

The management of potable water supply in Khuma Township, Matlosana Local Municipality

K.S Monnahela

12677612

Honours Baccalaureus Educations

&

Honours Bachelor of Arts

(Development and Management)

Mini-dissertation submitted in partial fulfillment of the
requirements for the degree *Master of Development and
Management in Disaster Studies* at the Potchefstroom Campus
of the North-West University

Supervisor: Prof EJ Nealer

May 2014

ACKNOWLEDGEMENTS

I would like to extend my special thanks to my Heavenly Father for giving me the strength and ability to study and the opportunity to do so under tremendous and challenging circumstances.

I would also like to extend my respect and gratitude to Prof. Eric Nealer for his guidance and support throughout my studies. If it was not his warm and fatherly advice I would most probably not decided to undertake this unforgettable venture of my studies.

To my dearest daughter REFILWE, THANK YOU SO MUCH FOR ALWAYS BEING IN MY LIFE THROUGH PAIN, SADNESS, and FRUSTRATION AND MOST IMPORTANTLY THE LOVE WE SHARED. When most people decided to withdraw their support, you stood by my side. You are the reason and motivation behind my determination and success. The absence of so many days from you due to my studies will be forever remembered my dear. Daddy loves you and you will always be my PRIDE and REASON to be ALIVE.

I am also thankful to my partner (Lerato Banyane) for always been there for me through difficult times, especially believing in me despite all criticisms and most importantly providing me with unconditional love and support.

A very big THANK YOU to my mother, Mrs. MONNAHELA MARIA, for always believing in me since my school days and giving me advices to keep on studying!!!!

My eternal gratitude goes to my former colleagues at THUTO THEBE SECONDARY SCHOOL in Khuma, Stilfontein for their words of encouragement and support. Most importantly “Ausi BOITUMELO LEHASA”. You will forever be my sister no matter I would be in life!!!

Special thanks to the public of Khuma for playing active role in my studies by providing me with their honest views and concerns about the management of potable water supply in their area. I should also thank officials from Matlosana Local Municipality especially Mr. Sibanyoni Godfrey and his Team.

Through this journey I learned and experienced the following Lessons in life...

“THE MOST DIFFICULT DECISION TO MAKE IS USUALLY THE RIGHT ONE TO MAKE HENCE IT ALWAYS SEEMS IMPOSSIBLE UNTIL IT IS DONE”.

“THE ULTIMATE MEASURE OF A MAN IS NOT WHERE HE STANDS IN THE MOMENT OF COMFORT AND CONVENIENCE BUT IN THE TIMES OF CHALLENGES AND CONTROVERSY”

“DIFFICULTIES BREAK SOME MEN BUT MAKE OTHERS. NO AXE IS SHARP ENOUGH TO CUT THE SOUL OF A SINNER WHO KEEPS ON TRYING, ONE ARMED WITH THE HOPE THAT HE WILL RISE EVEN IN THE END.”

BUT MOST IMPORTANTLY I LEARNED THAT

“COURAGE WAS NOT THE ABSENCE OF FEAR, BUT THE TRIUMPH OVER IT. THE BRAVE MAN IS NOT HE WHO DOES NOT FEEL AFRAID, BUT HE WHO CONQUERS THAT FEAR.”

ABSTRACT

The birth of a non-racial democracy in South Africa brought many challenges such as the supply of potable water to all societies irrespective of their colour or even location. Migration of people from rural to urban has increased the demand of potable water supply in many areas that were previously neglected by the former Apartheid regime. The increase of the human population in urban or developing areas of South Africa will therefore imply that various public services such as potable water supply, proper housing, electricity supply, schooling and basic health facilities should be provided in an efficient, effective and economic manner.

As the resident of Khuma Township, the researcher has a keen interest in the management of potable water supply in this area, *inter alia*, the nature and extent of the physical environment and the efficiency and effectiveness of a potable water supply as a means of improving service delivery by the Matlosana Local Municipality to Khuma Township. The area has the history of gold mining and the majority of the people from other rural areas and neighbouring states moved into this area and were later joined by their families. This resulted in an increase in the population to a point where people were placed in dangerous areas such as underlying dolomite and along the Koekemoer spruit. For example, extension 6 is known to experience sinkholes due to underground mining activities and the underline dolomite rock.

The population has increased in Khuma Township to such an extent that a shortage of potable water supply is been experienced. Khuma Township had one water reservoir for the past 40 years and Matlosana Local Municipality did not improve or developed infrastructure related to potable water supply to be able to cater for the increasing population of this area.

An empirical study was conducted in among the residents of Khuma Township, Matlosana Local Municipality and role-players in the management of potable water supply. From this study, it was evident that the supply of potable water in Khuma

Township is insufficient, and there was poor communication, cooperation and participation between Matlosana Local Municipality and the residents of Khuma Township. The ineffective management of potable water supply in Khuma Township by the Matlosana Local Municipality as well as ignoring the significance of settling people in a safe area that is free from water pollution, sinkholes and underlying dolomite rock left a lot to be desired.

The researcher arrived at logical conclusions and recommendations with regard to all aspects related to future management of potable water supply in Khuma Township.

Keywords: Portable water, integrated water resource management, geo-hydrology, underlying dolomite, vulnerability, active participation, insufficient potable water supply, underground mining.

OPSOMMING

Die geboorte van 'n nie-rassige demokrasie in Suid-Afrika het baie uitdagings gebring, soos die voorsiening van drinkwater aan alle gemeenskappe, ongeag kleur of selfs lokaliteit. Migrasie van mense vanaf landelike na stedelike gebiede het die vraag na drinkwatervoorsiening laat toeneem in baie areas wat vroeër deur die Apartheid-regime verwaarloos is. Die toename in die bevolking in stedelike of ontwikkelende areas in Suid-Afrika sal daarom impliseer dat verskillende openbare dienste, soos voorsiening van drinkwater, behoorlike behuising, elektrisiteit, skole en basiese gesondheidsdienste on 'n doeltreffende en effektiewe wyse voorsien moet word.

As 'n inwoner van die Khuma-Woongebied, het die navorser 'n besondere belangstelling in die bestuur van drinkwatervoorsiening in hierdie area, *inter alia*, in die aard en omvang van die fisies omgewing en die doeltreffendheid en effektiwiteit van drinkwatervoorsiening as 'n wyse om dienslewering deur die

Matlosana Plaaslike Munisipaliteit aan die Khuma-Woongeheid te verbeter. Die area het 'n geskiedenis van goudmyndou en die meeste mense vanaf ander landelike gebede en buurstade het in die area inbeweeg en is later deur hulle familie gevolg. Dit het uitbreiding en bevolkingstoename tot gevolg gehad tot by 'n punt waar mense in gevaarlike gebede geplaas is, soos op onderliggende dolomiet en langs die Koekemoerspruit. Uitbreiding 6 is byvoorbeeld bekend as 'n gebede waar sinkgate voorkom as gevolg van ondergrondse mynbedrywighede en die onderliggende dolomite-rots.

Die ongelukkige deel van die bevolkingstoename in Khuma-Woongebied is die onvoldoende drinkwatervoorsiening. Khuma-Woongebied het 'n waterreservoir die afgelope 40 jaar gehad en Matlosana Plaaslike Munisipaliteit het nie die drinkwatervoorsiening-infrastruktuur verbeter of ontwikkel ten einde in staat te wees om die toenemende bevolking te bedien nie.

'n Empiriese studie is uitgevoer by Khuma-Woongebied, onder sy inwoners, Matlosana Plaaslike Munisipaliteit en ander rolspelers in die bestuur van drinkwatervoorsiening in dié gebied. Uit die studie was dit duidelik dat die voorsiening van drinkwater in Khuma-Woongebied onvoldoende is, en dat daar gebrekkige kommunikasie, samewerking en deelname tussen Matlosana Plaaslike Munisipaliteit met betrekking tot die plasing van mense in veilige gebiede wat vry is van waterbesoedeling, sinkgate en onderliggende dolomite-rots, is onbevredigend: dus was die verbetering van drinkwatervoorsiening onvoldoende.

Die navorser het sekere logiese gevolgtrekkings gemaak, asook aanbevelings met betrekking tot alle aspekte rakende die toekomstige bestuur van drinkwatervoorsiening in die Khuma-Woongebied.

Sleutelwoorde: Drinkwater, Geïntegreerde Water Hulpbron Bestuur, Geo-hidrologie, onderliggende dolomiet, Kwesbaar, Aktiewe betrokke, Onvoldoende drinkwatervoorsiening, en Ondergrondse mynbedrywighede.

TABLE OF CONTENTS

Acknowledgements.....	i
Abstract.....	iii
Opsomming.....	iv
Table of contents.....	vi
Annexure.....	ix
List of figures.....	x
List of tables.....	xi

CHAPTER 1: ORIENTATION AND INTRODUCTION TO THE STUDY AREA.....1

1.1. INTRODUCTION AND BACKGROUND.....	1
1.2. ORIENTATION AND PROBLEM STATEMENT.....	2
1.3. RESEARCH OBJECTIVES.....	6
1.4. RESEARCH QUESTIONS.....	6
1.5. CENTRAL THEORETICAL STATEMENT AND HYPOTHESIS.....	7
1.6. RESEARCH METHODOLOGY.....	8
1.6.1. Literature review.....	8
1.6.2. Empirical investigation.....	9
1.6.2.1 Research design.....	10
1.6.2.2 Sampling.....	10
1.6.2.3 Instrumentation.....	10
1.6.2.4 Limitations and delimitations.....	11
1.7. SIGNIFICANCE OF THE STUDY.....	12

1.8. PROVISIONAL CHAPTER LAYOUT.....	12
1.9 CONCLUSION.....	13

CHAPTER 2: THE PHYSICAL ENVIRONMENTAL ASPECTS OF IMPORTANCE REGARDING KHUMA TOWNSHIP.....

2.1 INTRODUCTION.....	14
2.2 HYDROLOGICAL WATER CYCLE.....	14
2.3 GEO-HYDROLOGY OF KHUMA TOWNSHIP AREA	15
2.3.1 Dolomite.....	16
2.4 IMPACTS OF MINING TO THE POTABLE WATER SUPPLY OF KHUMA TOWNSHIP.....	18
2.5 DESCRIPTION OF POTABLE WATER.....	20
2.6 ORIGIN OF POTABLE WATER SUPPLY IN KHUMA TOWNSHIP.....	21
2. 6.1 Midvaal Water Company.....	21
2.6.2 The Blue-Drop Status of Matlosana Local Municipality's potable water.....	22
2.7 POTABLE WATER SUPPLY AND POVERTY REDUCTION.....	23
2.8 SUMMARY.....	26

CHAPTER 3: SOUTH AFRICAN LEGAL FRAMEWORK WITH REGARD TO THE MANAGEMENT OF POTABLE WATER SUPPLY IN A MUNICIPAL AREA.....

3.1 INTRODUCTION.....	27
3.2 AN OVERVIEW OF THE LEGAL FRAMEWORK PERTAINING TO THE MANAGEMENT OF POTABLE WATER IN SOUTH AFRICA.....	28
3.3 INTEGRATED WATER RESOURCE MANAGEMNT AS A TOOL FOR EFFECTIVE AND EFFECIENT MANAGEMENT OF WATER RESOURCES..	31
3.4 REGULATORY FRAMEWORKS ON WATER RESOURCE MANAGEMENT..	34
3.5 THE ROLE OF MUNICIPALITIES ON POTABLE WATER SUPPLY.....	36

3.6 WATER SUPPLY BY-LAWS IN MATLOSANA LOCAL MUNICIPALITY.....	38
3.7 SUMMARY.....	39

CHAPTER 4: THE MANAGEMENT OF POTABLE WATER SUPPLY IN KHUMA TOWNSHIP: EMPIRICAL FINDINGS.....	41
4.1 INTRODUCTION.....	41
4.2 RESEARCH METHODOLOGY AND DESIGN.....	42
4.3 COLLECTED DATA AND ANALYSES.....	42
4.4 ANALYSIS OF FINDINGS	62
4.4.1 Insufficient potable water supply to the residents of Khuma Township	63
4.4.2 Poor communication, cooperation and participation between Matlosana Local Municipality and Khuma Township residents.....	65
4.4.3 The impacts of mining to the quality of potable water supplied in Khuma Township.....	66
4.4.4 The impact of underlying dolomite rock to Khuma Township Home owners.....	67
4.5 SUMMARY.....	68

CHAPTER 5: SUMMARY CONCLUSIONS AND RECOMMENDATIONS.....	70
5.1 INTRODUCTION.....	70
5.2 PRIMARY FINDINGS LEADING TO CONCLUSIONS.....	71
5.2.1 Legislation on potable water supply in local municipalities.....	71
5.2.2 Overall nature and extent of management of potable water	

supply in Khuma Township.....	73
5.2.3 Efficiency and effectiveness of the management of potable Water supply by Matlosana Local Municipality in Khuma Township.....	74
5.2.4 The Role-players and Stakeholders.....	75
5.3 RECOMMENDATIONS.....	76
5.3.1 With reference to the underground mining activities and dolomite (Karst area).....	76
5.3.2 Legislation applicable to potable water supply by municipalities....	77
5.3.3 Nature and extent of management of potable water supply in Khuma Township.....	78
5.3.4 Improved potable water supply by Matlosana Local Municipality To Khuma Township.....	79
5.3.5 Role-players and Stakeholders.....	79
5.4 FURTHER RESEARCH.....	80
LISTS OF SOURCES.....	81

ANNEXURES

ANNEXURE A: MOOIRIVER CATCHMENT (Displaying areas with Dolomite
including Khuma Township

ANNEXURE B: GOOGLE EARTH OF KHUMA TOWNSHIP

ANNEXURE C: QUESTIONNAIRE REGARDING THE MANAGEMENT OF
WATER SUPPLY IN KHUMA TOWNSHIP

ANNEXURE D: INTERVIEW SCHEDULED WITH THE ROLE PLAYERS
IN POTABLE WATER SUPPLY IN KHUMA TOWNSHIP

List of Figures

Figure 1: Photograph of Midvaal Water Company Treatment Site (Midvaal Annual Report, 2010).....	3
Figure 2: Water demand growth trend of Khuma Township (City of Matlosana, 2007).....	4
Figure 3: Sewage- overflow in some parts of Khuma Township (Researcher's Personal Library).....	5
Figure 4: Water Cycle (Baumgartner & Recheil, 1975).....	15
Figure 5: Dolomite rocks in Khuma Township (Researcher's Personal Library)....	16
Figure 6: Sinkhole due to underground cavities (DWA, 2009).....	17
Figure7: Impact of Earth Tremors in Stilfontein near Khuma (Geosciences.2005).....	18
Figure 8: Scanned Section of Margaret Shaft Cone Depression (Environmental, 1993).....	19
Figure 9: Vulnerable Township Residents collecting water from Water Tanks (Researcher's Personal Library).....	25
Figure 10: Maintenance of Water Pipes around MATLOSANA (Researcher's Personal Library).....	38
Figure 11: Collection of water from trucks in Khuma (Researcher's Personal Library).....	44
Figure 12: Construction and Development of another Water Reservoir in Khuma Extension 8 (Researcher's Personal Library).....	45

List of Table(s)

Table1: Important Legislation in South Africa since 1994 as related to water and the role of municipal governance.....	29
---	----

CHAPTER 1: ORIENTATION AND INTRODUCTION TO THE STUDY AREA

1.1 INTRODUCTION AND BACKGROUND

The demand for potable water in many urban areas in South Africa is increasing at an alarming rate since 1994. This is due to most towns and cities experiencing an increased migration of people from rural to urban areas as well as foreigners from neighbouring countries in search for a better life in South Africa. According to Biswas (2004:248), water is a resource that is of direct interest to the entire population as well as the municipalities, private sector, and non-governmental organisations. The increase of the human population in urban or developing areas of South Africa implies that various public services such as potable water supply, proper housing, electricity supply, schooling and basic health facilities should be provided in an efficient, effective and economic manner.

Khuma Township was established in the late 1950's just after the discovery of gold in the vicinity of a white settlement area called Stilfontein by civil engineer, Jack Scott in 1949. According to Brown (1983:133), "Stilfontein acquired its black township called Khuma, in 1960". Several gold and uranium shafts were discovered and due to the lack of geo-hydrological and scientific knowledge and competency, most mining shafts were shut down by the government, up until the arrival of Jack Scott.

Stilfontein Gold Mining Company (see annexure B) was re-discovered in 1949 by Jack Scott and by that time it had 97 white and 1220 black employees. In addition to these workers, Potgieter, Spies, & Hiemstra, (1974:293) also emphasized that, in the early 1970's, this area had "inhabitants predominantly mine employees with 12137 Whites, 36 coloured and 9218 Bantus (Blacks)".

Potgieter *et al.* (1974:293) also indicated that this area at that stage received its water supply from the Western Transvaal Regional Water Supply Company. Brown (1983:224) added that, at the "end of 1950, some 117 houses had already been completed for employees of the mine".

In 1952, other mining shafts such as the Hartebeesfontein was discovered as the uranium producing shaft and in 1955, the Buffelsfontein Gold mine yielded both gold

and uranium producing shaft in this area. These three shafts are close to the Khuma Township. Most migrant labourers and job-seekers gathered in large numbers in this area.

As an educator and born in Khuma Township, the researcher has a keen interest in the management of potable water in the area. The research outlined the management of potable water supply in Khuma Township and the impact of the current management of potable water. Finally, possible suggestions to improve the management of water were provided.

