment criterion does not provide definite definitions but it sum-up the different parameters used to define safe water and sanitation.

To conclude, there is a need for further research on right to safe water and sanitation in totality – the review of the whole cycle of safe water and sanitation thus include the implementation of all policies (i.e. social, economic, legal policies etc), frameworks etc., integration of enablers, monitoring and so on for continuous improvements needed to achieve SA vision 2030. The increasing informal settlements is a matter of concern.

4. RESEARCH METHODOLOGY

4.1. Data acquisition

To critically assess the right to safe water and sanitation in a South African informal settlement, the research was conducted in the Marikana informal settlement. The assessments were conducted mostly on weekends and evenings. The study was conducted between April and June 2017. The research design used was a combination of qualitative and quantitative research methods. Prior to data collection the researcher sought and obtained written consents from relevant authorities (i.e. UCT etc) to formalise the research. The consents included the ethics codes consideration. The endorsement of consents was followed by the formation of a structured questionnaire which was passed by the supervisor before its application. During interviews, all the participants were only interviewed after they have given and signed the consent form. The ward councilor and street committees of Marikana were informed before conducting interviews.

The practical study was based on primary and secondary data. The primary data of Marikana informal settlement water and sanitation facilities were directly obtained by the researcher while the secondary data was obtained from various sources that include the City of Cape Town (CoCT). The study was carried out on theoretical and practical levels.

As stated in this study, the case study method was followed to get a close information (i.e. in-depth and first hand) understanding of water and sanitation status in informal settlements. Bromley (1986) state that the case study method helps to make direct observations and collect data in natural settings as compared to relying on ‘derived’ data e.g. recorded results or statistics maintained. Shavelson et al. (2002) concur that a case study is appropriate when the research addresses descriptive or an explanatory question. Therefore, it was decided that using Marikana informal settlement as a case study will help in the assessment needed as the research addresses an explanatory question such as “how” how is the state of the right to safe water and sanitation in informal settlements in alignment with SA constitution.

4.2. Methods of data collection

4.2.1. Primary data

Primary data was obtained from field study using the following: -

Structured questionnaire for households

Due to South Africa being a member of WHO which is a specialised agency of the United Nations that is concerned with international public health; and SA under Global Competitiveness Index, ranking 68 in 2nd pillar: infrastructure and ranks 126 in 4th pillar: health and primary education (Global Competitiveness Index, 2015-2016), the core harmonized questions derived from an in-depth study of several international survey instruments by WHO and UNICEF (2006) were used as part of critical assessment of the safe water and sanitation for households of South Africa informal settlement. A survey questionnaire consisted of structured 11 core questions mostly from the WHO and UNICEF (2016) JMP. The core questions from WHO have similarities with the assessment criteria in Table 5 and Table 6, derived from the Constitution of SA, and SANS. The WHO and UNICEF (2006) JMP core questions in Appendix 2; and Table 5 and Table 6 assessment criteria are the core components of study analysis.

Conducting Interviews

The questionnaire was administered verbally to each household owner / the eldest tenant in the absence of the owner. The interviews were conducted in the local native language such as Xhosa which is the most spoken in Marikana settlement. Each participant was only interviewed after they gave and signed the consent form. Some of the questions were open-ended while some were close-ended questions. The main aim was to assess compliance of municipality in providing safe water and sanitation in informal settlement thus checking if the dwellers have access to safe water and sanitation and, if not, the alternatives used in such cases.

A total of twenty (20) households were interviewed. The researcher aimed to interview more households, however, after noting that the study area group is homogenous, and the saturation was reached after interviewing 12 households, the researcher with the supervisor's approval interviewed 20 households only. Additionally, Crouch & McKenzie (2006) suggest that less than 20 participants in a qualitative study assist a researcher to have a close association with respondents considering that qualitative interviews often seeks to penetrate social life beyond appearance. Households were interviewed about the main source of their drinking water; the time is taken to collect water and the distance taken to collect water; who within the household collects the water, and they were asked about household water treatment process if any.

Part of the questionnaire focused on sanitation. Households were interviewed about the type of sanitation they use; if the facilities are shared or not; the time is taken to reach the facilities and the distance traveled, and they were interviewed about the maintenance and cleanliness of the facilities and their concerns. Residents' experiences in terms of the benefits and problems associated were teased out through interviews. Lastly, the households were interviewed about

the disposal of children faeces, disposal of wastewater and solid waste as these are the critical aspects of sanitary behavior (Refer to Appendix 2).

Structured questionnaire for the municipality

Maintenance is key to functionality and sustainability of existing infrastructure. Water can be accessed; sanitation facilities can be available but if the maintenance procedures are not sound the water and sanitation systems might be deemed unsafe. Without diverting from the study, the City of Cape Town (CoCT) water and sanitation department was interviewed about the maintenance management of water and sanitation facilities in informal settlements. The CoCT was interviewed about the Standard Operational Procedure for cleaning the ablution facilities; availability of maintenance budget; audits performed to evaluate maintenance regimes and quality standards; the maintenance awareness programme for informal dwellers; the CoCT was interviewed to understand if maintenance is outsourced or if it is attended by local people and the service level agreement - SLA's were asked. The CoCT was interviewed about the records of maintenance with an aim of assessing the root cause of failures to address and curb the future failures. The CoCT maintenance constraints were teased out through interviews.

Photographs

Photographs were taken to capture the conditions of the water and sanitation facilities during the assessments.

Water and sanitation facility observations

Assessment took place on existing water and sanitation facilities in the Marikana informal settlement. Assessment of conditions of the facilities was fundamental to this study. Field walkabout was carried out at a different time and different days to observe operations in the settlement. Through the site observation, the researcher observed the replacing of toilet tanks; cleaning of toilets carried by the EPDW janitors under the supervision of Moreki Solutions; and the cleaning of tanks at Borcherds Quarry wastewater treatment plant.

4.2.2. Secondary data

Secondary data was collected from various documents through literature review. The literature review included journals, reports, South Africa government policies, City of Cape Town documents, United Nations publications, electronic sources i.e. internet and other global relevant literature. Theoretical, public and official documents and the UCT MPhil: Urban Infrastructure Design and Management course notes and other scholarly reports were reviewed.

4.2.3. Water quality testing

A sample to test high-level water quality was taken on the 15th and 28th of June 2017. Though the informal settlement dwellers use the piped water for cooking and drinking and the municipalities test the water before it leaves the reservoirs, random sample tests were conducted. The water tests are important because the health of a human being is influenced by

the quality of water consumed. The water is generally tested for different reasons i.e. to check health risks, aesthetic risks or operational risks. In this study, the test conducted was mainly to test the acute health risks.

Merieux NutriSciences collected samples of water to analyze the water quality specifically to check if the water has any bacteria contamination. The sample collection and handling were conducted by the Merieux laboratory driver using the sterile container (500ml bottle) that was kept in a car built-in fridge. The water test was collected from the tap at Diaza road, a tap which was the closest tap from Stock road and it was at the safe place for the laboratory driver whom I escorted alone without the representative from the informal settlement. As mentioned in this study, the test was mainly to test the bacteriological that have an acute health risk to people. The bacteria test are not the only determiners of the drinking water quality test; the study did not focus on the in-depth water quality tests and water-borne diseases, and the researcher noted the blue drop drinking water quality results available at DWA website. It is therefore that the full water test was not conducted, additionally, the researcher was considerate of time and cost needed to do the full water test (i.e. chemical, physical test parameters etc as they can also impact on human health). The full water test was viewed as complicated by the researcher with little knowledge of chemical relations and an expensive process.

Total Microbial Activity (TMA), Coliforms, and Escherichia coli were the selected parameters to analyse the water quality under microbiological analysis as per SANS 241. As per the laboratory used for water testing, TMA assessment is the same as the heterotrophic plate count stated in SANS241. Heterotrophic plate count / TMA is used as an indicator of possible problems on treatment efficiency and an indicator of after-growth in distribution networks.

4.3. Data analysis and presentation

The collected primary and secondary data were analyzed. The data presentation is through descriptive notes with supportive demonstrative such as photographs. The researcher further consolidated an assessment criterion derived from the Bill of Rights in the Constitution of SA and WHO to define and analyze the right to safe water and sanitation.

4.3.1. The right to safe water and sanitation assessment criterion

The researcher adopted the Bill of Rights in the Constitution of SA, SANS and WHO and UNICEF (2006) Joint Monitoring Programme (JMP) concepts to define the right to safe water and sanitation. Table 5 and Table 6 about the South African constitutional context and Appendix 2 about the WHO & UNICEF harmonized household survey questions will be used as a basis to critically assess the right to safe water and sanitation in a Southern Africa informal settlement using Marikana in Cape Town as a case study.

Table 5 Right to safe water assessment criteria

derived from the Bill of Rights in the Constitution of SA and WHO

Responsibility (to achieve target)	**Reference /enforcing target**	**Target**
All SA government spheres	Section 10	Right to dignity
All SA government spheres	Section 11	Right to life
All SA government spheres, DEA	Section 24, NEMA (1998),	Human health, wellbeing, protected environment Environment that is not harmful
DHS, CoGTA, National Treasury,	Section 26, Housing ACT No 107 of 1997	Access to adequate housing
All SA government spheres, DHS	Section 27 (1), National Housing Code of SA *WHO	Access to sufficient water, Number of households per shared tap
All SA government spheres	National Standard Regulation 3 (basic water supply) WSA 108 of 1997	Physical accessibility • Within 200m of a household • Collection time not to exceed 30minutes • Right of access to basic water supply and basic sanitation”
All SA government spheres	National Standard Regulation 3 (basic water supply)	Quantity • Minimum flow rate of 10 litres per minute • Minimum 25 litres per person • Effectiveness – minimal disruptions (less than 7 full days in any year)
DWA Department of Health	NWA (1998) NHA (2003) SANS, *WHO	Promotes quality of water and water sustainability, Water quality monitoring

Responsibility (to achieve target)	Reference /enforcing target	Target
NHA,	SANS 241	Acceptable • bacteriological parameters limits
SAHRC	Human rights	• Acceptable water facilities • Gender, religion, culturally
All SA government spheres National Treasury (funds)	Free Basic Water Policy, Indigent Policy,	Affordable
Local government, National Treasury (funding)		Maintenance

Source: By Author, 2017.

Note: "All SA government spheres" include national, provincial and local government. Although the local government has a mandate to "ensure the provision of services to communities in a sustainable manner" and to "promote a safe and safe environment", due to understanding that the right to safe water and sanitation is not possible in isolation from other spheres, the researcher chose to make the responsibility for all SA government spheres.

Table 6: Right to safe sanitation assessment criteria

derived from the Bill of Rights in the Constitution of SA and WHO

Responsibility (to achieve target)	Reference /enforcing target	Target
All SA government spheres	National Standard Regulation 2 (basic sanitation) WSA 108 of 1997	Physical Accessible • Distance - to be within 200m • Travel time Right of access to basic sanitation
All SA government spheres	National Standard Regulation 2 (basic sanitation) Section 24	Environmental sound, Health, wellbeing, protected
All SA government spheres	National Standard Regulation 2 (basic sanitation) Section 10 and SAHRC	Provides privacy Right to dignity

Responsibility (to achieve target)	**Reference /enforcing target**	**Target**
All SA government spheres	National Standard Regulation 2 (basic sanitation)	Toilet that is safe
All SA government spheres	National Standard Regulation 2 (basic sanitation)	Reliable
All SA government spheres, SAHRC	National Standard Regulation 2 (basic sanitation)	Safe– • protection against weather • easy to clean
DHS	National Housing Code of SA	Adequate • 5 households per one toilet
Department of Health; Local government	National Health Act (NHA) 2003	Health – • well ventilated, • keeps smells to a minimum • prevents the entry and exit of flies and other disease-carrying pests • provision of appropriate health and hygiene education
	SAHRC	Acceptable • cultural appropriate • sensitive to gender • sensitive to age • sensitive to ability – considering physical disable/physical challenged people
All SA government spheres National Treasury (funds)	Free Basic Sanitation Policy, Indigent Policy,	Affordable
Local government, National Treasury (funding)		Maintenance

Source: By Author, 2017.

4.4. Limitations of the study

There were challenges experienced that affected the study. Lack of recent statistic data specific to Marikana was noted as a barrier to understanding the in-depth population statistics of Marikana. Marikana was formed in 2013 after the 2011 Census. The community survey (2016) is not in-depth and does not have the population statistic for the wards like Ward 35 where Marikana falls under.

I was generously given access to households; the respondents were welcoming. However, some respondents (*maintenance team emptying the buckets at night*) refused to respond to questions because they said they were not informed about the research by their street committees. Due to that, the field study was delayed until the broader notification of the study.

Due to safety concerns, to curb crime, rape relations, I was accompanied by the committee member during the interviews and by the Marikana activist on two (2) occasions. However, I was alone during the weekends because there were a lot of people in public area.

As stated in this study introduction, the focus of the study was to critically assess the right to safe water and sanitation in a South African informal settlement focusing mainly on the water and sanitation facilities and its maintenance regimes, thereby identify the problems and challenges related to safe water and sanitation if any, with an aim to show the status of the water and sanitation in a South African informal settlement. Having described the research methodology followed to acquire data, the study report will continue to research findings which will be then followed by the conclusion.

5. RESEARCH FINDINGS

5.1. Overview

The research findings in this chapter result from the fieldwork carried out during the study including various secondary sources. This study aimed to critically assess the right to safe water and safe sanitation in an informal settlement which is a human right for all and to get a broader picture of the progress or regress in South Africa informal settlements thus show the status of water and sanitation facilities in informal settlements. The existing informal settlements, land invasion contributing to the increase of informal settlements, failure to eradicate the informal settlements in 2014 and failure to eradicate bucket systems in 2007 including the 'toilet wars' noted in South Africa led to the critical assessment of safe water and sanitation. The Marikana informal settlement was used as a case study to avoid generalization the sanitation and water status. As stated in the research methodology chapter, 20 households were interviewed. The saturation of the research was reached from the 12 interviews, however, even though less than 20participants in a qualitative study is viewed significant, the researcher interviewed 20 households. All the participants responded positively and willingly to the interviews.

As stated in this study, Marikana's employment, education, gender, and age statistics is unknown. However, through observations, it is estimated that the high number of Marikana informal settlement is youth and is unemployed. Sources of income are unknown, however, there are informal tradings noted such as carwash, fruit and vegetable stalls, meat braai (*shisa nyama*), barbers, clothing, and household vending and so on.

5.2. Safe water

5.2.1. Main source of drinking water for household

The households were asked to determine the main source of drinking (Table 7). All respondents use the water from the standpipes. The study area has shared standpipes, each standpipe with two (2) taps. The taps are installed along the main roads of Marikana. As per the CoCT-GIS office, all the taps of the Marikana settlement are within 200m from each household. The public standpipes that are accessible to all are defined by JMP (2006) as the improved source of drinking. "Public tap or standpipe is a public water point from which people can collect water. A standpipe is also known as a public fountain or public tap" (JMP, 2006).