1.2 ORIENTATION AND PROBLEM STATEMENT

Khuma Township is situated in the Matlosana Local Municipality's geographical area of responsibility which is part of the Dr Kenneth Kaunda District Municipality. The Township is located immediately east of Stilfontein near Klerksdorp along the N12 National road (see annexure B for locality map).

Initially, the discovery was utilised for mining rather than permanent residential settlement. The mining of gold in this area started to experience a high influx of migrant labourers. Khuma Township was established by those who sought mining jobs and a space to settle closer to the mining-houses.

According to the City of Matlosana (2012:4), Khuma Township has an estimated total population of 43 033 people and more than 43% are currently unemployed. The number of registered housing stands were approximately 13 553 by 2011 and this number has increased at an alarming rate due to the influx of migrant labour to the mining area. According to a communiqué by Sibanyoni (2012), most basic services including the supply of potable water in Khuma Township, have been subsidised by the mining companies such as Buffelsfontein Gold Mining and Stilfontein Gold Mining Company. Unfortunately, the supply and subsidy of potable water to the mining community and the residents of Khuma Township could not foresee the possible population influx that took place in the early 1980s. The community of Khuma Township also got used to the fact that the mining companies would provide them with free water services.

Immediately after the political and socio-economic transformation in 1994, many areas, including Khuma Township, started to experience difficulties with regard to payment for services to their respective local municipalities. One of the common problems experienced by local municipalities such as Matlosana Local Municipality has been the statements in the early 1990's when political parties promised the residents that they would be provided with free basic public services such as water and electricity if they were voted into power. The communities in Khuma Township were unable to pay for their basic services and this led to an increased deficit for, *inter alia*, Midvaal Water Company; one of the suppliers of water to the residents of Khuma Township. Figure 1 below shows how potable water is processed at the Midvaal Water Company:



Figure 1: Photograph of Midvaal Water Company Treatment Site (Midvaal Water Company, 2010).

Midvaal Water Company is located almost 15km south of Stilfontein and was established in 1954 (Anon, 2011:13). The Company is situated on the northern bank of the Vaal River and serves an area of about 900km² (see annexure B). It is a water purification company which cleans and provides potable water to Matlosana Local Municipality areas which include residential as well as mining and industrial undertakings. According to Midvaal Water Company Annual Report (2010:10), the company has been supportive to the Department of Water Affairs in achieving economic growth and social development by ensuring sustainable and equitable resource management and improving governance and regulation in the area of Matlosana (Klerksdorp).

According to a communiqué by Sibanyoni (2011), most residents of Khuma Township's source of income was from the mining companies such as Buffelsfontein Gold Mining. As the pricing and value of gold started to decline in the mid-1980s, many mining shafts closed down and most of the miners were retrenched. At present, more than 43% of the mining community is unemployed and they depend entirely on government social grants (City of Matlosana, 2012:4). These problems have escalated the shortfall or non-payments for basic municipal services supplied and facilitated by the Matlosana Local Municipality. The non-payment of services also led to limited development and poor maintenance of water services infrastructures in the Khuma Township area. During peak hours and high season of high water consumption, there is less water or even no water supply in many sections of Khuma Township (Sibanyoni, 2012). Figure 2 below indicates the daily water demand growth trend in Khuma for a period of 11 years: 2006 to 2017.

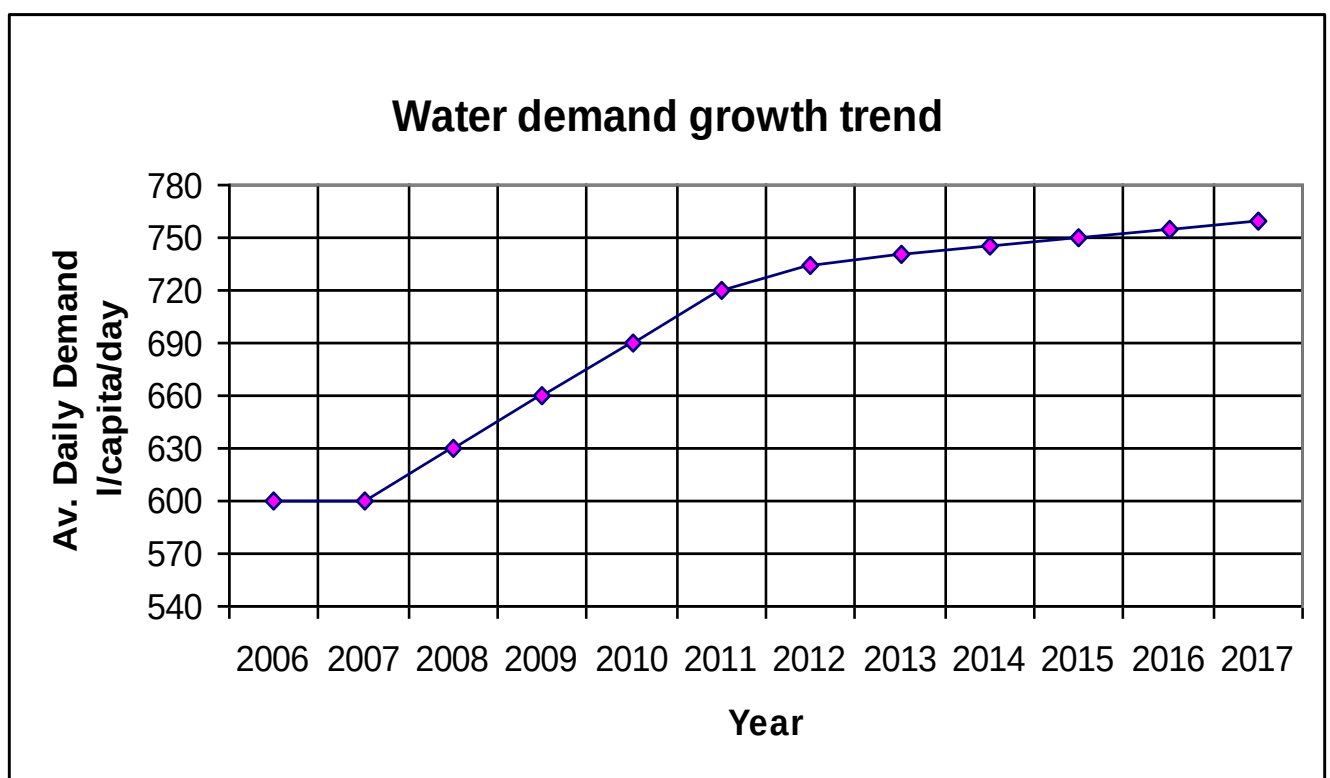


Figure 2: Water demand growth trend at Khuma Township.
(City of Matlosana, 2007:9)

Unfortunately, Khuma Township has a long history of shortages of potable water supply. According to City of Matlosana Technical Report (2007:3-4), the major problems found to be contributing to the shortage of potable water supply to the

community of Khuma Township are: empty water reservoirs, an insufficient water pressure tower, low water pressures and large amounts of air in the water reticulation system. Furthermore, the area is geologically underlain by dolomite rock, a number of sinkholes have formed in the area and the Koekemoer Spruit flowing through the settlement (See Annexure B). The last two mentioned natural aspects implicate a physical area unsuitable for a long-term settlement of municipal residents.

The lack of adequate supply of potable water has hindered and delayed other basic services such as education and health services in Khuma Township. Water-borne and air-borne diseases are possible health threats to the residents of Khuma Township due to inadequate potable water supply. The current sanitary conditions, daily sewage pipes bursts and used water spilling into the streets are an indication of how vulnerable this community is to an unhealthy environment and water related diseases. The image in Figure 3 below indicates this state of affairs:



**Figure 3: Sewage-overflow in some parts of Khuma Township
(Researcher's Personal Library)**

The inadequate and improper management of potable water supply is undoubtedly becoming worse, and the residents of Khuma Township are becoming vulnerable to health risks, including water-borne diseases such as diarrhoea, typhus and cholera. It is clear that the state of potable water supply and management in this area is in disarray and new approaches to long-term planning and management of potable

water supply that could incorporate principles of sustainability and equity are required for the area.

1.3 RESEARCH OBJECTIVES

The purpose of this research is to analyse the management of potable water supply in Khuma Township with the following sub-objectives in mind:

1. To determine the nature and extent of the physical environment where Khuma Township resides.
2. Become familiar with legislation and specific focus on the management and utilisation of potable water in a municipal area.
3. To determine the overall nature and extent of the management of potable water supply with the view to effective and efficient service delivery in Khuma Township by the Matlosana Local Municipality.
4. To determine the level of participation and commitment of Khuma Township residents in the management of their potable water supply.
5. To establish logical conclusions and recommendations on how to improve the management of potable water supply in Khuma Township.

1.4 RESEARCH QUESTIONS

In the light of the aforementioned objectives, the following research questions were identified:

1. To determine the significance of the physical environment of the Khuma Township residents.
2. What does South Africa's legislation in relation to potable water supply state about potable water supply management in a municipal area?
3. What is the overall nature and extent of the management and utilisation of potable water in bringing effective and efficient service delivery in Khuma Township by the Matlosana Local Municipality?

4. How can the participation and commitment of the community of Khuma Township assist in the improvement of potable water supply management in their area?
5. What logical conclusions and recommendations can be drawn to improve the management of potable water supply in Khuma Township?

1.5 CENTRAL THEORETICAL STATEMENTS AND HYPOTHESIS

Water is undoubtedly the most essential natural resource in nature. Without water, life comes to an end and no political, socio-economic and environmental stability can be reached. In South Africa water and its resources are governed at various sphere of government. According to Rhodes as quoted by Meissner (2013: on line) "Governance is define as the result of interactive socio-economic and political forms of governing that result in problem solving and opportunity creation." The unfortunate fact of water is that, unlike other natural resources, it is usually in motion, i.e. it moves from one area to another or is vulnerable and exposed to natural evaporation to the atmosphere where it also moves in the form of clouds from one geographical area to another. The motion of water makes the management thereof difficult. According to Biswas (2004:248), solutions to the potable water supply problems depend on factors such as the following:

- Process through which water is managed.
- Competency and capacities of institutions that manage water.
- Prevailing socio-political conditions that dictate water planning.
- Development and management processes and practice.
- Appropriateness and implementation status of the existing legal frameworks.
- Availability of the investment funds.
- Social and environmental conditions of the country concerned.
- Level of available and usable water service technology.
- Modes of governance, including issues like political interferences, transparency and corruption.

Biswas (2004:248) further emphasises that water problems are becoming increasingly interconnected with other developmental-related issues and also with

social, economical, environmental, legal and political factors at local and national spheres of government and sometimes at regional and even international spheres.

Water usage and its problems are not in isolation but are somehow related to development sectors in every state such as agriculture, energy, industry, transportation and communication and with social sectors which include education, health, rural and regional development. Due to these complex problems around water, it is important that every national, provincial and local sphere of government should begin to access, analyse, review and resolve all water related policies in their societal and development context. Any state or nation ignoring or neglecting these problems will be unable to accomplish water management objectives which include poverty alleviation, improved quality standard of peoples' life and environmental conservation. It is, therefore, important that proper management of potable water supply in the Khuma Township area be affected to improve the level of service delivery and the elimination of, *inter alia*, water-borne diseases.

1.6 RESEARCH METHODOLOGY

According to Leedy and Ormrod (2001:100), the methodology to be used for a particular research problem must always take into account the nature of the data that will be collected in the resolution of the problem. It, therefore, means that various research problems will then direct research designs and methods, which lead to the collection of various types of data and interpretations.

For the purpose of this research, the relevant methodologies were mixed. A qualitative and quantitative approach was used. Various instruments of data collection are found in both the approaches.

1.6.1 Literature review

Literature review is the exploration of a field of knowledge in order to provide definitions and frameworks for a piece of research (Anon, 2010:23). In order to have a clear understanding of the management of potable water supply in the Khuma Township area, a comprehensive literature study was undertaken. According to

Brynard and Hanekom (2006:31), researchers have to make a selection of the data available in order to be able to focus on only that which is relevant to their particular research project.

The first point of departure for this research was to consult primary and secondary sources such as:

- Books.
- Articles.
- Government reports
- Newspaper reports
- Catalogue of Theses and Dissertations from North-West University (Potchefstroom Campus).
- Sabinet- online.
- Internet.

Information concerning the nature and extent of the management of potable water supply in municipal areas of South Africa was gathered. Other related sources, such as, legislation with regard to the management of water resources, especially at the local sphere of governance was also consulted.

A literature review on the nature of the underlying dolomite rock and the underground mining in the Khuma Township area was also undertaken. The fact that the Township-area is drained by the Koekemoer Spruit was also taken into account to determine the realising geo-hydrology of the area. This area is also known for sinkholes which form near extension 6 (see annexure B).

1.6.2 Empirical investigation

Two research methods were used (qualitative and quantitative methods) since various instruments of data collection are found in both approaches. For example, in a phenomenological approach of the qualitative method real-life experiences of the Khuma Township residents concerning the supply of potable water was the central point of this research. On the other hand, interviewing (qualitative) and questionnaires as part of the quantitative approach was applied to collect data.

1.6.2.1 Research design

According to Brynard and Hanekom (2006:7), there are a number of research designs available which can be categorised into two, namely: basic and applied research. For the purpose of this research, applied research was based on the fact that the outcome of the research has somehow advanced the fundamental knowledge about the human world. This means that a number of different sources related to the management and supply of potable water, especially at local spheres of government were consulted in order to develop satisfactory critical research tools. Consultation of various sources assisted in broadening the understanding of management of potable water and how various local municipalities manage their water resources.

1.6.2.2 Sampling

Based on the research topic and its objectives, this research involved the entire community of Khuma Township. The residents of the township were, therefore, representatives of the population used. It was unclear at the beginning of research, how many residents of Khuma Township were negatively affected in the supply of potable water nor how many contributed negatively to the *status quo* of the management of potable water. By evaluating and analysing a sample of residents of Khuma Township, it was possible to draw informed conclusions and recommendations.

1.6.2.3 Instrumentation

The following instruments were used and validated to be able to obtain accurate and reliable data for this research:

- On four occasions, area visits and the study of crucial geohydrological aspects in the area were carried out by the researcher and the study leader in Khuma Township area. Evidence of houses built on geohydrological unsafe land (on dolomite rocks and along the edge of the Koekemoer Spruit) such as in extension 6, 9, 10 & 11 were collected. The researcher also visited the

Matlosana Local Municipality and Midvaal Water Company to collect data and information with regard to potable water supply to this area.

- Questionnaires were distributed to a population sample of all the role players.
- Interviews were conducted with role-players such as the residents of Khuma Township, Matlosana Local Municipality, Midvaal Water Company, Department of Water Affairs, Local health centres and Learning Centres in Khuma Township).

The completion of questionnaires and conducting interviews were the primary sources to obtain data for the qualitative study. The main purpose for collecting data from the stake holders' perspective was to gain clarity on the current management of potable water supply and establish their knowledge in this matter. The following role-players were questioned and interviewed:

- Residents of Khuma Township
- Engineers and Matlosana Local Municipality officials responsible for potable water supply in Khuma Township
- Midvaal Water Company
- Department of Water Affairs
- Local health centres
- Learning centres in Khuma Township.

1.6.2.4 Limitations and delimitations

The level of literacy of the Khuma Township community and some political bias affected the research. Most of the previously disadvantaged community members were unfamiliar with scientific research on the nature and extent of underground mining and geological located underlying dolomite. For example, where they were given questionnaires they did not always give their own views, but copied from fellow participants. On the other hand, research of this nature where probable poor performance of the ruling parties in terms of service delivery could be exposed, is usually bias in order to protect their future political positions.

1.7 SIGNIFICANCE OF THE STUDY

The knowledge and understanding by the communities in Klerksdorp, Orkney, Stilfontein and Hartebeesfontein (KOSH) area (Matlosana Local Municipality) about the management of water resources is of vital importance. The management of water resources in South Africa has become a political and socio-economic priority. The human demand for potable water is not only a South African problem but has become a global issue. For every country to meet human and ecosystem needs for especially drinking water, proper management of water resources should be a priority and the sustainable usage of water should be encouraged.

The research focused on how Matlosana Local Municipality manages water resources and problems associated with potable water supply in Khuma Township (one area in the larger municipal area) with a history of water supply problems.

1.8 CHAPTER LAYOUT

Chapter 1: Introduction and Orientation

A general orientation of the study of the management of potable water supply in the community of Khuma Township was presented in this chapter. A brief background of the Township with regard to potable water supply and the management thereof was also provided. The problem statement and research objectives were highlighted. The chapter also described the procedures to be followed in the research methodology and the process of data collection.

Chapter 2: Physical environmental aspects of importance: Khuma Township

This chapter contained a discussion and analysis of the physical environment aspects of importance in the Khuma Township regarding the management of potable water supply by the Matlosana Local Municipality.

Chapter 3: South African legal frameworks with regard to the management of potable water supply

This chapter attempted to identify and analyse the current South African legislation regarding the management of water with a specific focus on potable water supply by local municipalities in their respective geographical area and their residents.

Chapter 4: Empirical findings in Khuma Township

This chapter discussed the empirical findings of the research with regard to the current management of potable water supply by the Matlosana Local Municipality and its effectiveness and efficiency to the municipal residents. The primary focus of the research evolved around the discussion and analysis of potable water supply management in Khuma Township. Furthermore, the participation and commitment of Khuma Township residents was also discussed.