Table 7: Main source of drinking water

Main source of drinking water											
Improved sources					**Unimproved sources**						
Piped into the dwell-ing	Piped into the yard /plot	Public tap / stand-pipe	Bore-hole	**Percentage using improved sources of drinking water**	Surface water/ river/ rain water collection	Water truck / tanker	Bottled water	Other	**Total**	**Total number of people using unimproved sources of drinking water**	**Total number of household members**
		100		100					100	0	

Note; all the households interviewed had a minimum of 3 members

5.2.2. Time is taken to collect water

A questionnaire asked about the time taken to collect water in minutes and in distance (Table 8). Although all the taps are reported (CoCT-GIS office) to be within 200m of each household, 60% of the interviewed dwellers travel more than 200m to haul water because there are no straight and direct accesses to the water points. 60% of the respondents return trip takes more than 30minutes. Respondents close to the facilities and male respondents reported that they take an average of 10 - 30minutes to haul water. All respondents store water in buckets.

The households were asked if they fetch water at night. The respondents that work night shifts reported that they have safety concerns to haul water in the early hours of the day and late hours of the day due to no street lighting. The study did not investigate if the water was always covered and how long does it take to replace the stored water. The storing of water in buckets raised a concern about the quality of water.

Table 8: Time to collect water

Time to collect water										
How long does it take to go there, get water, and come back					**General safety concerns**					
minutes. more than 30 minutes	minutes. less than 30 minutes	Distance to the main source more than 200m	Distance to the main source less than 200m		Do you fetch water at night	Is it safe to travel to the water point	Do you keep water for over-night	Do you treat water to make it safe		
12	8	12	8		No[a]	No[a]	Yes	No[a]		

Note

a *same response from all the interviewed households*

Plate 1: Unserviceable water standpoint

Source: Author, May 2017 at Protea road.

Due to damaged and unserviceable taps, e.g. (Plate 1) respondents travel a long distance to access water. Additionally, the respondent reported that the water pressure from certain taps is low in the mornings due to high demand. The unserviceable taps and low pressures issues result in long ques on the taps that are operational which could take at least two hours to get water if some dwellers were not storing the water in buckets overnight thus reducing the morning water demands. 5% of the respondents reported that at times they stay without water during the pipe repairs when they missed the CoCT notifications. The number of water facilities can positively or negatively affect the quality of water same applies to sanitation facilities. Few operational standpipes can force people to use different water sources that might be unsafe. Positively, the dwellers reported that they have never stayed without water for more than 24 hours.

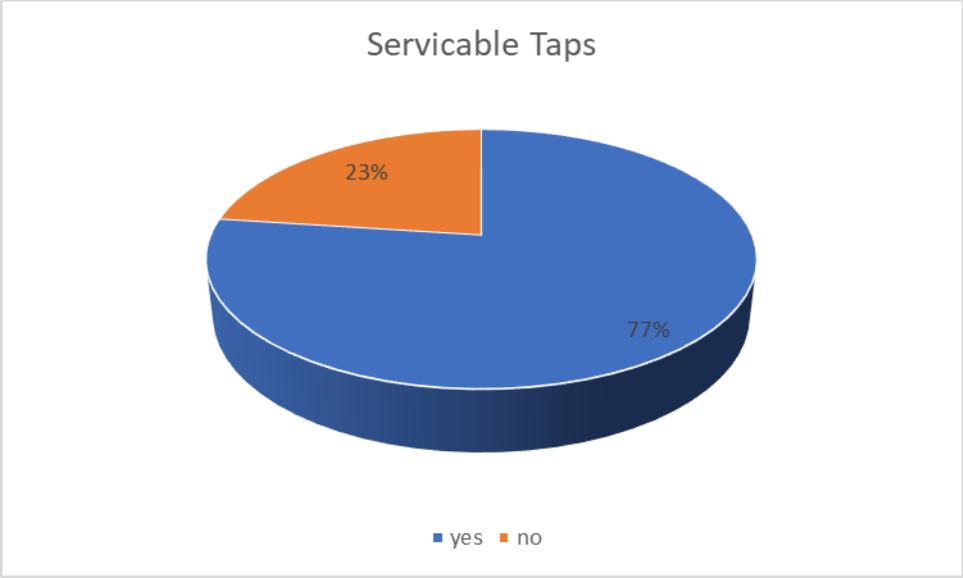
Plate 2: Leaking water standpipe

Source: Author, May 2017 at Daiza road.

Leaking underground pipes and leaking taps results in water loss, consequently, contributes to the low pressure in the pipe network. The water from the leaking pipes flood the roads and the

surrounding of the toilets. The flooding water combined with the solid waste become hazardous to the people. Dwellers get exposed to environmental risks, kids play in the contaminated water and can be exposed to health issues. People of Marikana and of the public can slip or slide, fall in the water and thereby get injured physically. The unavailability of street lighting as observed and reported can worsen the risks at night. Though the respondents had not recorded of physical incidents resulting from the water flooding the walkways, standpipes, and sanitation facilities they use, there have been health concerns about the water flooding especial during the summer season. During the observation of standpipes conducted in May, it was noted that 11 out 48 (23%) standpipes were unserviceable.

Figure 5: Serviceable Taps



Source: Compiled by the Author, May 2017

5.2.3. Water quality testing

Moreover, the interviewed were asked if they treat the water to make it safer. All the dwellers do not treat the water in any way, they use it for cooking and drinking as it is. Arguably, I recommend the dwellers that do not treat water because the treatment process like adding bleach or chlorine in water excluding the boiling of water can be dangerous as the dwellers can use high quantities of chemical which can be detrimental. All interviewed dwellers use water from the standpipes, they do not use any other water like bottled water etc.

Contamination is more frequent among some types of improved source (Bain et al., 2014). Households that store water risk to have faecal contamination where sanitation access is poor (Wright et al., 2004; Schriewer et al., 2015). Curtis et al., (2000) also points out that water "that is free of pathogenic agents at the source may become contaminated with faecal material in the private domain as it is carried home, stored, and used". Pickering et al (2010) associate the increased hand faecal contamination and faecal contamination of stored drinking water to unimproved sanitation access. However, the study parameters did not include the sample testing of household stored drinking water.

To perform a random test on the water used by the Marikana dwellers, water quality sample was collected from the first tap at Daiza road at Marikana in June 2017. The results of the test are recorded in Table 7 below.

Table 9: Water test results of sample 1

Test Type	Method No.	Result	Units	Limits
Coliforms	SWJM 48	40	cfu/100m	Results <=10
Escherichia coli	SWJM 45	No Growth	cfu/100ml	Not Detected/100ml
TMA	SWJM 35	350	cfu/ml	Results < =1000

Source: Merieux NutriSciences Company. Water sample received and tested by Merieux on the 15/06/2017. Results validated by Marieux on 23/06/2017. Test limits are as per SANS 241-1:2011(Edition 1).

SANS 241 recommend coliform growth of less than 10 while WHO recommends zero (0) for both total bacterial count and coliforms. Water with growth greater than 10 is Non-Conformance meaning not acceptable. Therefore, the sample tested failed in WHO and SANS recommended standards. The sampled water showed bacteria contamination that is viewed as an acute health risk to its users. Bacteria cause many diseases like diarrhea, vomiting, nausea etc, so "bacteria growth in water is a never a good sign" (Gogoi, 2016). The presence of coliforms are typically harmless but high quantities can result in illness, especially on people with compromised immune systems. Refer to Appendix 3 for water test results.

As suggested by SANS, when the water test results show bacteria contamination, a retest is needed to confirm the original results. The second water sample was collected on the 28th of June from the same tap as a secondment of the first water sample tested.

Table 10: Water test results of sample 2

Test Type	Method No.	Result	Units	Limits
Coliforms	SWJM 48	No Growth	cfu/100m	Results <=10
Escherichia coli	SWJM 45	No Growth	cfu/100ml	Not Detected/100ml
TMA	SWJM 35	No Growth	cfu/ml	Results < =1000

Source Merieux NutriSciences Company. Water sample received and tested by Merieux on the 28/06/2017. Results validated by Merieux on 03/07/2017. Test limits are as per SANS 241-1:2015(Edition 2).

The second sample results came negative with no growth of bacteria. Various reasons (such as environmental pollution, possible contamination of the sample, possible problems on treatment efficiency or and after-growth in distribution networks etc.) cause different results; however, the researcher did not dwell in water sample testing parameters, rather focused on the results. The different results from the same tape showed that at times the piped water supplied to the Marikana dwellers get contaminated by bacteria at times thus imposing health risks to the people drinking it.

5.2.4. Individuals collecting water

All the interviewed respondents reported that male and female adults collect water from the standpipes.

5.3. Safe Sanitation

5.3.1. Type of toilet facility

While South Africa community survey (2016) reported an increase in flush toilets connected to sewerage; and the Bill of Rights in the Constitution of SA and SAHRC speak of human dignity. During the study period, it was noted that Marikana dwellers do not have toilet facilities in their own household. Dwellers use the shared facilities. However, dwellers have the Porta-Potti supplied by the CoCT as an alternative to shared facilities and to accommodate the sick, elderly or and to be used at night. Porta-Potti is a commonly used name for Portable flush toilets. The Porta-Potti has a small lever that you pull to flush. The portable toilet can hold 16 litres in its bottom part after flushing. For an example of Porta-Potti refer to plate 4

Plate 3: Toilet facilities at Marikana

Source: Author, May 2017.

Marikana toilets (Plate 3) are not flush toilets connected to the sewerage rather they have replaceable buckets.

As per the questionnaire, the interviewed households were asked if they use the toilets at night. Respondents reported that it is not safe to go to the toilets at night. 20% of the household use the Porta-Potti provided by the CoCT. The Porta-Potti is meant to prevent the walking to toilets at night and to accommodate the elderly or sick and children. Although the provision of Porta-Potti aimed to assist the sick or elderly and children and to assist at night, the keeping of human waste in homes was found culturally objectionable as it was pointed out by McFarlane et al., (2014). 40% of the interviewed dwellers do not use the Porta-Potti because they do not feel comfortable to stay with human waste in their yards instead they practise open defecation. Existing open defecation practise by some of Marikana dwellers can produce taunts, harassment, violent attacks like rape to women and robbery to homes. The study did not enquire data of rape, crime, harassment that might result from open defecation. Neither did the study enquire about rape, crime, and harassment that might result to travel long to water and sanitation facilities at night.

Plate 4: Porta-Potti an alternative toilet facility

Source: Author, May 2017.

The Porta-Pottis are alternative toilet facilities that are provided to each household by the CoCT municipal. About 40% of households that do not use the Porta-Potti mentioned that they use their own buckets which they prefer to be better than Porta-Potti because they empty the buckets every day. They layer the inside of buckets with plastic, to remove the waste they remove the plastic with waste and dumpy it in toilets or dumping sites. The interviewed households did not seem to fully understand the risks of uncleanliness. Cleanliness at homes, for an example, handwashing with soap was not asked though it contributes to safe sanitation and health improvements. The full Porta-Pottis are collected on Tuesdays, Thursdays, and Sundays.

5.3.2. Distance traveled to the toilet facilities

Due to unproperly placed households, the water and sanitation facilities are allocated mainly on the main roads of the informal settlement such as Sheffield road and Daiza road that borders Marikana and on Protea road that divides Marikana settlement into two sections. There are no direct routes to the water and sanitation facilities. The Marikana settlement is dense. The Marikana settlement is overcrowded. As mention in the study, Marikana's calculated (Author, 2017) area size is 62.66ha with an estimate of 128 households per ha. The location of the toilet facilities is mainly near the water standpoints. The distance traveled, and time taken to the facilities is the same as accessing water points.

5.3.3. Coverage of the sanitation facilities

Noting that each toilet at Marikana settlement is shared by more than five households, the WHO/UNICEF (2012) JMP, classifies any shared or public sanitation facility as unimproved. In Gunther's et al (2012) view, if the toilets were shared by four or fewer household the toilets were going to be considered 'acceptable or improved'. The Marikana settlement has approximately 8000 households and 386 toilets. The ratio per each toilet is 22:1. SA legislation state that there must be 5 households sharing 1 toilet. At times, some of the 386 toilets are not operational, resulting in less number of toilets to be shared by the approximately 8000 households.

Table 11: Type of the facility used by household

Type of the facility used by household									
Improved sanitation facility (during the day)					**Unimproved sanitation facility (used at night)**				
Flush toilet (connected to sewerage)	Flush toilet (with septic tank)	Ventilated improved pit latrine	**Total improved**		Pit latrine without slab	Porta-Potti	Bucket toilet	Open defecation	**Total unimproved**
		100	100[a]			4	8	8	100

a as per WHO/UNICEF if the toilets are shared by households. The shared toilets are viewed as unimproved due to unhygienic conditions e.g. plate 5. The Author's view on the observed shared toilets concurs with the view. However, SA views the VIP as improved sanitation.

5.3.4. Conditions of the toilet facilities

Right to safe sanitation was assessed on the shared toilets. During the weekends of fieldwork, the shared toilets were dirty (Refer to Plate 5). Dirty toilet facilities are a health risk to all users either male or female. To have safe dwellers cleanliness of the shared toilets is important.

Plate 5: Toilet conditions

Toilets dirty and full, excreta visible on the toilet seats and the floor

Source: Author, April 2017 at Stafford road

The grey portable tank is collected, emptied, and disinfected at a treatment works thrice weekly by a municipal service provider. Different factors such as quantity of toilets, serviceability of toilets, and so on contribute to the cleanliness or uncleanness of the shared toilets. It was noted that the high number of users; few toilets in good condition; bad use by some households; and maintenance intervals by the CoCT appointed service provider contribute to the uncleanliness of the toilets.

Researchers have recorded that although the shared toilet provision increase, the usage of toilets does not always follow (Harris et al., 2017). The households reported open defecation practises, however, the study parameters did not include the location and the distance traveled to the open defecation sites. There was no evidence of soap near the toilets and water taps.

Adequate resources such as sufficient quantities of soap and water to wash hands after using the toilet or after open defecation contribute to better health (Curtis et al, 2000).

Unavailability of safe toilets was reported as a contributor to open defecation as 40% of the interviewed households reported that they practise open defecation. Open defecation pollutes the environment around the informal dwellers and imposes the women and children to more danger such as rape, crime, harassment etc.

Plate 6: Kids not able to use toilets

Source: Author, 2017

There are three forms of cleaning the toilet facilities contracted by the CoCT. The first is daily cleaning of toilets by janitors employed through the EPDW. The second is the waste removal through replacing the full toilet tanks and Porta-Pottis. The third is cleaning of the tanks at Borcherds Quarry wastewater facility. The existing sanitation system in the informal settlement was viewed as a major problem because it requires emptying which can be costly, inconvenient, and hazardous (Furlong et al.,2014). The process of emptying informal settlement sanitation was found unsafe.