Chapter 5: Summary, Conclusions and Recommendations

A summary, conclusions and recommendations provided in this chapter were drawn from the findings and results of the research process. The *status quo* on the management of potable water supply by the Matlosana Local Municipality with specific focus on Khuma Township was summarised. The summary of the research attempted to reveal how the current management of potable water supply in Khuma Township affected the community and possible recommendations towards an efficient management of its potable water supply was provided.

1.9 CONCLUSION

A general orientation of the study of the management of potable water supply in the community of Khuma Township was presented in this chapter. A brief background of the Township with regard to potable water supply and the management thereof was also provided. The problem statement and research objectives were highlighted. The chapter also described the procedures to be followed in the research methodology and the process of data collection.

In the next chapter, the discussion and analysis of the physical environment aspects of importance in the Khuma Township regarding the management of potable water supply by the Matlosana Local Municipality will be done.

CHAPTER 2: THE PHYSICAL ENVIRONMENTAL ASPECTS OF IMPORTANCE REGARDING KHUMA TOWNSHIP

2.1 INTRODUCTION

In an attempt to understand the management of potable water supply in Khuma Township, it was very important to discuss and analyse the relevancy of the physical environmental aspects of importance in the area.

Water is the necessary ecological resource in every ecosystem and every species is constantly in need of water to survive. This resource is managed carelessly and recklessly by human beings in an unsustainable manner. The management of potable water is also influenced by physical environmental features of where members of the community reside. Khuma Township is underlain by dolomite and underground mining activities.

Furthermore, this area has the Koekemoer Spruit flowing through it and air pollution from the mining dumps in the area constantly affects the resident's health. It is these aspects around Khuma Township that force municipalities to meet the needs of the human and ecosystem for proper management of resources, and, *inter alia*, the sustainable usage of water.

The research focused on how the Matlosana Local Municipality manages this resource and the problems associated with potable water supply in the Khuma Township area in Klerksdorp which has a history of water supply problems.

2.2 HYDROLOGICAL WATER CYCLE

According to International Union for Conservation of Nature (IUCN) (quoted by Bekker, 2010:16-17), the hydrological water cycle from rainfall to water runoff is a complex system where several processes (infiltration, surface water runoff, recharge of underground water aquifers, seepage, re-infiltration and moisture recycling) are interconnected and interdependent with only one direction of flow: downstream. Nealer and Raga (2008a:296) further explain hydrology as the study of the nature,

extent and behaviour of the aforementioned surface water runoff and that of groundwater, as geo-hydrology. Consequently, the study and understanding of the hydrological water cycle should include understanding of the surface and underground water runoffs. Figure 4 below outlines the process of the water cycle:

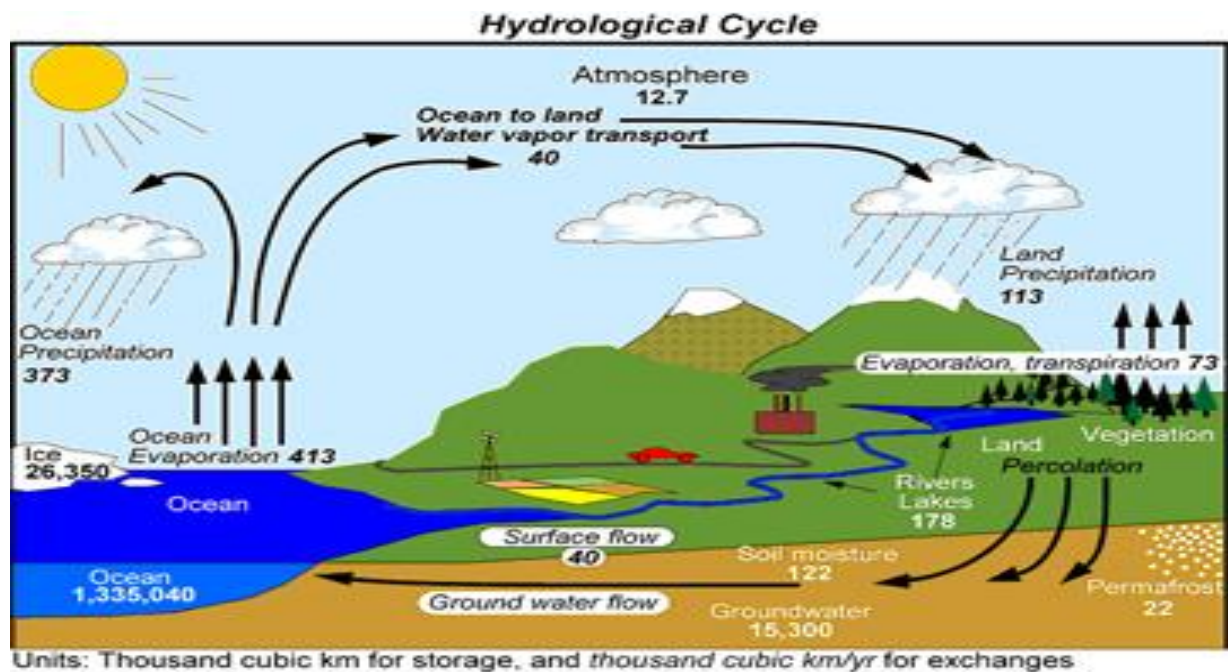


Figure 4: Water cycle
(Baumgartner and Recheil, 1975)

South Africa is an arid to semi-arid country with an average rainfall of around 500mm per annum. A lot lower than the world average of 860mm per annum (Bekker, 2010:16). The rainfall within the country is very unevenly distributed and of the “fallen rain” only 10% which make-up the potable water resources of South Africa (Nealer & Raga, 2008b:158).

2.3 THE GEO-HYDROLOGY OF KHUMA TOWNSHIP AREA

The geo-hydrology of the underlying stratum in Stilfontein area which includes Khuma Township is mainly governed by pre-mining geological constraints and the water flow in the upper weathered aquifer is from the north to the south towards the Vaal River. According to Veltman and Wilke (2008), ground and surface water recharge in the Klerksdorp, Orkney, Stilfontein and Hartebeesfontein (KOSH) area, presently known as (Matlosana Local Municipality), varies between 6% and 12% for

mean annual precipitation and is relatively high due to top soil resulting from erosion of the underlying by dolomite rock which is transmissive and areas of Karstification (dissolution) which allow for rapid infiltration.

2.3.1 Dolomite

Dolomite is a most significant rock type when it comes to the groundwater potential due to the nature of the groundwater occurrence in it (Bekker, 2010:20). Khuma Township is one of the areas that are underlain by dolomite in South Africa (see annexure A) and it is believed that most of the densely populated areas in this country which include gold mining areas such as Stilfontein area where Khuma Township is located are on the dolomite areas. DWA (2009:6) defines dolomite as the sedimentary limy rock that originates from chemical deposits in shallow seas. Dolomitic Limestone, as a natural rock, consists of the mineral dolomite and magnesite (magnesium carbonate). The picture in Figure 5 below indicates the type of dolomite mineral and rock which is found around gold mining areas in South Africa and KOSH (Matlosana Local Municipality) area in particular.



**Figure 5: Dolomite rocks in Khuma Township area
(Researcher's personal library)**

According to DWA (2009:8), dolomite rocks make up some of South Africa's best aquifers because they often support boreholes and springs which yield vast quantities of good quality groundwater. The dolomite rock usually has large fissures and openings through which lots of groundwater can move quickly. Ngcobo (2006:251) explains that dolomite is soluble and that rainwater and infiltrating groundwater gradually dissolve the rock over time as it seeps through the joints, fractures and fault zones in the rock. The dissolution of dolomite will, therefore, result in cracks, cave systems and voids which in turn could result in sinkhole disasters such as the one indicated in Figure 6 below:



**Figure 6: Sinkhole due to underground cavities.
(DWA, 2009)**

The pollution of groundwater by underground activities such as mining in the KOSH area has impacted on the formation of sinkholes. According to IWQS (1995:18), groundwater or surface water interaction between the dolomites is another matter and the volume of water contributed to the Vaal River has been estimated at 73.1 Ml/day (Mega litres per day) with the enormous associated salt load to the river system. The community of Khuma Township is, therefore, vulnerable to ground-fall and water-borne diseases due to, *inter alia*, the unstable ground rock layers and soil around their area. The community is also vulnerable from air pollution from the mining dumps and Earth tremors like the one indicated in Figure 7 below due to underground blasting:



Figure 7: Impact of earth tremors in Stilfontein immediately west of Khuma (Geosciences, 2005)

2.4 IMPACTS OF MINING TO THE POTABLE WATER SUPPLY OF KHUMA TOWNSHIP

Economic development in most urban areas, especially in developing countries, is also a contributing aspect of pollution to water. The decline of quality of domestic water supply sources is becoming a major concern in many countries United World Water Development (UNWWD, 2009:137). Khuma Township like most gold mining areas in South Africa also experiences contamination or pollutants from mining activities to its potable water supply. In 1996 alone, a total of 377 millions of mine waste was produced, accounting for 81% of the total waste stream in South Africa (Chamber of Mines of South Africa, 2001).

The contamination from South African gold mining pollutes the Vaal River and other sources of surface water in this area. Veltman and Wilke (2008) believe that water quality at the upper levels of Margaret Shaft (see annexure B) indicates high levels of contamination from sulphate and sodium-chloride, and that because of the upper levels' proximity to surface, this contamination is mostly pollution from gold mine tailings and rock dumps. Nitrates are also common pollutants to the groundwater in this area and they contaminate drinking water in the form of potassium nitrates and ammonium nitrates. Nitrates have a high potential to migrate to groundwater and due to their lack of evaporation, nitrates are likely to remain in the water until consumed by plants or other organisms (Pretorius & Dennis, 2003:7). Figure 8 below indicates a section of the Margaret Shaft cone near Khuma under severe depression due to underground activities:

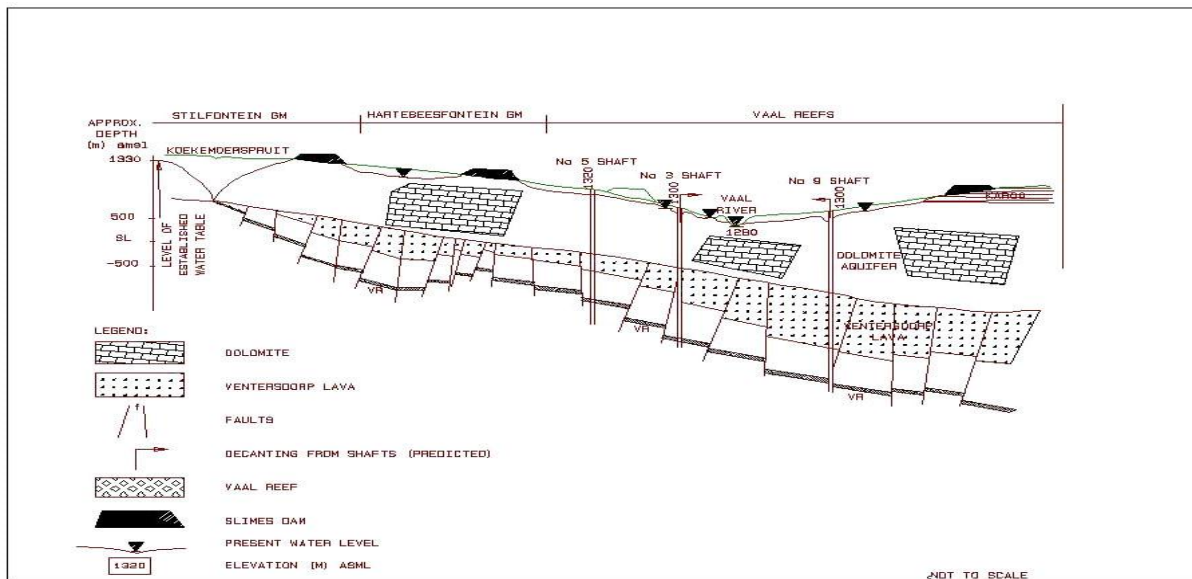


Figure 8: Scanned section of Margaret Shaft cone of depression (Environmental, 1993)

Presently, the waste water from the surrounding gold mines which include Margaret Shaft, Toni Shaft and Charles Shaft (see annexure B), is directly discharged into the Vaal River which is the main supply of water to the Midvaal Water Company to be purified before consumption. The discharge of contaminated water from Margaret Shaft into the Koekemoer Spruit has led to the artificial recharge of poor quality water to the underlying groundwater aquifer, resulting in recirculation and causing a deterioration of groundwater quality in the vicinity of this stream (DARCY, 2002).

Pretorius and Dennis (2003:5) outlined the following gold mining activities in the KOSH area as the common sources that contribute to the degradation of groundwater in the area:

- Acid mine or rock drainage;
- waste deposits such as mine tailings dams and waste rock dumps;
- recirculation of process between metallurgical plants;
- tailing dams and underground;
- return water dams;
- incidents such as pipe bursts and other spills at gold metallurgical plants; and
- decant and abandoned mines.

According to Fisher as quoted by Labuschagne and Human (2009:792), the West Rand groundwater aquifers have been significantly polluted by disposal of mining related waste on surface, and that the mine tailings storage facilities are the main contributors of sulphate to the groundwater in this area. Labuschagne and Human further emphasize that, in areas around Klerksdorp Gold-fields, the West Rand as well as the East Rand Gold-fields, many tailings storage facilities (TSFs) are located directly on top of dolomitic aquifers. They identify the following classification of groundwater impact sources in the Stilfontein area:

1. Change in groundwater quantity:

- Mine de-watering; and
- Groundwater supply well-fields

2. Change in groundwater quality:

- Seepage from waste storage facilities like tailings and waste rock through Acid Rock Drainage (ARD).
- Seepage from dirty water storage facilities.
- Poor quality leakage from old and redundant open pit or underground mines through AMD (Acid Mine Drainage).
- Poor quality seepage from other surface infrastructure like metallurgical plants and workshop areas (mainly hydrocarbon contaminants).

2.5 DESCRIPTION OF POTABLE WATER

Potable water is commonly used or known as drinkable water. Potable water refers to water that does not contain objectionable pollution, contamination, minerals, of infective agents and is considered satisfactory for drinking (Nealer & Raga, 2008a: 297). Potable water is water that has been treated, cleaned or filtered and meets established drinking water standards or used to be reasonably free from bacteria and contaminants. This water is expected to be safe to be consumed by humans or used with low risk of harm or pathogens that could be a threat to human health. Various kinds of potable water include treated municipal water systems, water that has been filtered and distilled water or purified by reverse osmosis. This drinkable water is commonly used or supplied to households for domestic use such as drinking,

cooking or preparing food, washing and flushing toilets. It can also be used for industrial purposes and mining activities. In the case of Khuma Township, potable water is supplied mostly to the public for domestic purposes.

2.6 ORIGIN OF POTABLE WATER SUPPLY IN KHUMA TOWNSHIP

Matlosana Local Municipality receives its water mainly from Vaal River but it needs to be purified by the Midvaal Water Company before reticulated to the public. This river runs from the north-east down to the north-west of this area. Other sources include underground sources such as the Schoon and Koekemoer Spruits which used to supply water for mining activities and small farming around the Matlosana Local Municipality area. The potable water of the municipality's area of responsibility is purified and treated by the Midvaal Water Company. Unlike other municipalities, Matlosana Local Municipality has no dam or any other water resources to supply its communities and the surrounding areas with water in case the Vaal River runs dry. According to Sibanyoni (2012: Interview), the Vaal River is the only source of water which supplies the local municipality, mines and the surrounding farming community. The biggest portion of this water from Midvaal Water Company is pumped to the Alabama reservoirs in the Matlosana Local Municipality area before it is reticulated for domestic, industrial and mining purposes throughout the municipal area.

The lack of a sizeable dam in this area poses a threat to the future reliability of water resources to the KOSH communities, especially due to climate change and global warming effects to most areas of this country

2.6.1 Midvaal Water Company

The Midvaal Water Company is located on the south-west side of the Klerksdorp near the town of Stilfontein (see annexure B). Midvaal Water Company purifies water from the Vaal River and provides potable water to the City of Matlosana including its surrounding towns such as Klerksdorp, Orkney, Stilfontein, Hartebeesfontein, Jouberton Township, Kanana Township, Khuma Township and Tigane Township.

Midvaal Water Company also assists the Matlosana Local Municipality as water service authority in the management of water quality with specific reference to tap water in the distribution network in order to support it in achieving the Blue-Drop certification status and meet the compliance requirements. Midvaal Water Company is a water utility which provides services to the Matlosana Local Municipality areas which include residential as well as mining and industrial undertakings. According to Midvaal Water Company Annual Report (2011:5), the Company has been supportive to the Department of Water affairs in achieving economic growth and social development by ensuring sustainable and equitable resource management and improving governance and regulation in the vicinity of Klerksdorp. In 2011, Midvaal Water Company also took a number of initiatives towards the achievement of Blue-Drop Certification status in the region by:-

- developing water safety plans for the region comprising the total water chain;
- assumption of responsibility for electronic submission of data on behalf of the city of Matlosana into the Blue-Drop system; and
- publication of water quality results to comply with Blue-Drop system requirements.