Plate 7: The toilets are emptied on the floor at Borcherds Quarry

Source: Groundup.

Huge numbers of people are still part of handling another people's waste. The sanitation system of informal settlement is not safe. The workers-handlers of raw sewage did not get the Hepatitis A and B injections prior starting the work. They later received it through the intervention of the public media, the workers did not know that they deserved the injections.

Irrespective of provided personal protective equipment (PPE) the risks of contamination with waste are high. During observations, it was noted that the workers are not having fully compliant PPE. Safety talk was not given to the staff as a reminder of the importance of PPE and how to handle the tanks fully with waste. The study did not assess the induction(s) provided to the workers.

Plate 8: Infrastructure condition

Source: Author, 2017

A questionnaire asked if the toilets can be used by the public. It was noted that majority of toilets were locked and have dedicated households. 11% of the toilets inspected were without doors and lids. It was reported that there is a contract appointed to repair or/and replace toilets when they are damaged, however, the remedial works do not happen often or immediately. During the interviews with the CoCT representative, it was reported that vandalism is one of the main challenges in maintaining the Marikana water and sanitation facilities.

Section 10 of the Constitution of South Africa (1996), state the “everyone has inherent dignity and the right to have their dignity respected and protected”. The state of broken toilet doors compromises the dignity of toilets users. Section 14 of the Constitution of SA further, state that “everyone has the right to privacy”. It was noted that the tanks of the toilets with no doors were removed to protect the privacy people. The unserviceable toilets reduced the number of toilets required as per the number of the people of Marikana settlement.

Plate 9: Accessibility to the toilets

Source: Author, May 2017

No ramps for physically disabled people and wheelchair users to safely access the facilities.

The researcher assumed that Marikana informal settlement has all kind of people including physical disable people. No household with a physical disable person was interviewed and the population statistics of Marikana was not found. However, the researcher assessed the location and accessibility of facilities factoring the public and visitors of Marikana that might be physical disable. The location and position of the toilets and water points do not show the consideration for the physically disabled people. The toilets are narrow to accommodate the wheelchair and do not have ramps to allow them to climb freely. Rights of physical disable and old people were found to be compromised.

SA (2030) national development plan acknowledges that disability must be integrated into all facets of planning, recognizing that there is no one-size-fits-all approach. As per the study observation, people with disabilities face multiple discriminatory barriers.

Table 12: Time taken to the sanitation facilities

Time is taken to the sanitation facilities									
How long does it take to the shared facilities					General safety concerns				
minutes. more than 30 minutes	minutes. less than 30 minutes	Distance to the main source more than 200m	Distance to the main source less than 200m		Do you use toilets at night	Is it safe to travel to the toilets at night	Are the toilets shared by women and men	Can any member of the public access the toilets	
12	8	12	8		No[a]	No[a]	yes	yes	

Note; a same response from all the interviewed households

5.4. Solid waste management

Although the study is on right to safe water and sanitation, it was noted that the solid waste refusal is an issue in Marikana settlement. The Constitution of SA (1996), section 24 (a) state that “everyone has a right to an environment that is not harmful to their health or well-being and (b) (1) “to have the environment that is protected for the benefit of present and future generations”. The dirty and unclean surrounding of the sanitation facilities can cause maggots and flies thus affect the toilets hygiene even if they were in the excellent state. The water quality can also be affected and get bacteria like Coliforms etc. The solid waste noted as per Plate 10 is an environmental pollution. The piles of solid waste around the toilet facilities and the lack of street lighting at night can expose the dwellers to safety risk such as falling when they go to the toilets.

Plate 10: Area surrounding the toilet facilities

Source: Author, May 2017.

The Sustainable Development Goals (SDGs), goal 6 requires that the countries ensure availability and sustainable management of water and sanitation. Target 3 of goals 6, state that, by 2030 “improve water quality by reducing pollution, eliminating dumping and minimizing the release of hazardous chemicals and materials, having the proportion of untreated wastewater, and increasing recycling and safe reuse by x% globally” (UNDP). In the Marikana settlement in SA, it was noted that sustainable environmental management is a challenge. Thus, threatens the right to safe water and sanitation in informal settlements. Integration of principles and policies is key. The poor environmental management threatens the right to safe water and safe sanitation then threaten the public health and hygiene which is goal number 3 (target 9) of SDG’s to be achieved by 2030. Adequate waste disposals are as important as safe water and sanitation because they contribute to health outcomes.

Plate 11: Solid waste disposal

Source: Author, May 2017.

Plate 11: Solid waste surrounding the household. Solid waste dumped on stormwater channels. Manhole openings blocked.

The households of Marikana do not have refuse bins in their homes or /and communally shared skips for the waste produced from cooking, children wearing diapers, waste from sweeping etc. Waste produced by households is dumped on open spaces and on stormwater channels. As per the CoCT waste management by-laws, evidence in Plate 11 is viewed as illegal dumping, however, in Marikana settlement the case is different because there CoCT did not provide dustbins or communally shared skips. Households do not even have the black or blue waste bags. During the interviews, the dwellers reported that the waste has not been collected by the CoCT since August 2016.

5.5. Public hygiene and safety

Plate 12: Unsafe public space

The Marikana residents are not trained on public hygiene and public safety. The children were seen playing around the overflowing wastewater. Wastewater floods the households surrounding posing risks to all dwellers especially the children. It was noted that the dwellers do illegal electrical connections for their households, and the cables were seen lying on the public road. Due to severe bad smell conditions, especially during summer season, the dwellers reported that they clean the solid waste on their own.

Awareness of environmental risks, cleanliness of toilets facilities and safe hygiene practises in the households (Cairncross, 1990) and its surrounding promote the full effectiveness of public infrastructure. “Improving the living conditions of informal settlement dwellers is a pressing concern for international agencies like the World Bank, UN-Habitat, the WHO and national SA government alike” (Brown et al)

5.6. Water and sanitation maintenance and sustainability

As per the Constitution of SA (1996) the City of Cape Town metropolitan municipality is the body responsible for the provision of safe water and sanitation in Cape Town. The department of water and sanitation is the custodian responsible for the informal settlement. The CoCT manages and repairs the water supply points through their in-house employees. The maintenance of portable toilets in an informal settlement is outsourced. Different companies are appointed to provide cleaning services for toilet facilities – wastewater facilities in total.

During the interviews, the CoCT representatives reported that there is no maintenance policy for departments to adhere to. However, the department of water and sanitation attend to failures through *work instructions* that are dispatched by the Technical Operational Centre (TOC). There are no planned preventative programs, however, maintenance is ongoing, there are daily planned works as per the calls or reports from the ward councilors including Ward 35 of Marikana Informal settlement. The absence of programmed maintenance raised a concern, as per (Curtis et al., 2000) the improved maintenance of “infrastructures such as water and sanitation facilities, can also contribute to preventing disease transmission” especially on children. Additional, the absence of programmed maintenance impacts on financial budgeting, pro-activeness, availability of contingency material needed to replace the damaged taps and toilets.

During the interviews with the CoCT representative, it was reported that vandalism is one of the main challenges in maintaining the Marikana water and sanitation facilities. The non-operational taps due to vandalism and low pressure during peak hours prove the unsustainability of access to safe water in an informal settlement. This poses a challenge to the expectation of the Water Services Act (108 of 1997) and the SDG requirements for sustainable access to safe to drinking water. The maintenance of sanitation services in an informal settlement is costly due to frequent cleaning, and the maintenance of water facilities such as standpipes is costly due frequent repairs resulting from vandalism (CoCT-WSDP, 2016). The CoCT representative acknowledged the frequent sewerage blockages imposing health and safety risk to the settlement residents. Concurring with Furlong et al (2014) maintenance in an informal settlement is inconvenient and **hazardous**. The SDG’s which are the base of SA vision 2030 (Dhande and Al-sharafi, 2017) are high valued principles aim to wisely protect the resources for the future generations. The study findings reveal sustainable challenges towards the safe water and safe sanitation. Provision of services alone is not enough; provision of safe water and sanitation is key. Jong-wook (2004) refer to clean water and adequate sanitation for all people as “health 101” meaning once they can be secured, “a huge battle against all kinds of diseases will be won”.

Relating to the Bill of Rights, this study focused on the right to safe water and sanitation in an informal settlement, however, there are existing rural areas that also need attention to guarantee safe water and sanitation to all people.

5.7. Summary of research findings

The summary of the study findings are as follows: -

Table 13: Research findings on assessment of the right to safe water as per the Bill of Rights in the Constitution, SANS and WHO terms

Reference / enforcing target	Assessment criteria	Findings
Section 11	Right to life	Compromised, • no street lighting, • evident possibilities of crime, rape to women
Section 24, NEMA (1998),	Human health, wellbeing, protected environment Environment that is not harmful	Unsafe, • evidence of un-maintained solid waste and environmental pollution • no bins, communal skips or black/blue waste bags for household waste
Section 26, Housing ACT No 107 of 1997	Access to adequate housing	Dense and overcrowded informal settlement with no planned layout, access routes for vehicles especially fire trucks or ambulances for in case of emergency
Section 27 (1), National Housing Code of SA *WHO	Access to sufficient water, Number of households per shared tap	• Not enough coverage, • Low water pressure on certain taps on some mornings • Certain taps unserviceable • Long ques due unserviceable taps
NWA (1998) NHA (2003) SANS, *WHO	Promotes quality of water and water sustainability, Water quality monitoring	As per the water sample results, there is the growth of coliforms at times. Water with growth of coliforms is deemed unsafe in WHO's terms *Water quality monitoring system no assessed in this study*

Reference / enforcing target	Assessment criteria	Findings
National Standard Regulation 3 (basic water supply) WSA 108 of 1997	Physical accessibility • Within 200m of a household • Collection time not to exceed 30minutes • Right of access to basic water supply and basic sanitation"	Toilets facilities placed next to the shared taps Responded walk more than 200m • due to unserviceability of certain taps, • due to low pressures from certain taps, • due to no straight and direct routes to the water facilities. 40% of the respondents return travel time is at 10-30 minutes average, while, 60% return travel time is more than 30 minutes and can take to 2 hours due to challenges mentioned above Right of access to basic compromised
National Standard Regulation 3 (basic water supply)	Quantity • Minimum flow rate of 10 litres per minute • Minimum 25 litres per person • Effectiveness – minimal disruptions (less than 7 full days in any year)	Compromised by • unserviceability of certain taps, • low pressures from certain taps, Water disruptions resulting to no access to water do not exceed 24 hours
SANS 241	Acceptable • Presence of E. coli and coliforms in water	Water test 1 had coliforms detected, however, test 2 had no growth detected. Presence of coliforms in water is an acute health risk.
SAHRC	Acceptable water facilities Gender, religion, culturally freedom	No gender, religion, culturally issues reported,
Free Basic Water Policy, Indigent Policy,	Affordable	Water provided for free
	Maintenance	No maintenance policy No programmed preventative maintenance plans besides daily work instructions

Source: By Author, 2017.

Table 14: Research findings on assessment of the right to safe sanitation as per the Bill of Rights in the Constitution and WHO terms

Reference / enforcing target	**Target**	**Findings**
National Standard Regulation 2 (basic sanitation) Section 24	Environmental sound, Health, wellbeing, protected	Unsafe, • evidence of un-maintained solid waste and environmental pollution no bins, communal skips or black/blue waste bags for household waste Toilets unclean with visibility of excreta Protective personnel clothing (PPE), no safe talk – awareness prior each shift observed as a concern
National Standard Regulation 2 (basic sanitation) Section 10 and SAHRC	Provides privacy Right to dignity	Compromised, certain toilets were with no doors Privacy compromised during the open defecation practiced by dwellers Toilet facilities compromise the right for physical disable people and elderly, toilets are narrow with no access ramps
National Standard Regulation 2 (basic sanitation)	Toilet that is safe	Toilets unclean with visibility of excreta Certain toilets full and unserviceable WHO view the shared toilets as unimproved and unsafe
National Standard Regulation 2 (basic sanitation)	Reliable	Not reliable, certain toilets locked and cannot be accessed by all, Maintenance regimes not always and quickly attended
Reference / enforcing target	**Target**	**Findings**
National Standard Regulation 2 (basic	Safe– • protection against weather	Unsafe, certain toilets were with no doors, travel distance and time an issue on

sanitation)	• easy to clean	rainy days Not easy to clean, the tanks get full and become heavy to be emptied **Huge number of people are still part of handling another person human waste**
National Housing Code of SA	Adequate • 5 households per one toilet	Not adequate, • Approx. 8000 households • Approx. 60 000 people • 386 toilets • 22:1 ration per each toilet vs to 5:1 household policy
National Health Act (NHA) 2003	Health – • well ventilated, • keeps smells to a minimum • prevents the entry and exit of flies and other disease-carrying pests • provision of appropriate health and hygiene education	Not in satisfactory state • Flies and smell noted Hepatitis A&B not provided to workers prior work, Households did not seem to fully understand the uncleanliness risks and faecal contamination through open defecation
SAHRC	Acceptable • cultural appropriate • sensitive to gender • sensitive to age • sensitive to ability – considering physical disable/physical challenged people	No gender, religion, culturally issues reported, however, the Porta-Pottis were reported a cultural objectionable
Free Basic Sanitation Policy, Indigent Policy,	Affordable	Provided for free But not a full flush system and connected to the sewerage
	Maintenance	Emptying of tanks is viewed costly, inconvenient and hazardous Intervals of cleaning the tanks not adequate considering the number of households and its people vs the number of available toilets

Source: By Author, 2017.

Safe sanitation is interdependent on housing. Housing is interdependent to health. Safe sanitation can decrease the health costs thus improve the economy of the country. Health problems resulting from unsafe sanitation are associated with low – income housing such as informal settlement (Tshikotshi, 2009). As stated by SARHC (2014) “The Constitution’s revolutionary commitment to dignity, equality and social justice has a potential to a transform old

fault-lines of the political, economic, and social powers or centuries", the researcher note that South Africa made commendable progress in providing access to water and sanitation nationally, however, the inequality in providing safe water and sanitation exist; there is lack of freedom due to poor safety to the public facilities and overcrowded settlements, and protection of human dignity is still an issue in informal settlements.

The study further notes that South Africa met the 2015 MDG target 10 to half the number of people without access to adequate sanitation, the argument is on the 'safety' of the provided sanitation in informal settlements not forgetting the initial goal of the national sanitation policy of 1996 that defined adequate sanitation as "the provision and ongoing operation and maintenance of system of disposing of human excreta, wastewater and household refuse, which is acceptable and affordable to the users. The system must be structurally safe, hygienic and easily accessible. **Each household should have access to its own facilities**. Furthermore, it should be accompanied by correct hygienic practises and does not have an unacceptable impact on the environment".