2.6.2 The Blue-Drop status of Matlosana Local Municipality's potable water

Access to safe drinking water is a basic human right and is very important for the health of the residents in the Klerksdorp area. The Blue-Drop status system is one governmental tool facilitated by Department of Water Affairs (DWA) which attempts to maintain an acceptable standard of drinking water to South African communities and also tries to encourage tourists to use and drink water within various local municipality areas without any fear of infections. There have been several incidents of poor drinking water in many cities around South Africa, especially the non-metropolitan cities and according to the Department of Water Affairs and Forestry (2010: 183) reasons for these were:

- lack of understanding by Water Services Authorities (WSA's) regarding the requirements for effective drinking water quality;
- inadequate management including monitoring of drinking water services;
- inadequate infrastructure management;

- inadequate WSA's institutional capacity; and
- lack of interventions to address poor drinking water quality when detected.

The Blue-Drop Award Assessment System promotes proactive drinking water quality management. According to Municipal Information North West (2010), Matlosana Local Municipality received position 5 in the North West Province with 59.63% of its Blue Drop water status. Over the past 2 years a remarkable improvement in terms of the Blue-Drop status in Matlosana Local Municipality's geographical area of responsibility has been seen. In 2011 Matlosana Local Municipality received 95.38% and slight decrease in 2012 to 95.36%. This percentage puts the Matlosana Local Municipality, in collaboration with Midvaal Water Company, in overall second position after Tlokwe Local Municipality in the North West Province. Despite the improvement of the quality of potable water by Midvaal Water Company, the Blue-Drop assessment carried out by DWA (2012:304) identified the following aspects which need urgent attention:

- Large chemical storage vessels are not bonded and can present a risk to the environment if spillage occurs.
- Although the chemical supply is efficient and is delivered on time, there is less than 30 days storage of some chemicals (including chlorine) on site. It is recommended that there is 30 days storage of chemicals on site to ensure that effective treatment takes place at all times.
- The sludge dams require some attention and plans are in place to upgrade the current system with the construction of a wash water plant in 2012.

2.7 POTABLE WATER SUPPLY AND POVERTY REDUCTION IN KHUMA

Human health is also influenced and compromised by not having access to safe potable water and enough sanitation services in most communities. The World Health Organisation (WHO) believes that one-tenth of the global diseases burden could be prevented by improving water supply, sanitation, hygiene and management of water resources and that such improvement reduce child mortality and improve health and nutritional status in a sustainable way. Some 1.4 million children die each

year from preventable diarrhoeal diseases (UNWWD, 2009:89). According to Bouguerra (2006:89), poverty is the root of water shortage and lack of sanitation.

The importance of safe and adequate potable water supply in and around the world implies that proper and efficient management of potable water in communities including Khuma Township could reduce poverty. About 48% in Khuma Township residents are unemployed and in cases where there is a shortage of potable water supply, most of the community members become vulnerable because they are not financially viable to buy clean water for drinking. Vulnerability is described by Twigg (2004:13) as the extent to which a person, group or socio-economic structure is likely to be affected by hazards. Hazards in this case refer to the state and shortage of drinking water in the Khuma Township area. The unemployment level of most of the residents of this community is indicative of the level of poverty and vulnerability to water borne diseases. The chance of being infected by water borne disease such as diarrhoea is, therefore, high. Schooling and learning by both educators and learners are usually disturbed by infectious diseases from water collected from secondary tanks and water containers.

The most vulnerable residents of Khuma Township always form queues to collect drinking water from water tanks provided by the Matlosana Local Municipality. Incidents like the one in figure 9 are commonly seen in Khuma Township. The most disturbing cases related to these queues are fights among the residents over who has come first especially if the water tanks are inadequate to provide water to all the residents. Public services such as education and health services are affected the most and domestic activities. According to Motswenyane (2012: interview), “many secondary schools seem to be performing below the expected level due to the ever shortage of potable water in Khuma Township”.



Figure 9: Vulnerable township residents collecting water from water tanks (Researcher's personal library)

The most disturbing fact about the above scene is that, women and children are the most vulnerable since they collect water while schooling and other important domestic duties are compromised. According to the Matlosana Local Municipality Draft Project Proposals for Khuma Township (2012:4), the following are some weaknesses and threats in Khuma Township in relation to potable water supply management:

- Very high unemployment rate of 43%
- Water network has a limited storage capacity.
- Sewer network has a mechanical screening problem
- Flood dangers of Koekemoer Spruit between extension 9, 10 and 11.

2.8. SUMMARY

The demand for potable water is of outmost importance for the residents of Khuma Township. Therefore, it is very important to use potable water in a sustainable manner. Proper management of water resources with an integrated water resource management approach is an imperative to ensure a sustainable supply of water. The geo-hydrology of the Khuma Township area needs to be clearly understood by all the role-players, especially the water services management officials of the Matlosana Local Municipality. The mining activities and their impact on the lives of the residents of Khuma Township should also be identified and given the necessary attention it deserves.

South African legislation pertaining to public potable water supply is discussed in Chapter three.

CHAPTER 3: SOUTH AFRICAN LEGAL FRAMEWORKS WITH REGARD TO THE MANAGEMENT OF POTABLE WATER SUPPLY IN A MUNICIPAL AREA

3.1 INTRODUCTION

The birth of democracy in South Africa in 1994 brought laws, legislation and policies which transformed all spheres of governments to accommodate every citizen of this country. The primary aim of the South African Constitution has been to recognise basic needs for human rights. These needs include rights to human dignity whereby every citizen is living in a healthy environment free from any infectious diseases and contamination which include access to potable water. The Constitution as the mother-body to all laws and policies in this country was promulgated in 1996 to transform all form of sectors which included political, social, economic and environmental sectors in South Africa. In addition to the Constitution, outlines that, the Water Services Act 108 of 1997 and National Water Act 36 of 1998 came into being with an aim of shifting the management of water in South Africa to a level entailing more integrated water resource management (IWRM) (Bekker, 2010:29).

The Local Government Municipal Structures Act 117 of 1998 was also established to focus on the responsibility of municipalities in terms of basic service delivery which includes potable water supply to their respective communities. According to Nealer and Eeden (2010:133), the role of a developmentally orientated local government sphere was clearly defined for the first time with the implementation of the Local Government: Municipal Structures Act. In addition to the water laws and policies, the South African Disaster Management Act 57 of 2002 was also introduced as a way of taking initiatives and preventive measures to avoid or reduce all risks and disasters that might result in instances such as water related diseases. Water should, therefore, be used in a sustainable manner because sustainable water usage supports the ability of human society to endure and flourish into the indefinite future without undermining the integrity of the hydrological cycle or the ecological systems that depend on it (Gleick *et al.*, 1995:87).

The chapter attempted to identify and analyse the South African current legislation regarding the management of water with a specific focus on potable water supply by municipalities to their geographical areas of responsibility and their residents. The focus area for this study was the management of potable water supply in Khuma Township which is located in the Matlosana Local Municipality's geographical area of responsibility.

3.2 OVERVIEW OF THE LEGAL FRAMEWORK: POTABLE WATER IN SOUTH AFRICA

According to Alder *et al.*, (2007:33), following the advent of democracy in 1994, South Africa's challenges have been based on upholding citizens' constitutional rights to have equal access to water and other natural resources. The access to potable water by all citizens is interconnected to other developmental-related issues such as social, economic, environmental, legal and political factors at local and national spheres and sometimes at regional and even international sphere (Biswas, 2004:248). The management of water resources in South Africa has become a political and socio-economic priority. A human demand for potable/ drinkable water is not only a South African problem but has become a global issue. Water usage and its problems are not seen in isolation but are somehow related to development sectors in every state such as agriculture, energy, industry transportation and communication and with social sectors which include education, health, rural and regional development. These complex problems around water indicate that every national, provincial and local spheres of governance should begin to assess, analyse, review and resolve all water related policies within their societal and development context. Any state or nation ignoring or neglecting these problems will be unable to effectively accomplish water management objectives which include poverty alleviation, improved standard quality of peoples' lives and environmental conservation.

South Africa is part of the global society and it is compelled by the international policies such as the Millennium Development Goals. In 2002 the various countries under the umbrella of the United Nations combined all efforts of governments, civil society organisations and the private sectors in creating stronger and more effective

global partnerships for global development. The target for at least reaching half of its goals was 2015. Some of these goals were to reduce child mortality, improve maternal health, and combating HIV/AIDS, malaria and other diseases. Usually, disastrous events such as flooding and droughts destroy drinking water, sanitation and health care systems, and these in turn increase the risks of diseases. These problems could be reduced or eliminated by having a more integrated approach to the management of water resources, hence formidable and effective legislation are not only to be formulated but also to be implemented.

In an attempt to transform legislation on the management of water in this country, several and important legislation related to water were established. The table below outlines them:

Table1: Legislation in South Africa (1994) related to water and the role of municipal governance

Year:	Act:	Summarised purpose and/or goal
1994 (Nov.)	White Paper on Water Supply and Sanitation Policy	This document is dedicated to the millions of SA's citizens who struggle daily with the burden of not having the most basic of services.
1995 (Nov.)	National Sanitation White Paper	It recognises that all South Africans have equal rights to a healthy environment and that this should be addressed. Unfortunately DWAF cannot do it alone. Assistance from role-players is needed in an integrated approach to management of additional aspects from the economic, social and environments.
1995 (Nov.)	White Paper on the Transformation of Public Service	To establish a policy framework to guide the introduction and implementation of new policy and legislation aimed at transforming the South African public services.
1996 (Oct.)	Constitution of the Republic of South Africa, 1996.	This is the supreme law of the Republic, which embraces the human rights principles and sets forth the right of access to water as part of a lengthy list of social and economic rights. These include, <i>inter alia</i> , the right to a healthy environment, housing, health care, food, social security, education and culture.
1996 (Apr.)	Water law principles'	A set of principles submitted by various role-players and stakeholders which guided DWAF in drafting a new water act (Fuggle & Rabie, 2005).
1997 (Oct.)	White Paper on Transforming Public Service Delivery (better known as the <i>Batho Pele</i> White Paper)	These seeks to introduce a fresh approach to service delivery: an approach which puts pressure on systems procedures, attitudes and behaviour within the Public Service and reorients them in the customer's favour, an approach which puts the people first.
1997 (Oct.)	Local Government Green Paper	This puts forward a vision for a developmental local government system in SA.
1997 (Dec.)	Water Service Act 108 of 199	To provide for, <i>inter alia</i> , the rights of access to basic water supply and basic sanitation, the setting of national standards and of norms and standards for tariffs, water services development plans, establishment of water boards,

		monitoring of water services institutions.
1998 (Mar.)	Local Government White Paper	This establishes the basis for a new developmental local government system, which is committed to working with citizens, groups and communities to create sustainable human settlements which provide for a decent quality of life and meet the social, economic and material needs of communities in a holistic way.
1998 (Jul.)	Local Government: Municipal Democratic Act 27 of 1998	To provide criteria and procedures for the determination of municipal boundaries by an independent authority.
1998 (Aug.)	National Water Act 36 of 1998	This Act replaced the old inherited Water Act 54 of 1956 and now for the first time recognises that water in SA is scarce and unevenly distributed national resource which belongs to all its inhabitants and that a National Government is responsible for the nation's water resources and their use. This should be attained in a sustainable manner by means of, <i>inter alia</i> , integrated water catchment management of all aspects of water resources and, where appropriate, the delegation of management functions to a regional or catchment level so as to enable everyone to participate.
1998 (Nov.)	National Environmental Management Act 107 of 1998	To provide for co-operative, environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for coordinating environmental functions exercised by organs of state.
1998 (Dec.)	Local Government: Municipal Structures Act 117 Of 1998	To provide for the definition and establishment of municipalities in accordance with the requirements relating to categories and types of municipalities and provide for an appropriate division of functions and powers between the categories of municipalities.
2000 (Nov.)	Local Government: Municipal Systems Act 32 of 2000	To enable municipalities to move progressively towards the social and economic upliftment of local communities, and ensure universal access to essential services that are affordable to all.
2003 (Sep.)	Strategic Framework for Water Services.	To map a vision for how the water sector as a whole will work in providing water services.
2004 (Feb.)	Local Government: Municipal Finance Management Act 56 of 2004	To secure sound and sustainable management of the financial affairs of municipalities and other institutions in the local sphere of government.
2005 (Aug.)	Intergovernmental Relations Framework Act 13 of 2005	To establish a framework for the national government, provincial governments and local governments to promote and facilitate intergovernmental relations.

(Source: Nealer & Raga, 2008b: 298-300)

Legislation is to be upheld by all role-players and should be implemented because the overall objective was to change South Africa's water dispensation so that socio-economic demands and environmental management requirements would be met in as effective, efficient and economical manner as possible and equal access would be provided for all South Africans (Pienaar & Van der Schyff, 2005:263).

3.3 INTEGRATED WATER RESOURCE MANAGEMENT AS A TOOL FOR EFFECTIVE AND EFFICIENT MANAGEMENT OF WATER RESOURCES

The usage and management of water within the South African communities especially at the local sphere of government, needs an integrated water resource management approach. This approach is described by the Global Water Partnership as “a process which promotes the co-ordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystem”. The rationale would be to have a sustainable usage of water resources. All the relevant role-players in water should play an active and effective role in the management of water resources. Water supply should not be the responsibility of one party only but rather a more communal approach must be encouraged. Aspects such as public participation and the involvement of public-private-partnerships (PPP) must be encouraged at all times. Potable water was recognised as a scarce and unevenly distributed national resource that belongs to all the people of the country and that the water collected in various rainfall catchment areas (river basins and underground cavities, channels and fractures) and water resources are managed in an integrated way (Fuggle & Rabie, 2005:293).

Water is usually governed by various institutions for the purpose of better management and services of potable water to the nation. The service delivery of potable water to the public is not only having institutions which help to manage water but it also has water service providers which according to Thompson (2005:225) provide the following services:

- Abstraction, conveyance, treatment and distribution of water, which could be potable in some cases.
- Collection, removal, treatment and disposal of water-related waste due to the use of water.
- Collection, removal, treatment and disposal of waste (which could include solid material) that impact or are likely to impact on the water resources.
- Services are necessary to ensure that the water could be used in a sustainable manner in the long term.
- Services that might be necessary to enhance water resource management.

- Resource, assistance and information associated with the provision of services.

Water should be governed by various organisations for the purpose of better management and services of potable water to the nation. The following are institutions and their roles involved in the provision of water to the nation:

3.3.1 Department of Water Affairs

This is the mother body in terms of the provision and management of water in the country. It provides the necessary frameworks governing the provision of potable water and sanitation services. It is responsible for sector policy, support and regulation. DWA operates water resource infrastructure like dams, some bulk water supply schemes and some retail infrastructure. The Department also provides water to support life and personal hygiene as well as the provision of bulk water to the other service providers, irrigators and individual users (Thompson, 2005:226).

3.3.2 Department of Co-operate Governance and Traditional Affairs.

This Department is responsible for the effective performance by municipalities of their functions, which include the provision of potable water and sanitation services. Nealer and Raga (2008b:295) are of the opinion that a municipality which is fully dependant on the correct identification, development, transport and use of its potable water, can only be successful in bringing about effective, efficient and economical water services management if the following requirements are adhered to:

- Incorporate an environmental management approach in its day-to-day service rendering.
- Obtain and incorporate specialised hydrological, geo-hydrological and engineering knowledge and skills regarding the origin, handling and management of its potable water.
- Facilitate optimum transparency and access to relevant information, citizen participation and communication on aspects of its water management.

3.3.3 Water Boards

Water Boards provide water services, mainly potable water, to water services institutions within its area. It also provides catchment management services to or on behalf of the responsible authorities and also supplies untreated or non-potable water to end-users who do not use the water for household purpose. According to Thompson, (2005:227), water boards should exercise their powers and carry out their duties by:

- Striving to provide efficient, reliable and sustainable water services.
- Promoting the efficiency of water services authorities.
- Taking reasonable measures to promote water conservation and demand management, including promoting public awareness of these matters

3.3.4 The local government structures

Local government structures such as the Matlosana Local Municipality are responsible for ensuring the provision of water services, mainly for domestic and industrial purpose within their areas of jurisdiction. They also supply water and sanitation services to consumers and operate wastewater collection and treatment systems. According to Ismail *et al.*, (1997:66), local authorities (governments' sphere) should strive to achieve within their financial and administrative capacity, the following objectives:

- The promotion of democratic and accountable government for local community.
- The provision of services to citizens in a sustainable manner.
- The promotion of social and economic development.
- The promotion of safe and healthy environment.
- The encouragement of citizen participation in local government matters.

The Matlosana Local Municipality is also compelled to accomplish the above stated objectives to the residents of Khuma Township with no reservation. The council is, by law, accountable to the provision of basic services to its residents within its area of jurisdiction which include the supply of potable water and access to it.

3.4 REGULATORY FRAMEWORKS ON WATER RESOURCE MANAGEMENT

South Africa, as a democratic country, has the Constitution and regulations that govern the management of water to its citizens by various organs of state. In 1994, only 43% to 45% of the South African black population had access to piped water, while almost 100% other races had access to piped water (Perret *et al.*, 2006:55). The situation resulted in the African National Congress (ANC) initiate programmes to balance and normalise the situation. The Reconstruction and Development Programme (RDP) prioritised the supply of basic needs to the following members of the public: housing, water and electricity to the South African community irrespective of race or any other discriminating systems (ANC, 1994:7). The following legislation was adopted to redress the injustices of the past regime:

In **1996, The Constitution of the Republic of South Africa** was finalised. The Constitution protects, promotes and fulfils the fundamental rights of the people of South Africa. It also acts as the framework within which the South African water related legislation should operate under. The Constitution contains the Bill of Basic Human Rights. These rights include a right to safe and clean potable water to all citizens regardless of their race. According to Thompson (2006:256), it is very important for each sphere of government to apply the following democratic values and principles:

- Efficient, economic and effective use of resources must be promoted and maintained.
- People's needs must be responded to, and the public must be encouraged to participate in policy-making.
- Transparency must be fostered by providing the public with timely, accessible and accurate information.

According to Section 27 of the Constitution, every person has the constitutional right to have access to sufficient water. Monashe, (2011:10) emphasised that the state must adopt legislation and certain measures to achieve the progressive realisation of this right. The following acts are also related to the management of water in South Africa:

In **1997, Water Service Act 108** was established to ensure the provision of basic water supply and sanitation and a regulatory framework for water service providers. The objective thereof was the promotion of effective water conservation and all water service authorities had to ensure the right of access to basic water supply and sanitation. According to this Act, the Ministry may prescribe compulsory national standards relating to the effective and sustainable use of water resources for water services as well as the nature, operation, sustainability, operational efficiency and economic viability of water services (Thompson, 2006:360). This Act ensures that all water providing institutions are obliged to prioritise the provision of basic water supply to all communities including Khuma Township. Bekink (2006:315) emphasised that the provision of water and more specifically drinking water to local residents, is generally considered to be the basic service that a municipality must render. Shortage of water in each community makes it difficult for most services to be rendered.

The National Water Act 36 of 1998 was also implemented to enhance water resource management. The Act was formulated with the objective of providing and reforming laws related to water resources in South Africa. The purpose of the Act was to ensure that the nation's water resources are protected, used, developed, conserved, and controlled in ways which consider promoting the efficient, sustainable and beneficial use of water in interest of the public. In terms of this Act, any person using water without permission, is guilty of an offence and is liable to a fine or imprisonment. It is, therefore, very important by the authorities to take into consideration all relevant factors, including efficient and beneficial use of water in the public interest when issuing licences. This Act enables the Ministry to formulate regulations such as:

- Limiting or restricting the purpose, manner or extent of water use.
- Requiring that the use of water from a water resource be monitored, measured and recorded.
- Regulate the design, construction, installation, operation and maintenance of any waterworks.
- Regulate or prohibit any activity in order to protect a water resource or riparian habitat.

The Act was primarily formulated to protect/preserve all water resources so that water will still be available in the future. Therefore, it is very important for all role players in the management and usage of water resources to ensure the sustainability of water.

3.5 THE ROLE OF MUNICIPALITIES IN POTABLE WATER SUPPLY

According to Craythorne (2006:159), a municipality is required to give effect to the provisions of the Constitution and priority to the basic needs of the local community, and to ensure that all members thereof have access to at least the minimum level of basic municipal services. In 2000, the first local government elections were held in South Africa and this was the new democratic measure in which the public at grassroots level were given power to elect their leaders that would directly be serving them. Nealer (2009:76) described this as a new system of local governance in South Africa which was empowered and granted some degree of autonomy and expanded responsibility. The supply of basic service such as potable water to the public is one of those responsibilities of the local municipalities.

The effectiveness and efficiency of the municipalities in this country are not only limited to the provision of potable water to the public, but could also include the conserving of suitable water resources by identification, surveying, and demarcation of resources and then subsequently, the development, transport, treatment, distribution, imposition of tariffs, municipal administration regarding the potable water, recollection of the used water, treatment and final release of the effluent back into the water catchment for use by other downstream users (Nealer, 2009:77). In order to function effectively and efficiently, several legislation which relate to the functioning of the municipalities were established, namely:

3.5.1 Local Government: Municipal Structures Act 117 of 1998 was implemented to provide the definition and establishment of municipalities with regard to categories and types of municipalities in South Africa. South Africa has the following municipal categories:

- Category A municipalities (Metropolitan municipalities such as Tshwane Metropolitan Municipality).
- Category B municipalities (Local municipalities such as Matlosana Local Municipality).
- Category C municipalities (District municipalities such as Dr Kenneth Kaunda District Municipality).

For example, according to the aforementioned Act, a Category C municipality such as Dr Kenneth Kaunda has the power and functions in administering bulk supply of water that affect its subordinate Category B municipalities (in this instance, the Matlosana Local Municipality) is responsible for its storm-water management in its own local municipal boundaries. Khuma Township is part of this local municipality's area of responsibility. One of the challenging aspects pertaining to the responsibility of these categories of municipalities in terms of service delivery such as potable water supply to the public is clean safe drinking water.

Water related acts and legislation seem to contradict each other in terms of responsibilities and jurisdiction pertaining to the provision of potable water by these categories of municipalities. The contradictions of these Acts often force officials to justify their inefficiency to provide services to the public. In the case of Khuma Township, the frequent inadequate supply of water is often used as an excuse by officials of the Matlosana Local Municipality that the budget and permission by Dr Kenneth Kaunda Municipality in terms of bulk water supply has not been allowed or is still under discussion. Repairing and maintenance of water pipes such as in Figure 10 below is also one of the 'burning' issues:



**Figure 10: Maintenance of water pipes in the Klerksdorp area.
(Researcher's Personal Library)**

3.5.2 The Local Government: Municipal Systems Act 32 of 2000 was implemented with the aim of enabling municipalities to move towards the social and economic upliftment of local communities. It also intends to ensure universal access to essential services that are affordable to all citizens of South Africa, regardless of race, gender and age. Aspects such as maintenance of municipal infrastructure regarding basic services such as potable water are to be given priority by the municipal authorities to enable effective and efficient service delivery. In accordance to this Act, a municipality must develop a culture of municipal governance that complements formal representative government with a system of participatory governance and, encourage community participation. The Act also expects the municipality to apply the following as a means of encouraging public participation:

- encourage and create conditions for the local communities to participate in the affairs of the municipality.
- contribute to building the capacity of local community, councillors and staff.

3.6 WATER SUPPLY BY-LAWS IN MATLOSANA LOCAL MUNICIPALITY AREA

The Matlosana Local Municipality has passed by-laws which relate to the management and consumption of water by its residents within its area of jurisdiction which includes Khuma Township. According to the by-laws, the following are some of the important controlling and management strategies for sustainable usage of water supply pertaining to the residents of the Matlosana Local Municipality area:

- No connection shall be made to any main communication pipe except by an authority officer of the Council.
- No water installation pipe, tank, cistern or other apparatus for storing or conveying water supplied by council shall be directly connected with any system or source of water supply other than that of the Council.
- No person shall take any water from or make or cause to be made any connection with main communication pipe, reservoir, hydrant, conduit pipe, cistern, or other place, containing water belonging to the council except with written permission of the council first had and obtained.

- No person shall wilfully or negligently damage or cause to be damaged any main, communication pipe, meter or other plant or apparatus belonging to the Council.

Water pollution in the Matlosana Local Municipality's geographical area of jurisdiction is also guided by the following restrictions of which if neglected, heavy penalties will be incurred by the perpetrators:

- Swim in any stream, reservoir, aqueduct or other place belonging wholly or partially to the Council.
- Throw any rubbish, dirt, filth or other delirious matter into such stream, reservoir, aqueduct or other place.
- Permit the water of any sink, sewer, drain, steam engine, boiler or other unclean water or liquid to run or be brought into any such stream, reservoir, main, aqueduct or other place of the Council.

Non-payment or negligence of water payments by the residents of the Matlosana Local Municipality are also regulated by the water supply by-laws. All South Africans are entitled to free 6 kl drinking water per month/ household and additional litres consumed by the residents of any municipality, are charged and expected to pay the Council. In Matlosana Local Municipality, by-laws are in place to deal with any person who fails or neglects to pay for such services. Instances where the residents fail to pay the water services; the Council may terminate or disconnect the provision of services.

3.7 SUMMARY

This chapter identified and analysed legislation regarding the management of water with a specific focus on potable water supply by municipalities to their residents. The area of focus for this study was the management of potable water supply in Khuma Township which is located in the Matlosana Local Municipality's geographical area. The complex problems around water indicate that the national, provincial and local spheres of government should access, analyse, review and resolve all water related policies within their societal and developmental contexts. Any state or nation which ignores or neglects these problems will be unable to accomplish water management objectives which include poverty alleviation, improved quality of peoples' lives and

environmental conservation. It should also be highlighted that these Acts and legislation are worthless if they are not implemented and enforced effectively by the local authorities.

The next chapter focuses on the empirical findings of the research with regard to the management of potable water by the Matlosana Local Municipality, with specific reference to the residents of Khuma Township.

CHAPTER 4: THE MANAGEMENT OF POTABLE WATER SUPPLY KHUMA TOWNSHIP: EMPIRICAL FINDINGS

4.1 INTRODUCTION

In order to provide clear and well informed knowledge and understanding of the management of potable water supply in Khuma Township, a 5-point Likert scale type questionnaire was compiled and used for data collection in the research (see Annexure C). The interviews with the role-players in the management of potable water supply were also conducted (see Annexure D).

The participants for the questionnaire were chosen from relevant role-players in the management of potable water supply in Khuma Township such as the Matlosana Local Municipality, Dr Kenneth Kaunda District Disaster Management Centre and community members of Khuma Township.

The main objective of the questionnaire was to determine the nature and extent of knowledge on the management of potable water supply in Khuma Township. The knowledge included the effectiveness and efficient way of managing potable water, the participation and the commitment level of Khuma Township residents, *inter alia*, the impact which underground mining activities and underlying dolomite rock have on the potable water supply in Khuma Township.

This chapter also analysed the findings based on the responses to the questionnaires, *inter alia*, the interviews with randomly selected residents of Khuma Township, officials of the Matlosana Local Municipality and some of the role-players in the management of potable water supply to the area. The purpose of analysing the findings was to build tangible conclusions and recommendations to contribute positively in the quest for improved management of potable water supply in Khuma Township.

4.2 RESEARCH METHODOLOGY AND DESIGN

There are a number of research designs available which can be categorised into basic and applied research (Brynard & Hanekom, 2006:7). For the purpose of this research, applied research was used based on the fact that the outcome of the research will somehow advance the fundamental knowledge about the human world. This means that a number of different sources related to the management of potable water supply in Khuma Township, were consulted.

Two research methods were used (qualitative and quantitative methods) since various instruments of data collection are found in both approaches. Qualitative research approach is usually relevant since its purpose of being able to accumulate sufficient knowledge leads to understanding. For example, in phenomenological approach of qualitative method of real-life experiences, Khuma Township residents concerning the supply of potable water were the central point of this research. On the other hand questionnaires and interviewing as part of quantitative approach were applied to collect data.

4.3. COLLECTED DATA AND ANALYSES

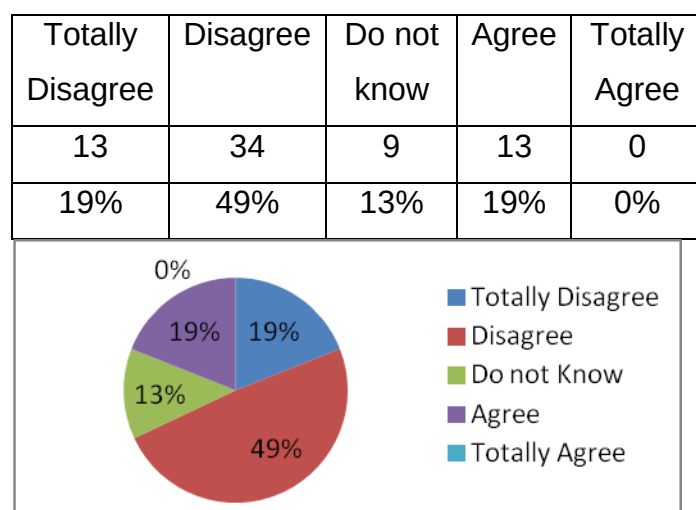
The psychometric scale was used in the questionnaires and the respondents to this scale specified their level of agreement with 16 statements. The number 1 at the beginning of the scale represented Totally Disagree, 2 = Disagree, 3 =Do not know, 4 =Agree and at the end of the scale the number 5 represented Totally Agree.

Khuma Township has 11 extensions (see Annexure B) with a total population of about 43033 residents. Two hundred and twenty copies of the data collection questionnaire were handed out to all the participants. The purpose of the questionnaire was to establish the knowledge on the extent and nature of potable water supply management by the Matlosana Local Municipality and the participation and commitment of the residents of Khuma Township. Unfortunately, only 69 respondents completed and returned the questionnaires.

The questionnaires were distributed to eleven extensions of Khuma Township as indicated in the map (see Appendix B) and the members of the community that were

presented with the questionnaires included educators, nurses, police officials and ward councillors. The research does not overrule the fact that different findings may have been found if more than 50 percent of the questionnaires could have been completed and returned in time.

Statement No.1 “Residents of Khuma Township always have access to safe and clean potable water”



More than 68% of the respondents from Khuma Township differ with the statement and less than 19% agree while 13% do not know whether the water they have access to is safe and clean potable water.

According to most residents and government employees around Khuma Township such as nurses, police officials and educators, access to potable water in Khuma Township has always been a challenge for the community. The acknowledgement of such high percentages by the respondents to this statement indicated that the residents of Khuma Township do not always have access to water they are not informed about the quality of potable water. This situation, therefore, implied that the community might be ill-informed, vulnerable to water-borne diseases and this could lead to child mortality, malaria and extreme poverty.

This notion was supported by one of the patients in Khuma Clinic (Marcus Clinic), Mrs Lehasa in extension 8 (see Annexure B) who said:

“Frequent and trend of insufficient potable water supply in this area is making our lives miserable and we have to use wheelbarrows to fetch water as far as in Stilfontein. The health services in the local clinic are not always guaranteed simply because the area is mostly in short of potable water”.

The limited supply of potable water during weekends in Khuma Township appears to be a norm. For example, during 11 to 21 August 2012, most sections of Khuma Township had no water or limited supply of potable water and most services such as schooling had to be restricted or lessened. In addition, “the residents are unable to enjoy luxurious life such as usage of geysers and irrigation for gardening purpose” (Lehasa: interview). A scene like the one in Figure 11 below is common around Khuma Township during a shortage or restricted potable water supply.

In addition to these problems, the City of Matlosana (2012:4) reported that of the Khuma Township’s estimated total population of 43 033 residents, more than 43% are unemployed, and that they are entirely dependent on government social grants. The problem of high unemployment has led to the shortfall or non-payment of services in the Matlosana Local Municipality (Sibanyoni, interview: 2012).



**Figure 11: Collection of water from trucks in Khuma
(Researcher’s personal library)**

On the other hand, the non-payment of services by Khuma Township residents has led to poor development and maintenance of water services infrastructure to the community. In support of the impact of the high rate of unemployment and non-payment of services by the residents of Khuma Township, Strydom, (Interview: 2013) emphasised that “payments for services are extremely low hence capital projects to improve infrastructure development are low.”

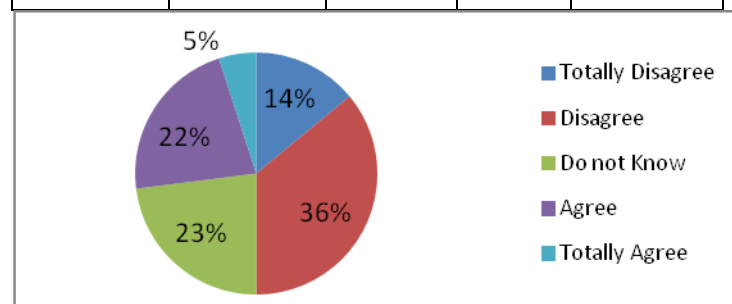
In an interview with Sibanyoni (2012), "the non-payments of services by the residents of Khuma Township are somehow to be blamed because, the Municipality could not afford to improve infrastructure to this area while its residents are not playing their part". However, present projects of building a new water reservoir (see Figure 12), below must be applauded and hopefully it will reduce the frequent potable water supply shortages and cut-offs. There are instances of Khuma Township residents owing more than R56 000 00 towards their water supply services. These residents dispute payments on the grounds that they do not want to pay such because the supply of potable water to their area is irregular.



**Figure 12: Construction of the new water reservoir in Khuma extension 8
(Researcher's personal library)**

Statement No. 2 **"The quality of potable water in Khuma Township is of an acceptable standard"**

Totally Disagree	Disagree	Do not know	Agree	Totally Agree
10	25	16	15	3
14%	36%	23%	22%	5%



Exactly 50% of the respondents disagree/totally disagree with the statement and 23% do not know if the quality of potable water supply to the community is of an acceptable standard. Only 26% of the respondents agree/totally agree that the quality of potable water supply is of an acceptable standard. In an interview with one of the community members, Lehasa (2012) emphasised that “the bad smell from the water-taps usually left many residents of Khuma Township with the belief that the quality of water provided to the public of Matlosana Local Municipality is of poor quality and they are scared if this smell would not affect their health”.

In a response to these allegations, the Matlosana Local Municipality representative, through Sibanyoni (2012) said:

“The bad smell which usually comes out from the potable water supplied to Matlosana Local Municipality’s residents has actually been identified as the result of some fungal growth within the pipes from Midvaal Water Company towards the houses around Matlosana. The municipality in collaboration with Midvaal Water Company are working very hard to replace pipes in order to reduce this problem” (see figure 10 above in section 3.5).