The study notes the existing water and sanitation infrastructure; however, the absence of infrastructure maintenance frameworks impacts on the right to safe water and safe sanitation. Also, there are gaps in public hygiene and environmental awareness. According to the findings of this study using Marikana informal settlement as a case study, the study views the water and sanitation as unsafe because the rights to safe water and sanitation are inadequate and the compulsory national standards such as regulation 2 and 3 are not fully met.

6. CONCLUSION

The findings of this study suggest that the rights to safe water and sanitation are inadequate in so many ways. Most of the Bill of Rights in the Constitution of SA are not fulfilled in the South African informal settlements. From the assessment criterion consolidated by the researcher, the right to safe sanitation has most inadequacies.

Noting that there are dwellers that practise open defecation irrespective of the shared toilets facilities provided, shows that, availability of shared sanitation facilities does not guarantee safe sanitation. Additionally, the number of toilets is often not the most important factor in health improvements (Black and Fawcett 2008). When the sanitation system is not sustainable due to uncleanness and poor maintenance there is, therefore, no safe sanitation. Lack of adequate sanitation and inadequately maintained or inappropriately designed systems constitute a range of pollution risks to the environment, especially to surface and groundwater resources, which in turn pose a threat to health (NSP, 1996). As per the above and study findings, this study shows that the compulsory national standard regulations are not sufficient without the supporting systems that will stop the practise of open defecation.

Undertaking a further study on cleanliness behavior on shared toilet facilities may assist in making considerable measures to the cleanliness of toilets facilities thus improve the safety of sanitation in SA informal settlement. Factors like the location of toilets, sustainable sanitation system, cultural and hygiene relations (i.e. education and awareness) contribute to health improvements. The solutions to the sanitation challenges and to address the mistakes made in the past e.g. building socially inappropriate infrastructures i.e. narrow toilets that cannot accommodate the physical disabled people; or insisting on forms of sanitation practise that do not fit with cultural conditions e.g. the use of Porta-Potti not accepted by all dwellers, gender, religion etc. need not be repeated (McFarlane et al., 2014). The suggested study ‘cleanliness behavior’ may assist to better understand the daily nature of living in informal settlements.

Results from this study and other studies conducted by other researchers may assist government to improve the state and demands of safe water and sanitation facilities thus reduce the water-borne diseases and improve sustainability and reliability on existing infrastructure. Although the study acknowledges the informal settlement constraints, for an example, poor access to safe water and sanitation attributed by unplanned settlements; poor sanitation planning and implementation due to maybe financial or policy constraints; rapid urbanization and overcrowded living conditions; lack of adequate space to allow people to build private facilities (Oyeniyi and Oloyede, 2016); and lack of space to allow municipalities to build adequate sanitation facilities, the right to safe water and sanitation cannot be overlooked. The existing informal settlements in SA, the settlements that will be formed either through UISP or through land invasion, demand accelerated improvements on the safety of water and sanitation. Growing number of informal settlements calls for the need to know more about the everyday nature of informal settlement sanitation (McFarlane et al., 2014) because it is an important basis from which intervention should develop.

To end, this study focused narrowly on one informal settlement known as Marikana. The findings of this study may be different from other informal settlements in Cape Town and South Africa. However, the findings possible similar, with caution on generalization, the findings may be transferable to other informal settlements. The study was conducted during the autumn season. It is assumed that during the winter season the percentage of people accessing shared sanitation facilities (toilets) decrease because Cape Town winter has more rainfall, winter is mostly dark (the sun rises late, and sunset early). Different results can be expected in the winter season and the risks associated with solid waste refusal and contamination of water can possible increase in the winter season.

South Africa vision 2030 adopted from the post-2015 SDGs, Goal 6, calls for universal and equitable access to safe and affordable drinking water for all and calls for universal access and adequate sanitation and hygiene for all and an end of open defecation, paying special attention to the needs of women and girls and those in vulnerable situations by 2030. The study findings can be factored in the action plans set towards achieving SA vision 2030. The study findings are indeed the motivator for SA to achieve its initial aim for all households to have access to its own flush toilet (connected to sewerage) and access to its own safe (piped) water facilities.

It was, therefore, useful to study the right to safe water and sanitation in a South African informal settlement through using Marikana informal settlement as a case study

7. LIST OF APPENDICES

7.1. Appendix 1: Fieldwork record

Date	Activity	Location
16 March 2017	Phone calls with CoCT sewer & water technician	
18 April 2017	Phone call with	Marikana
23 April 2017	Site visit Marikana, and Meeting with the Activist	Marikana
24 April 2017	Phone call with Swift Lab	
25 April 2017	Meeting with the Ward 35 Councillor	Marikana
26 April 2017	Phone call with clinic (medicals)	Airport
29 April 2017	Site survey	households
03 May 2017	Meeting with CoCT, Bellville (GIS Department)	Bellville
06 May 2017	Site survey	households
07 May 2017	Site survey	Households
10 May 2017	Hillstar depot visit Phone call with Hillstar Superintendent, CoCT	Hillstar, Ottery
13 May 2017	Site survey	Marikana
23 May 2017	Meltonrose depot visit	Meltonrose
13 June 2017	Meeting with CoCT, Bellville (Monitoring & Evaluation)	Bellville
15 June 2017	Water sampling for testing	Marikana
	Phone call with Hillstar, CoCT (Health & Environment Department)	
01 August 2017	Phone call with Ms. Muller, CoCT solid waste management department	

7.2. Appendix 2: Interview guide for Marikana residents and City of Cape Town officials

SECTION 1- SURVEY QUESTIONS ABOUT DRINKING-WATER

	Safe Drinking water questions (international benchmark)	Yes	No
1	Determine the main source of drinking water for household • Surface water - river, dam • Spring, borehole, dug well • Piped water into the dwelling /yard • Public tap – piped water to • Rainwater collection – Jojo tank • Rainwater collection - buckets • Water truck/tanker • Bottled water • Other Aim of the question to is to determine the improvement drinking source		
2	Determine the time taken to collect water		
	• Number of minutes • Distance to the main source of drinking water (m) • Water in premises • *Do you fetch water at night?* • *Is it safe to travel to the water point?* • *Where do you keep water at night?* o *Covered bucket* o *Bottles*		
3	Individual(s) collecting water		
	• Adult woman • Adult man • Female child (under 15) • Male child (under 15)		
5	Water treatment: do you treat water to make it safe		
	• Yes • No • Don’t know		
7	What do you usually do to the water to make it safer to drink		
	• Boil add bleach/chlorine • Strain it through a cloth • Let it stand and settle • Don’t know		

SECTION 2 SURVEY QUESTIONS ABOUT SANITATION

	What kind of toilet facility of your household usually use	Yes	No

1	• Flush/pour flush:
	  ○ Pipe sewer system
	  ○ Septic tank
	  ○ Pit latrine
	  ○ Don't know
	• Ventilated improved pit latrine
	• Pit latrine with slab
	• Composting toilet
	• Bucket
	• No facilities or bush or field
	• Other		

2	Do you share the facilities with other households		
	• Facilities in premises, if not • Distance to the shared toilet facilities (in meters) • Number of minutes to the shared toilets		
	• *Is it safe to travel to the toilets at night?* • *Do you use the toilet facilities at night?* ○ *Do you use a bucket?* • Any physical disable individuals		
3	How many households use the shared toilet facility		
	• Is the toilet shared by women and men? • Can any member of the public use this toilet? • Don't know		
4	Disposal of waste and environmental conditions around the water and sanitation facilities		
	The last time the children passed stools, what was done to dispose of stools? • Thrown into garbage • Buried • Put/rinsed into the toilet or latrine • Put/rinsed into drain or ditch After washing the dishes or clothes, what was done to dispose of the grey water • Thrown into the open drain • Thrown in the toilet What kind of solid waste bins do you have? • Do you share the solid waste bins? • Where do you throw the solid waste		

SECTION 3 SURVEY QUESTIONS ABOUT MAINTENANCE

First tick whether the factor is present or not present. Then tick the importance of the factor in making sure that maintenance programme is implemented successfully.