Evidence of people buying water from private companies in and around Klerksdorp has become a norm because the majority of the residents doubt the cleanliness and reliability of the quality of potable water supply provided by the Matlosana Local Municipality.

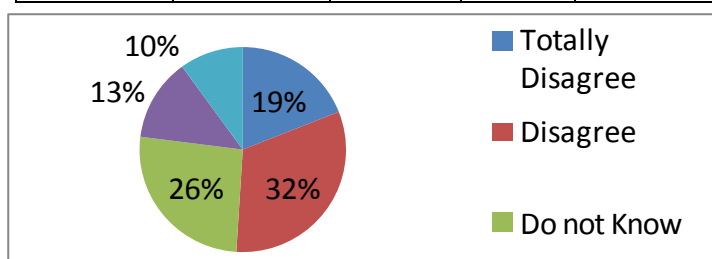
Previous and recent records indicate that Matlosana Local Municipality is in line with the national standards of supplying its municipal area’s residents with good and acceptable standards of potable water (Department of Water Affairs, 2012:303). The supply of potable water in Khuma Township is also managed by the same local municipality. Therefore, it must be accepted that they do have potable water supply of an acceptable standard. In 2011, Matlosana Local Municipality received a Blue Drop percentage of 95.38% and a slight decrease as compared to 2012 of 95.35 %. This percentage puts the Matlosana Local Municipality and Midvaal Water Company as their service provider in the second position after Tlokwe Local Municipality in the North West Province (Department of Water Affairs, 2012:303).

With regard to 50% of the respondents saying that they either disagree/totally disagrees with statement 2 indicated a lack of information on how the quality of drinkable water is measured by the South African Drinking Water Quality Management. In an interview with one of the community members Hlalele (2012), it

became very clear that the community of Khuma Township lacks knowledge and information on how these standards are achieved by the South African Drinking Water Quality Management facilitated by DWA. Therefore, it was not surprising to learn from the respondents that close to 73% either disagree or do not know whether the quality of potable water supplied to them is of an acceptable standard. This is also an indication of the lack of participation and commitment on the sides of Khuma Township residents.

Statement No.3, **“Khuma Township has adequate water reservoirs to supply the entire community”**

Totally Disagree	Disagree	Do not know	Agree	Totally Agree
13	22	18	9	7
19%	32%	26%	13%	10%



Fifty one per cent of the respondents disagree/totally disagree with the statement and 26% do not know if the present water reservoir(s) are or is sufficient to supply the entire community of Khuma Township with adequate potable water, while 23% agreed with the statement.

The responses to this statement correlate with how the respondents responded to the first statement, “Residents of Khuma Township always have access to clean potable water”.

In reacting to these statements, one of the senior citizens in this area, Mrs Moloi, who is now a retired educator, said:

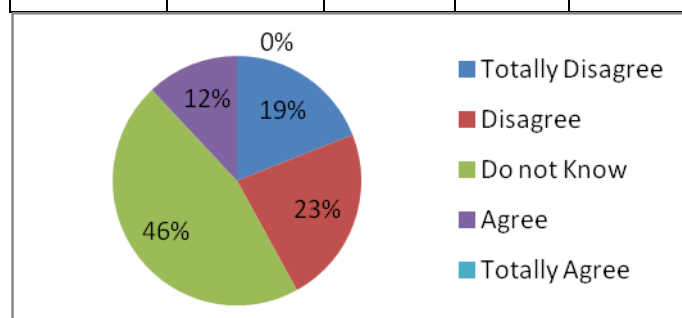
“It is very difficult to expect the entire area of Khuma Township to always have sufficient and equal access to potable water supply. Khuma Township has had one reservoir which is located north of this Township since in the late 1960’s with a population of less than 10 000 then. The population of this Township has increased enormously and the solution to this problem could be the construction of

another big reservoir especially nearer to the new extensions that have just been developed after 1994. It is also not surprising why the community is mostly experiencing water cut-offs or limited supply of potable water because one old reservoir which was meant to supply 10 000 people in the 1970's cannot do that any longer to more than 43 000 people".

According to a communiqué by Strydom (2013), "the Matlosana Local Municipality is providing Khuma Township with enough water reservoirs to supply the entire community with enough water at all times".

Statement No. 4 "The maintenance and cleansing of water reservoir around Khuma is undertaken regularly"

Totally Disagree	Disagree	Do not know	Agree	Totally Agree
13	16	32	8	0
19%	23%	46%	12%	0%



Forty two per cent of the respondents disagree/totally disagree with the statement and only 12% agree that maintenance and cleansing of the water reservoir in Khuma Township is undertaken while (46%) of respondents have no idea of the maintenance and cleansing. This situation indicated the lack of cooperation and public participation with regard to activities around their area relating to potable water supply by the municipality.

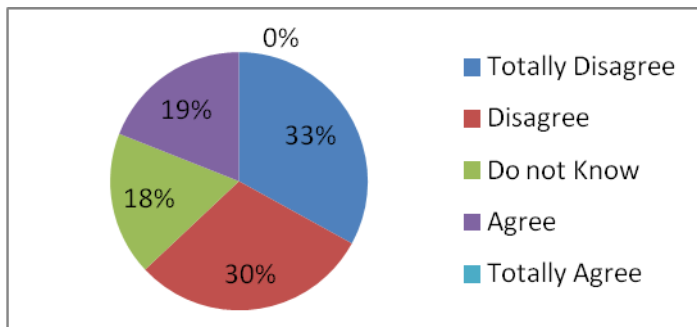
According to communication by Strydom (2013), there is no involvement and assistance to Khuma Township residents by the Matlosana Local Municipality in the management of potable water supply. He further indicated that the residents of Khuma Township did not participate in the management of potable water. One other possible reason for this scenario could be public ignorance of municipal activities in its surroundings. According to Monashane (2011:22), to create mutual respect and

support, municipalities must work hand in hand with their communities to fulfil their (municipal officials) obligations.

The cleanliness and quality of potable water supply to Khuma Township residents is actually one aspect that implicates the security of water resources in the Matlosana Local Municipality area. Turton and Henwood (2002:85) argue that there are two forms of security i.e. hydraulic mission and national security. Hydraulic mission refers or is related to the engineering, ensuring that the security of supply of water is done by means of developing infrastructure such as dams, inter-basin transfers and water reticulation systems like pipelines and aqueducts. Safety in this instead refers to water resources such as water reservoir(s) and pipes that deliver potable water to houses for domestic consumption, from such chronic threats as hunger, diseases and repression. It could as referred to whether potable water is protected from sudden and hurtful disruptions in the pattern of daily life, whether in homes, in jobs or in communities. Any threat to potable water supply or possible danger to it should be eliminated or prevented as it could result in catastrophic consequences such as diseases and hunger. Lack of security to potable water supply to Khuma Township could threaten the health, environment, community and political security or stability. For example, incidents of mass destruction by poisoning water are well known to other countries due to lack of security to water supply, and such incidents need to be avoided at all times. According to Sibanyoni (2011: interview), all water reservoirs in the Matlosana Local Municipality are secured with 24 hour security. There is no unauthorised entrance to these sites. The reservoirs are periodically checked and cleaned as precautionary measures to avoid accumulation of fungi in water.

Statement No. 5 **“The public is informed in advance by the Matlosana Local Municipality of anticipated water supply cut-offs”**

Totally Disagree	Disagree	Do not know	Agree	Totally Agree
23	21	12	13	0
33%	30%	18%	19%	0%



Approximately 63% of the respondents disagree/totally disagree with the statement and a total of 19% agree that the residents of Khuma Township are usually informed in advance by the Matlosana Local Municipality during anticipated water cut-offs. The remaining 18% do not know of such notices.

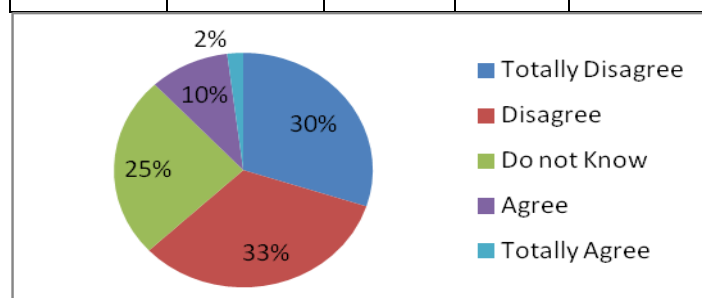
The high percentage of the respondents that are not in agreement with the statement is also a clear indication of the poor public involvement and cooperation in activities relating to the management of potable water supply in Khuma Township. According to Sibanyoni (2013), the residents of Khuma Township are usually made aware well in advance (for at least 7 days) before anticipated water cut-offs by the Matlosana Local Municipality. The Matlosana Local Municipality uses weekly news-letters such as *LENTSWE* and Klerksdorp Record which are distributed freely or at a lower price of R3.00 per paper to all the residents in the municipal area of jurisdiction. It was surprising that the Council could use this source of information to communicate with residents of Khuma Township, because less than 50 copies of the news-letter are distributed at a gas station in Khuma Township area. The gas station is located in one section of the township and only a limited number of households would be furnished with the news-letters.

The Council also said that they used the ward councillors to deliver the messages to the residents. In a contradicting statement, the residents of Khuma Township disagree that their councillors do not call meetings nor do they inform them of any anticipated potable water cut-offs. A communication programme in consultation with the residents should be encouraged to enable the provision of an active, two-way information exchange to ensure that the customer's needs and expectations are understood and satisfied (Monashane, 2011:22). In addition, Bassette (2006:7) also emphasised that participatory communication is helpful in identifying solutions to conflict.

Matlosana Local Municipality should, therefore, acknowledge and adhere to the fact that they have an obligation to develop a culture of participatory governance to encourage and empower local communities to participate in activities affecting their day-day lives (DPSA, 2003:19).

Statement No. 6 “The public is actively involved in matters relating to water management such as prevention of water pollution”

Totally Disagree	Disagree	Do not know	Agree	Totally Agree
21	23	17	7	1
30%	33%	25%	10%	2%



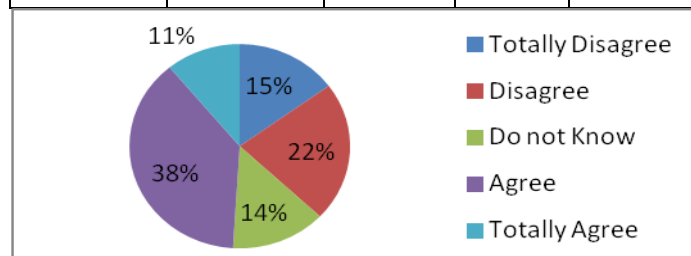
Sixty three percentages of the respondents disagree/totally disagree with the statement and 25% of the respondents do not know if the public is actively involved in matters relating to water management such as prevention of water pollution. Only 11% of the respondents agree/totally agree with the statement.

Public involvement in matters relating to the management of potable water supply is very important and this could assist in matters such as prevention or reduction of water pollution in Khuma Township. Most of the residents around Khuma Township are not well informed of the dangers related to dumping refuse at every corner of each street and this in return is carried by floods to the nearby Koekemoer Spruit leading to the Vaal River. This river is the only source of water in the Matlosana Local Municipality’s area of jurisdiction. According to Midvaal Water Company Inspector as quoted by the Department of Water Affairs (2012:303), the Vaal River is seriously affected by the activities of upstream users, Vaal Barrage, SASOL effluent, Parys waste-water treatment works as well as many mines and other agricultural activities. Therefore, the only source of water to Matlosana Local Municipality is

heavily polluted and all residents of the Local Municipality should be kept well informed in order to act and behave accordingly to reduce water pollution within their area.

Statement No. 7 “Public service delivery such as education and health services are affected by the supply of potable water”

Totally Disagree	Disagree	Do not know	Agree	Totally Agree
10	15	10	26	8
15%	22%	14%	38%	11%

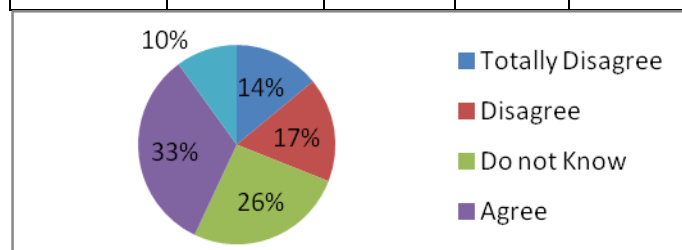


More than 50% of the respondents agree/totally agree that services such as education and health are affected by supply of potable water in Khuma Township and 14% do not know about the impact of inadequate supply of potable to public services. On the other hand, 37% disagree/totally disagree with the statement.

The majority of the respondents acknowledged that water is a necessary resource and its limited supply to the local residents would result in some kind of instability and most services within the area are affected and experiencing problems. From the literature review, it was revealed that schooling in Khuma Township is constantly and negatively affected by shortages and cut-offs of potable water by the Matlosana Local Municipality. Incidents of pupils arriving late at school or do not attend school due to the shortage of potable water supply is common in Khuma Township. Most schools are forced to reduce their teaching time due to the non-functionality of toilets and the shortage of potable water supply on the school premises. Health services are also restricted in providing effective and efficient services to the residents of Khuma Township.

Statement No. 8 **“Residents of Khuma Township are vulnerable to water related diseases due to frequent water cut-offs”**

Totally Disagree	Disagree	Do not know	Agree	Totally Agree
10	11	18	23	7
14%	17%	26%	33%	10%



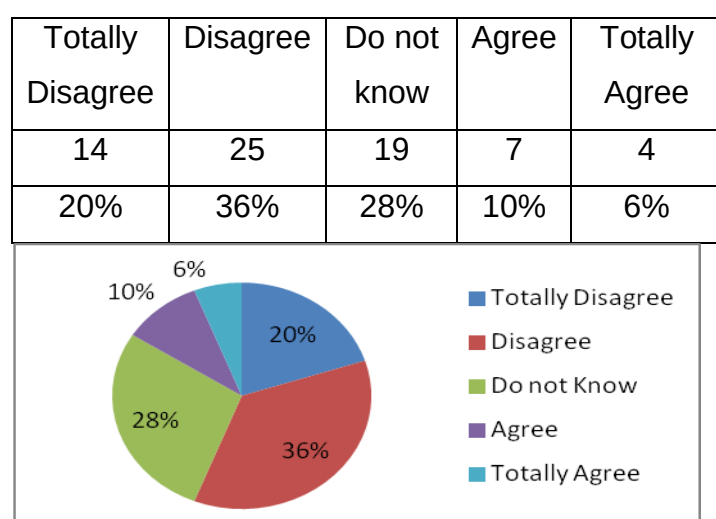
The results on this statement indicate that 31% of the respondents disagree/totally disagree with the statement and 43% of the respondents agree/totally agree that the residents of Khuma Township are indeed vulnerable to water related diseases due to frequent water cut-offs. On the other hand, 26% do not know whether frequent water cut-offs in Khuma Township could lead to water related diseases. The World Conference on Disaster Reduction (2005:1) describes vulnerability as ‘the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of a community to the impact of hazards’. In this case, water as the environmental aspects is putting Khuma Township residents’ lives at risk and potential disasters are eminent if necessary actions are not taken into account as soon as possible. Van Niekerk (2008:12) emphasised that, “there is a very close relationship between hazards that may cause disaster events and the vulnerability of societies in the sense that hazards alone cannot cause disasters. According to Van Niekerk (2008:17), “the extent to which elements at risk, including people, buildings, infrastructure and assets are vulnerable to hazards also play a significant role”.

According to the information from the three local clinics, it became clear that there are frequent diseases related to stomach infections among Khuma Township residents, especially young children. The most common disease is diarrhoea but there are no records on whether it is related to inadequate water supply to in this area or any other infection because the same problem is usually experienced even

during the periods where everyone receives an adequate supply of potable water. The majority of the community members confirmed that there are high unrecorded cases of frequent diarrhoea during periods of water shortages. During these periods most people turn to use water collected in buckets and drums which could have been supplied by the local municipality. The danger with this method of water supply is that the water remains in the open buckets for a long period of time and this water can be easily contaminated.

Frequent water cut-offs also created a burden on the grey water transportation. Most toilet pipes are blocked and as a result, pipes burst and there are always some grey water flowing in most of the streets of Khuma Township. This could also be as a result of most children playing and coming into contact with grey water. As a result, infectious diseases are another problem.

Statement No. 9 **“The supply of potable water in Khuma Township is in line with the population growth”**



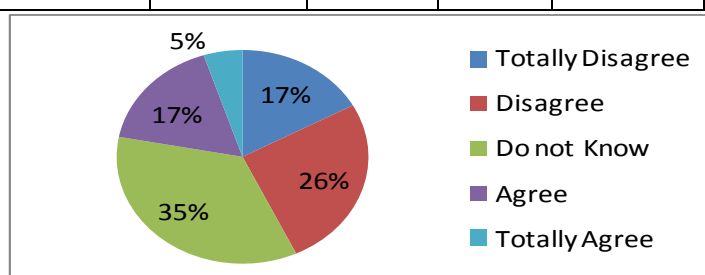
Most of the respondents (56%) disagreed with the statement and 28% do not know whether the potable water supply is in line with population growth. Less than 17% do agree that the supply of potable water in Khuma Township is in line with the population growth.