1. Excellent, no deviations
2. Excellent – minor deviations
3. on target – acceptable deviations
4. below target – too many deviations
5. unacceptable – too many serious deviations

No	Description	Factor Present	Factor not Present	1	2	3	4	5
1	Is there a maintenance policy?							
2	Is there an existing planned maintenance programme?							
3	Maintenance cost center and its budget (frequency of cleaning, replacement/vandalism, tariff income) influenced by any targets?							
4	Maintenance department KPI's determined and monitored							
5	Is maintenance outsourced though service level agreement?							
6	Maintenance works carried by local people (transformation / socio-economic)							
	Are the local people trained and vaccinated by hepatitis A & B?							
	Do the water pipe burst? How often? How long does it take to repair?							
	Do the sanitation system block and flood? How often? How long does it take to unblock?							
7	Audits are performed to establish the state of infrastructure facilities.							
8	Audits are performed to evaluate maintenance regimes and quality standards							
9	Management fully participate in at least one full audit infrastructure water and sanitation facilities and review maintenance system							
10	The maintenance management system is computerized, are records documented?							
11	Is there maintenance awareness programme for all informal dwellers?							
12	Any maintenance constraints?							

7.3. Appendix 3: Laboratory water testing

Section 4– Drinking Water AS PER SANS 241:2015 Drinking Water, SA

Water Services Act of 997, state that the Minister may, from time to time, prescribe compulsory national standards relating to, amongst others, the provision of water services, the quality of water taken from or discharged into any water services or water resource system and the effective and sustainable use of water resources for water services. These standards may differentiate between different users of water services and different geographic areas, taking into account, amongst other factors, the socio-economic and physical attributes of each area.

In prescribing these standards the Minister must consider

(a) the need for everyone to have a reasonable quality of life;
(b) the need for equitable access to water services;
(c) the operational efficiency and economic viability of water services;
(d) any norms and standards for applicable tariffs for water services;
(e) any other laws or any standards set by other governmental authorities;
(f) any guidelines recommended by official standard-setting institutions;
(g) any impact which the water services might have on the environment; and
(h) the obligations of the National Government as custodial of water resources.

Every water services institution must comply with the abovementioned standards.

Merieux NutriSciences formerly known as SWIFT is a laboratory that offers a lot of SANAS-accredited microbiological test methods for food, beverage, cosmetic and pharmaceutical products. The Cape town laboratory used for the sample testing is being accredited by the South African National Accreditation System (SANAS) as meeting the technical competency requirements of the internationally recognized ISO 17025 standard. Because of the met ISO 17025 standard requirements, Merieux certificates of analysis are recognized and accepted worldwide, a benefit to clients who export (www.swift.co.za).

One (1) sample of water was tested for Microbiological Analysis only, the test for the Total Microbial Activity, Coliforms, and Escherichia coli. The SANS 241 (Full Drinking Water Spec) tests were not done for the results are available on the DWA website, Blue Drop System. Since ensuring the safeness of tap water requires proactive preventative management, CoCT as one of the water services adopted the required preventative approach towards the management and regulation of drinking water.

Sample 1 Test Results

FINAL CERTIFICATE OF ANALYSIS

COA Nº:	266926-0
COA Date:	23/06/2017
Page	1 / 1

Customer: Ntomboxolo Danti
Order Nº:
Client Reference Nº:
Project Nº: CT 17-025228

Analysed By Swift Slliker (Pty) Ltd t/a Mérieux NutriSciences

7 Warrington Road
Claremont 7708
Western Province
Phone: +27 21 683 8436 Fax: +27 21 683 8420

Received from Ntomboxolo Danti
Cape Town Airport
Tower Road Next Atns, Foxtrot 3
8000

To Ntomboxolo Danti
- Ntomboxolo Danti
Cape Town Airport
Tower Road Next Atns, Foxtrot 3
8000

SAMPLE DESCRIPTION

Lab Sample Ref #: CT 17-025228-001 **Sample Nº:** 1 702 421 **Test Date:** 15/06/2017
Category Detail: Water **Sample Condition:** SEALED **Date received:** 15/06/2017
Product Description: Water

ANALYTICAL RESULTS

Tests	Analysis Start Date	Results	Units	Limits *(Target value)*	
☑ **Coliforms** METHOD: SWJM 48	15/06/2017	40	cfu/100ml	Result <= 10	NC
☑ **Escherichia coli** METHOD: SWJM 45	15/06/2017	No Growth	cfu/100ml	Not Detected /100ml	
☑ **TMA** METHOD: SWJM 35	15/06/2017	350	cfu/ml	Result <= 1000	

Limits as per SANS 241-1:2011 (EDITION 1)

Results validated on 23/06/2017

Jonade Festers
Technical Signatory

☑ Accredited analysis * Non Accredited analysis NC Non Conformance
TMA = Total Microbial Activity / Total Viable Plate Count.
No growth = Not detected / less than the lower detection limit of the test method, for the specified sample type / volume of sample tested.

Sample 2 Test Results

FINAL CERTIFICATE OF ANALYSIS

COA N°:	268968-0
COA Date:	03/07/2017
Page	1 / 1

Customer: Ntomboxolo Danti
Order N°: CT 17-026734
Client Reference N°:
Project N°: CT 17-026734

Analysed By Swift Slilker (Pty) Ltd t/a Mérieux NutriSciences

7 Warrington Road
Claremont 7708
Western Province
Phone: +27 21 683 8436 Fax: +27 21 683 8420

Received from Ntomboxolo Danti
Cape Town Airport
Tower Road Next Atns, Foxtrot 3
8000

To Ntomboxolo Danti
- Ntomboxolo Danti
Cape Town Airport
Tower Road Next Atns, Foxtrot 3
8000

SAMPLE DESCRIPTION

Lab Sample Ref #: CT 17-026734-001 **Sample N°:** 1 715 745 **Test Date:** 28/06/2017
Category Detail: Water **Sample Condition:** SEALED **Date received:** 28/06/2017
Product Description: Water

ANALYTICAL RESULTS

Tests	Analysis Start Date	Results	Units	Limits *[Target value]*
☑ **Coliforms** METHOD: SWJM 48	28/06/2017	No Growth	cfu/100ml	Result <= 10
☑ **Escherichia coli** METHOD: SWJM 45	28/06/2017	No Growth	cfu/100ml	Not Detected /100ml
☑ **TMA** METHOD: SWJM 35	28/06/2017	No Growth	cfu/ml	Result <= 1000

Limits as per SANS 241-1:2015 (EDITION 2)

Results validated on 03/07/2017

Tasmin Wakefield
Technical Signatory

☑ Accredited analysis * Non Accredited analysis NC Non Conformance
TMA = Total Microbial Activity / Total Viable Plate Count.
No growth = Not detected / less than the lower detection limit of the test method, for the specified sample type / volume of sample tested.
Tests marked with a * in this report are not included in the SANAS Schedule of Accreditation for this laboratory T0060

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