Khuma Township, like most gold mining areas has the history of migrant labourers moving into the area at an alarming rate. The migration of people into this area

increased the population and unfortunately there has not been adequate improvement or development of water resources to supply potable water to handle the influx. According to Charmbers and Conway (1991:6), migration of people to towns and cities, also influences people to live in cheap and un-maintainable house-dwellings due to non affordability to pay rent. The poorest communities are the ones who suffer the most and are affected by disasters due to their vulnerability and inadequate resources to deal with disasters such as water borne diseases.

Statement No. 10 **“Matlosana Local Municipality is actively involved in the management of the resources of potable water in Khuma Township”**

Totally Disagree	Disagree	Do not know	Agree	Totally Agree
12	18	24	12	3
17%	26%	35%	17%	5%



Forty three per cent of the respondents disagree/totally disagree while 22% agree/totally agree with the statement. 35% of the respondents do not know if Matlosana Local Municipality is actively involved in the management of the resources of potable water in Khuma Township. The 43% correlates with statement No 5 (the public is informed in advance by Matlosana Local Municipality during anticipated water supply cut-offs) and statement No 6 (the public is actively involved in matters relating to water management such as prevention of pollution).

The three statements (5, 6 & 10) reveal that the community of Khuma Township and the Matlosana Local Municipality are not integrated in relation to the management of potable water supply.

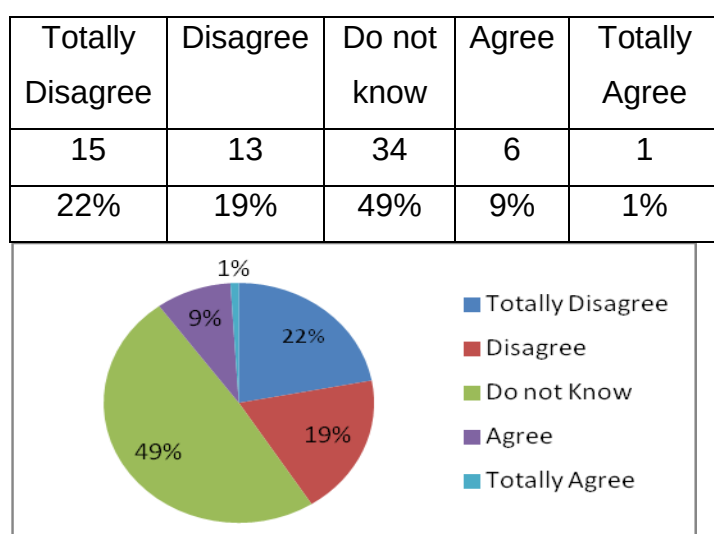
It is really surprising that Matlosana Local Municipality does not involve the community of Khuma Township in matters related to the management of potable water supply in Khuma Township. This is in contradiction to section 16 (1) of the

Local Government Municipal Systems Act, 32 of 2000. The Act stipulates that a municipality must develop a culture of municipal governance that complements formal representative government with a system of participatory governance, and must encourage and create conditions for the local community to participate in the affairs of the municipality.

According to Gildenhuys and Knipe (2000:130), citizens should be treated as customers by making sure that the promised level and quality of services are always of the highest standard and that the local government must respond swiftly and sympathetically when standards of services fall below the promised standard. Van der Waldt (2004:326) also emphasises that a local government is in fact established to promote the interest and quality of life of the community concerned. If the community is engaged effectively, it leads to better decision making and better implementation of policies.

Statement No. 11 “Public-Private-Partnerships play an active role in the management of potable water in Khuma Township”

Forty one per cent of the respondents disagreed and 49% did not know or have no idea about the role of public-private-partnership. Only 10% of the respondents agree/ totally agree to the statement.



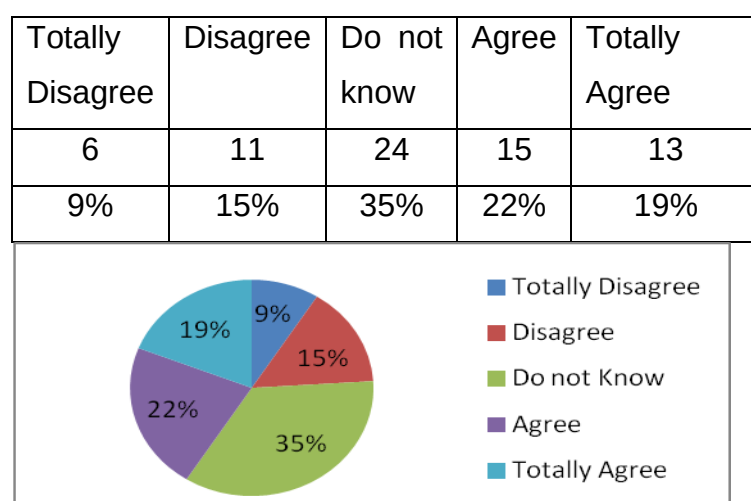
The high per cent of the respondents disagreeing or not knowing anything about the place and role of public-private-partnerships is a clear indication of how most of the

South African public such as in Khuma Township are ill informed of important issues relating to good governance in their country. According to Akintoye *et al.* (2004:4), a Public-Private-Partnership is the contractual arrangement between a public sector agency and a for-profit private sector concern whereby resources and risks are shared for the purpose of delivery of public service or development of public infrastructure.

According to Ouyahia (2006:4), the idea of public-private-partnership came into being in the early 1990s with the awareness of environmental degradation and increasingly widespread water stress. The United Nations and the international community started to take fresh water issues more seriously with the “Dublin Principles” that emerged from the International Conference on water and Environment and Development in Rio in 1992, market driven approaches for water resources management gained acceptance.

Statement No. 12 “An Integrated Water Resource Management approach is necessary for effective management of potable water in Khuma Township”

Twenty four per cent of the respondents disagree and 35% do not know if Integrated Water Resource Management (IWRM) is indeed necessary for the effective management of potable water supply in Khuma Township.



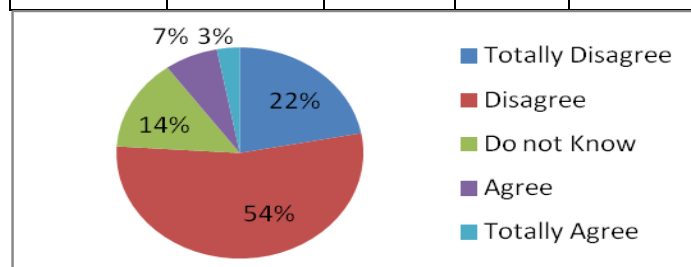
More than 41% of the respondents to this question do agree and totally agree that an IWRM approach is indeed necessary for effective management of potable water in Khuma Township.

IWRM is described by the Global Water Partnership as a process which promotes the co-ordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystem. Biswas (2004:248) emphasises that water problems are becoming increasingly more and more interconnected with other developmental-related issues and also with social, economic, environmental, legal and political factors at local and national levels and sometimes at regional and even international levels. Water usage and its problems are not in isolation but are somehow related to development sectors in every state such as agriculture, energy, industry, transportation, communication and with social sectors which include education, health, rural and regional development.

Statement No. 13 **“The public is always made aware of the necessity to preserve water”**

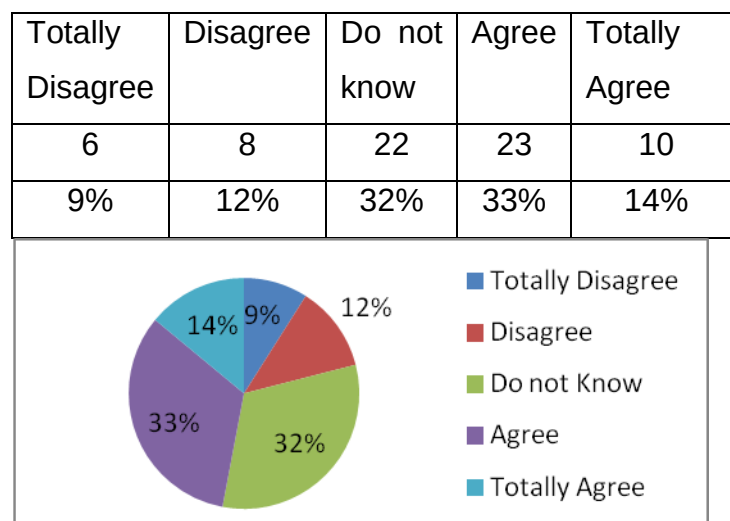
More than 75% of the respondents disagree/totally disagree and only 10% agree/totally agree that Khuma Township residents are always made aware of the necessity of preserving water. Only 14% of the respondents do not know or have no idea of the public being made aware of the necessity of conserving water.

Totally Disagree	Disagree	Do not know	Agree	Totally Agree
15	37	10	5	2
22%	54%	14%	7%	3%



Seventy five per cent of the respondents are not in agreement with the statement, and this is once again confirmation of the poor relationship and communication between the public of Khuma Township and Matlosana Local Municipality. This high percentage is in line with the responses to the statements No 5, 6 and 10. It is clear that the Matlosana Local Municipality and the residents of Khuma Township do not cooperate or work together in the management of potable water supply. Matlosana Local Municipality must encourage and create conditions for representatives of the local community to participate in the affairs of the municipality. The conditions will include campaign and road shows aimed at the public to preserve water and use water in a sustainable manner.

Statement No. 14 “Potable water supply in Matlosana Local Municipality is at risk of pollution by mining activities”



Twenty one per cent of the respondents disagree and 32% do not know. 47% of the respondents are of the view that potable water supply in the Matlosana Local Municipality responsibility area is at risk of pollution by mining activities. It is surprising that 32% of the respondents have no idea of the mining impact on the quality of potable water. According to an interview with one of the officials from Matlosana Local Municipality, Matlosana, which includes Khuma Township is sourcing water from the Vaal River, and is cleaned and processed by the Midvaal Water Company which is near Stilfontein. The surrounding gold mines are believed

to be dumping their waste into the Vaal River and this on its own is the danger to water and its inhabitants.

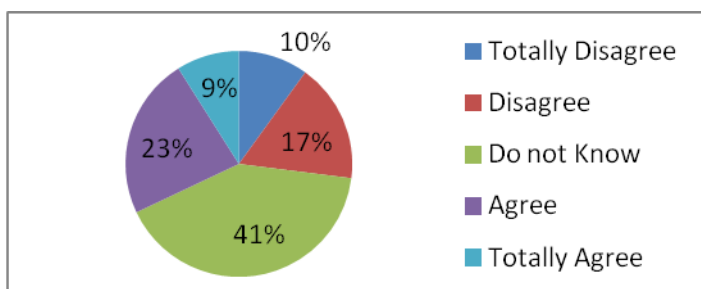
Khuma Township like most gold mining areas in South Africa is also contaminated with pollutants from mining activities to its potable water supply. The contamination from South African gold mining pollutes the Vaal River and other sources of surface and groundwater in this area. Veltman and Wilke (2008) believe that water quality at the upper levels of Margaret Shaft (Old mining shaft near Khuma Township) indicates high levels of contamination from sulphate and sodium-chloride, and that, because of the upper levels' proximity to the ground surface, this contamination is mostly pollution from gold mine tailings and rock dumps.

Presently, the waste water from the surrounding gold mines which include Margaret Shaft, Toni Shaft and Charles Shaft, is directly discharged into the Vaal River which is the main supply of water to the Midvaal Water Company to be purified before consumption. The discharge of contaminated water from Margaret Shaft into Koekemoer Spruit has led to the artificial recharge of poor quality water to the underlying groundwater aquifer, resulting in recirculation and causing a deterioration of groundwater quality in the vicinity of this stream (DARCY, 2002). The Khuma Township community is also vulnerable to air pollution from the mining dumps and earth tremors.

Statement No.15 “The underground lying dolomite rock in the area possesses threats to the quality of water and lives of the people of Khuma Township”

Altogether 27% of the respondents disagree/totally disagree with the statement and 41% do not know of any impacts of dolomite on the quality of potable water and their lives. Only 32% of the respondents agree/totally agree that the dolomite rock underlying Khuma Township, is a serious threat and it possesses future uncertainty to their properties and lives.

Totally Disagree	Disagree	Do not know	Agree	Totally Agree
7	12	28	16	6
10%	17%	41%	23%	9%

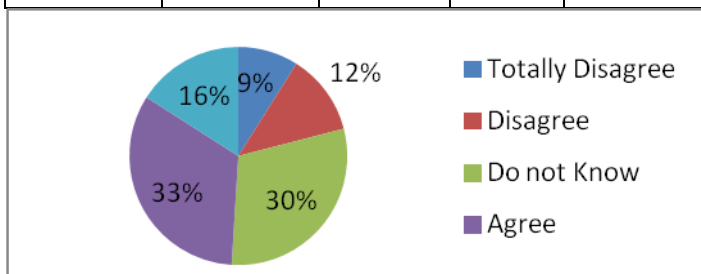


According to Strydom (2013), the Matlosana Local Municipality is fully aware of the underlying dolomite rock in Khuma Township. The local municipality has admitted to developing and constructing houses on top of the underlying dolomite rock. Sections of Khuma Township such as extension 6, 9, 10 and 11 were also developed within the one-year-flood lines (see Annexure B). This situation confirms that the community of Khuma Township is vulnerable to ground-fall and water-borne diseases due to, *inter alia*, the unstable ground rock layers and soil around their area.

Statement No. 16 “Midvaal Water Company is committed to the provision of high quality potable water in Matlosana Local Municipality”

Twenty one per cent of the respondents disagree/totally disagree and 30% do not know if Midvaal Water Company is committed to the provision of high quality potable water in Matlosana Local Municipality. Only 49% of the respondents agree/totally agree with the statement.

Totally Disagree	Disagree	Do not know	Agree	Totally Agree
6	8	21	23	11
9%	12%	30%	33%	16%



According to Hlalele (2012), most residents believe that the restriction and water cut-offs of potable water supply to Khuma Township are monitored and controlled by the

Midvaal Water Company. The people also believe that the contamination and pollution to their potable water supply is negligence from Midvaal Water Company. They are unaware that pipes that are not cleaned regularly or well-maintained by their local municipality are not the concern of the Midvaal Water Company and the maintenance of the pipes and reservoirs are the responsibility of their local municipality.

Midvaal Water Company is a water utility which provides a service to Matlosana Local Municipality area of jurisdiction includes residential areas as well as mining and industrial undertakings. In order to show its commitment to the quality of potable water, Midvaal Water Company, in 2011, also took a number of initiatives towards the achievement of Blue-Drop Certification status in the region by:

- Developing water safety plans for the region comprising the total water chain.
- Assumption of responsibility for electronic submission of data on behalf of the City of Matlosana into the Blue-Drop system managed by DWA.
- Publication of water quality results to comply with Blue-Drop system requirements.

The Blue Drop system is one tool which attempts to maintain an acceptable standard of drinking water to the South African community and also attempts to encourage tourists to use and drink tap water in various local municipal areas without any fear of infection.

4.4 ANALYSIS OF FINDINGS

The research empirical findings identified the following major factors which created problems related to the management of potable water in Khuma Township:

1. Insufficient potable water supply to the residents of Khuma Township.
2. Poor communication and participation between the Matlosana Local Municipality and Khuma Township residents.
3. The impact of mining to the quality of potable water supply in Khuma Township.
4. The impact of underlying dolomite rock to Khuma Township home owners.

The effects of the above factors were analysed in order to arrive at logical contributions for the improvement of service delivery and the management of potable water supply to Khuma Township.

4.4.1 Insufficient potable water supply to the residents of Khuma Township

According to Potgieter *et al.* (1974:293), “Khuma Township is believed to had a population of approximately 10 000 residents between 1970 and 1971”. These people were located around extensions 1 and 2 (see annexure B). The entire population could be supplied with potable water from the reservoir “A” (see Annexure B). Due to unforeseeable influx of people to this area in search for employment in gold mines around this area (see Annexure B), the population increased substantially more than 43 000 by 2011. Most of the residents built shacks around this area. Hence, extensions such as Extension 3, 4, 5 and 6 came into being. After the 1994 elections and the introduction of the Reconstruction and Development Programme (RDP) by the ANC government, new sites were identified to build RDP houses. The Township is expanding with extensions 7, 8, 9, 10 and 11 in the process of being developed (see Annexure B).

Unfortunately, the infrastructure with regard to the supply of potable water to Khuma Township and its population increase were not given the attention it deserved. The only reservoir which is used to supply potable water to this community as far back as 1960s is still the only water storage facility to supply the entire community of this Township (see annexure B). Irrespective of increasing human demand relating to the domestic consumption of potable water, there has been no development or improvement to the old reservoir. According to Lehasa (2012), “cases of potable water supply shortages to this township have been there since the 1980s”.

In response to the interview question “Why has no improvement or development with regard to supply of adequate potable water supply to Khuma Township for the past 40 years by Matlosana Local Municipality?” Mr Sibanyoni said:

“The problem with Khuma Township shortage of potable water supply is contributed by many factors such as, lack of funds due to the non-payments of water services by the community and the positioning of the reservoir, making it difficult for the flow of water to reach every household especially

the newly formed Extensions (6, 7, 8, 9, 10 and 11). He also mentioned that the Mining companies around Stilfontein and Khuma Township are also equally to be blame because they used to subsidise Khuma Township residents with potable water supply, hence, when they started to close-down mining operations, residents started to be hesitant or reluctant in paying their services”.

In response to above statement by the Matlosana Local Municipality, one of the senior residents to this township, Mr Hlalele said:

“The apartheid regime is equally to be blamed for this; hence the community saw it fit to use the non-payments of services as a tool to fight the old regime. He further said that the present government is somehow politically obliged to take responsibility and half of the blame, because, they promised people to provide them with free water if they could be voted into power and yet they failed to explain the meaning of “free basic services to people”. People around here, do not see any need of paying for basic municipal services because there are no improvement in terms of the service delivery, especially enough potable water supply to each and every household every time”.

The responses from the questionnaires, especially statements 3, 7 and 9, display an alarming high number of Khuma Township residents who are convinced that there is insufficient supply of potable water supply to their area by the Matlosana Local Municipality (see section 4.2 above). The response by Mr Strydom, who is the Director of Cooperative Services in Matlosana Local Municipality, is controversial. The shortage of potable water supply in Khuma Township is a well-known fact. Contrary to this, the Assistant Manager of the Water Section in Matlosana Local Municipality, Mr Sibanyoni and the report by City of Matlosana admitted that there has been insufficient potable water supply to Khuma Township due to reasons provided previously (see section 1.2).

The insufficient potable water supply could also be viewed that not all extensions of Khuma Township experience water cut-offs or shortages simultaneously. Extensions 6, 7, 8, 9, 10 and 11 experience potable water shortage because presently, Reservoir 1 (see Annexure B) is the only one reticulating water to all 11 extensions in Khuma Township. This reservoir was meant to pump water to the old extensions (1, 2, 3, 4 and 5). Only residents from extension 6-11 are usually affected by the water cut-offs to an extent of being seen walking and travelling towards Stilfontein in search of potable water.

It is, therefore, important for Matlosana Local Municipality to be reminded that Section 27 of the Constitution of South Africa outlined that every person has the constitutional right to have access to sufficient water.

4.4.2 Poor communication, cooperation and participation between Matlosana Local Municipality and Khuma Township residents

According to statements number 2, 4, 5, 6, 11, 12, 13, 14 and 15 of the questionnaire (see section 4.2 above), most of the responses indicated poor communication, ignorance or negligence and lack of cooperation and participation between the residents of Khuma Township and Matlosana Local Municipality.

Statement 2 attempted to establish whether the community of Khuma Township has an idea of the state of the quality of their potable water. Surprisingly, 23 percent have no idea of what they are consuming every day. Close to 50 percent also disagree that the quality of potable water to this region is of an acceptable standard. As previously indicated the Blue Drop status of Matlosana Local Municipality was at 95.38 % in 2012 and rated the second best after Tlokwe Local Municipality (see section 1.6.2 above).

The residents of Khuma Township also display signs of ignorance and negligence with regard to their health and life threatening aspects by not making an effort to establish whether the reservoir is maintained and cleaned regularly, preserve water, the risk of pollution by mining activities to the potable water and threats of the underlying dolomite rock to their property and lives.

Even though this is the case, the question is whether Matlosana Local Municipality is doing enough to communicate and make the residents of Khuma Township aware of the threats, hazards that they are surrounded by. It is still the responsibility of the Municipality to arrange road shows and awareness campaigns with regard to these issues. The responsibility of making the public aware of every municipal activity or projects is the responsibility of the authority at the level of municipalities and government. In 1997 the Batho Pele Principles were established which according to Nealer and Raga (2008:298-300), seek to introduce a fresh approach to service delivery: an approach which puts pressure on systems, procedures, attitudes and

behaviours within the Public Service and reorients them in the customer's favour, an approach which puts the people first. Furthermore, in 1998 the Local Government White Paper was also promulgated to create a new developmental local government system, which is committed to working with and for citizens, groups and communities to create sustainable human settlement which provide for a decent quality of life and meet the social, economic and material needs of communities in a holistic way.

4.4.3 The impact of mining on the quality of potable water supplied in Khuma Township

The literature survey (see section 2.4 above) identified that Khuma Township, like most gold mining areas in South Africa, is also experiences contamination or pollutants from mining activities to its water resources. For example, in 1996, a total of 377 million mine waste was produced, accounting for 81% of the total waste stream in South Africa (Chamber of Mines of South Africa, 2001). With regard to Khuma Township, the contamination by gold mines in the area pollutes the Vaal River which is to the south of Khuma Township, (see the map) and other sources of surface water in this area. Vaal River is the only source of water in this region and if such impact is prevented, the residents of Matlosana Local Municipality including Khuma Township are at risk to water-borne and respiratory diseases. Veltman and Wilke (2008) believe that water quality at the upper levels of Margaret Shaft, (located north-west of Khuma Township) (see annexure B) indicates high levels of contamination from sulphate and sodium-chloride, and that, because of the upper levels' proximity to ground surface, this contamination is mostly pollution from gold mine tailings and rock dumps. Nitrates are believed to be common pollutants to the groundwater in this area and they contaminate drinking water in the form of potassium nitrates and ammonium nitrates.

According to the responses from statement .14, 47% of the respondents agree that mining activities are potential risk factors in the municipal area. Khuma Township is presently surrounded by old and unused mining shafts. It has also been revealed that these gold mining shafts directly discharge their waste into the Vaal River. According to DARCY (2002), the discharge of contaminated water from Margaret Shaft into Koekemoer Spruit (see the map) has led to the artificial recharge of poor

quality water to the underlying groundwater aquifer, resulting in recirculation and causing a deterioration of groundwater quality in the vicinity of this stream. The implication hereof is that mining activities are polluting water and this in turn is affecting the quality of potable water supply in this area.

In addition to these concerns, more than 50% of the respondents indicated that the quality of potable water is of unacceptable or low standard. Air pollution from mining-dumps is also one fact that has been affecting Khuma Township residents. The recent initiative by the Matlosana Local Municipality to remove the dumps needs to be applauded.

The planning by Matlosana Local Municipality, for the development of Khuma Township, also leaves much to be desired. The positioning of the sewage works (see the map) from Stilfontein and Khuma Township wastes, one can also see that there is potential for pollution from the sewage system because it is not positioned strategically. From this position, one can imagine the amount of waste that flows down to the Vaal River and the impact on human and animals that drink or depend on this resource for survival. The map (see annexure B) reveals that there are two graveyards (1 and 2) that are not strategically located due to the underlying dolomite rock and karst landscape.

4.4.4 The impact of underlying dolomite rock to Khuma Township home owners

According to statement 15 of the questionnaire (see section 4.2), 27% of the respondents disagree/totally disagree that “the underground lying dolomite rock of the area poses a threat to the quality of water and lives of the people of Khuma Township”. This finding indicated ignorance and the lack of information given to the residents of Khuma Township with regard to possible hazards or life threatening aspects. For example, there are a number of sinkholes due to the underlying dolomite rock around extension 6 (see the map) and the area between reservoir “A” and “B”. According to Ngcobo (2006:251), dolomite is soluble and rainwater and infiltrating groundwater gradually dissolves the rock over time as it seeps through the joints, fractures and fault zones in the rock. The dissolution of dolomite usually results in cracks, cave systems and voids which in turn result in sinkholes.

During the literature study it was identified that some areas in South Africa, including gold mining areas such as Stilfontein area where Khuma Township is located, are underlain by dolomite.

Based on the underlying dolomite rock in this area, the development of new houses especially in extensions 6, 7, 8, 9, 10 and 11, should not be built because peoples' lives and properties are at risk of underground mining activities and geological hazards. Matlosana Local Municipality should have considered the flow of the Koekemoer Spruit through the Khuma Township area with the underlying dolomite and underground mining activities which constantly faced with tremors. The area is unstable for human settlement. All of the physical challenges place Khuma Township residents and properties in line for possible disaster. The residents of Khuma Township are vulnerable to ground-fall and water-borne diseases due to, *inter alia*, the unstable ground rock layers (dolomite) and air pollution of the mining sludge dams.

4.5 SUMMARY

The empirical findings of the research study on the management of potable water supply in Khuma Township was discussed and analysed. The analysis was based on the responses received from all role-players in the management of potable water supply in Khuma Township. The data was acquired through the use of a 5-point Likert-scale type questionnaire and interviews with officials from Matlosana Local Municipality.

It transpired from the findings that poor communication, cooperation, negligence and a lack of basic knowledge and active participation in the management of the potable water supply by both residents of Khuma Township and Matlosana Local Municipality are practical problems that pose threats, instability and uncertainty for good governance in the Matlosana Local Municipality's municipal area.

The next chapter focused on the summary, conclusions and recommendations drawn from the findings and results of the research process. The *status quo* on the management of potable water supply by Matlosana Local Municipality with a specific

focus on Khuma Township was summarised. The summary of the research attempted to reveal how the current management of potable water supply in Khuma Township affects the community members. Lastly, several recommendations were made of how to manage potable water supply effectively and efficiently.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

Water is the necessary ecological resource in every ecosystem and every species requires water to survive. Unfortunately, the value of this resource for human, flora and fauna survival is ignored. The origin and usage of water has now become a centre of debate on who has the final jurisdiction of water in respective municipal areas. Bekker (2010:57) emphasised that due to the developing nature of the world, rapid urbanisation, industrialisation, available water resources are exposed to many forms of exploitation and pollution.

This study focused on how the Matlosana Local Municipality manages potable water supply in Khuma Township. Based on the literature review, this area has a history of potable water supply challenges. The purpose of this research was, therefore, to analyse the management of potable water supply in Khuma Township with the following sub-objectives in mind:

- To determine the nature and extent of the physical environment where Khuma Township is located.
- Become knowledgeable on current legislation with specific focus on the management and utilisation of potable water in a municipal area.
- To determine the overall nature and extent of the management of potable water supply in Khuma Township by Matlosana Local Municipality.
- To determine the levels of participation and commitment of Khuma Township residents in the management of their potable water supply.
- To come up with logical conclusions and recommendations on the improvement of the management of potable water supply in Khuma Township.

The aim of this research study was to outline the management of potable water supply in Khuma Township, the impact of the current management of this community

and possible suggestions to improve an effective management of potable water supply in this area.

Data was collected by reviewing the literature along with interviews and a Likert-scale type questionnaire which was provided to the residents of Khuma Township and relevant stakeholders (see 4.2 above). The geo-hydrology of the area was also taken into consideration with the underlying dolomite rock that poses threats to the development of this area (see 2.3 above). The impact of underground mining activities also appeared as human and infrastructural development threats since this area is commonly renowned for earth tremors due to the underground mining which result in houses disintegrating and water pipes breaking. The research also reviewed the current the management of water legislation with specific focus on potable water supply to municipal areas (see 3.2 above).

This chapter summarised the major findings of the research study and produced logical conclusions and recommendations. The recommendations could be implemented to improve the management of potable water supply in Khuma Township by Matlosana Local Municipality.

5.2 PRIMARY FINDINGS LEADING TO CONCLUSIONS

The following conclusions of the research were drawn taking into account the research questions in chapter one.

5.2.1 Legislation on potable water supply by local municipalities

The Constitution of the Republic of South Africa, 1996, protects and promotes the fundamental rights of the people of South Africa. These rights include the right to safe and clean potable water by all citizens regardless of race. Water is usually governed by various institutions for the purpose of better management and service of potable water to the nation, for example, Department of Water Affairs and Rand Water Board.

The South African democracy has portrayed a valuable government shift towards a developmental government which is responsible for the management of potable water. A number of structures have been established to ensure the adoption of an integrated water resource management (IWRM) approach as a means to overcome the challenges facing the management of potable water in South Africa. For example, the Water Services Act 108 of 1997 and National Water Act 36 of 1998 were established in order to shift the management of water in South Africa to an integrated water resource management. On the other hand, as a way of decentralising and sharing governance and responsibilities, the Local Government: Municipal Structures Act 117 of 1998 was also established to focus on the responsibility of local authorities (municipalities) in terms of basic service delivery which includes potable water supply to all the municipal residents.

In addition to the water laws and policies, the South African Disaster Management Act 57 of 2002 was implemented to take preventive measures in avoiding or reducing all risks and disasters including water related diseases. Water should, therefore, be used and consumed in a sustainable manner because sustainable water usage and consumption support the ability of human society to endure and flourish into the indefinite future without undermining the integrity of the hydrological cycle or the ecological systems that depend on it (Gleick *et al.*, 1995:87).

Despite the formulation of legislation, there is still much confusion such as the paradox between local and district municipalities. This could lead to inadequate cooperative governance and optimal public participation and involvement in matters relating to the management of potable water in Khuma Township. There is still much to be done in terms of implementing applicable legislation for effective and efficient management of potable water supply.

There is poor communication, cooperation and participation between Khuma Township residents and Matlosana Local Municipality with regard to the management of potable water supply in the dolomite and mining area. For example, most residents (75% of the respondents) are not even aware of the necessity of preserving water and 63% of the respondents agree that they are not involved in matters relating to potable water supply in their area. On the other hand, Matlosana

Local Municipality is not doing enough to engage the Khuma Township residents with regard to anticipated water cuts.

According to Pienaar and Van der Schyff (2005:263), “the water laws and regulations should be upheld and implemented by all role-players because the overall objective is to change the South Africa water dispensation so that socio-economic demands and environmental management requirements one met in an effective, efficient and economical manner to enable equal access to all South Africans”.

5.2.2 Overall nature and extent of management of potable water supply in Khuma Township

In an attempt to understand the management of potable water supply in Khuma Township, it was important to analyse the relevancy of the theory of the management of potable water supply in a responsibility area of local municipality. The research focused on how Matlosana Local Municipality manages its drinking water and the problems associated with potable water supply in Khuma Township (which is one of several areas in the Matlosana area). The following factors were found to play a significant role in the management of potable water supply in Khuma Township:

5.2.2.1. *Geo-hydrology of Khuma Township*

The geo-hydrology of the underlying strata in Stilfontein area, which includes Khuma Township, is mainly governed by pre-mining geological constraints and the flow in the upper weathered ground water aquifer flows towards the Vaal River. It became clear from literature study that the recharge in Klerksdorp, Orkney, Stilfontein and Hartebeesfontein (KOSH) area (presently known as Matlosana Local Municipality), varies between 6% and 12% for mean annual precipitation which is relatively high due to soils (weathered dolomite rock) which are transmissive and areas of Karstification (dissolution) which allows for rapid infiltration of surface water into the sub-surface groundwater.

Khuma Township is underlain by dolomite which is a significant rock type when considering groundwater potential. Furthermore, the research established that the dolomite rock usually has large fissures and openings through which large amounts of groundwater moves at a rapid pace. The community of Khuma Township is, therefore, vulnerable to ground-fall and water-borne diseases due to the unstable ground or rock layers around their area. The empirical survey revealed that 32% of the respondents agree/totally agree that the dolomite rock underlying Khuma Township is a serious threat and it poses future uncertainty to their properties and lives.

5.2.2.2 Impact of underground mining on water quality in Khuma Township

The research findings also established that 47% of the respondents are of the view that potable water supply the Matlosana Local Municipality is at risk of pollution by mining activities. Khuma Township, like most gold mining areas in South Africa, is exposed to contamination or pollutants from mining activities to its potable water supply. The pollution of groundwater by underground mining activities such as mining in the Klerksdorp, Stilfontein, Orkney and Hartebeesfontein (KOSH) area also has an impact earth tremor on the formation of cracks and sinkholes.

The contamination in the KOSH mining area pollutes the Vaal River and other sources of surface water in this area. For example, Veltman and Wilke (2008) believe that water quality at the upper levels of Margaret Shaft (old mining shaft near Khuma Township) indicates high levels of contamination from sulphate and sodium-chloride, because of the upper levels' proximity to the ground surface.

5.2.3 Efficiency and effectiveness of the management of potable water supply by Matlosana Local Municipality in Khuma Township

It is believed that the efficiency and effectiveness of proper municipal management is usually measured in terms of the outcome of services and the willingness, determination, efforts and organisation by service providers such as Matlosana Local Municipality to its public (Khuma Township). More than 68% of the community members of Khuma Township differ with the statement that "Residents of Khuma

Township always have access to safe and clean potable water”. This implies that the management of potable water supply to the residents of Khuma Township is not efficient and effective enough. Access to potable water in Khuma Township remains a challenge to the community and the Matlosana Local Municipality. Most extensions of Khuma Township usually have limited supply of potable water and most of the services such as schooling and health services are restricted.

5.2.4 Role-players and Stakeholders

In accordance to the Local Government: Municipal Systems Act 32 of 2000, a municipality must develop a culture of municipal governance that complements formal representative government with a system of participatory governance and must encourage community participation. The Act also requires local authorities to apply the following measures as a means to encourage public participation:

- Create conditions for the local community to participate in the affairs of the municipality.
- Contribute to building the capacity of the local community, councillors and municipality staff.

The usage, consumption and management of water among South African communities at the local government sphere need an integrated water resource management approach. The rationale is to have a sustainable usage of water resources. Relevant role-players in water should play an active role in the management of water resources. Water supply should not only be the responsibility of the government but rather a collective and integrated approach must be encouraged. Aspects such as optimal public participation and the involvement of public-private-partnerships (PPP) must be encouraged.

The key role-players identified in the management of potable water supply by Matlosana Local Municipality in its geographical demarcated responsibility area, are the Matlosana Local Municipality, the residents of Khuma Township, Department of Water Affairs (DWA), Mines, business sector and Non-Government Organizations (NGOs). Technical and engineering expertise is usually provided by the Matlosana Local Municipality and DWA as the primary role-players. In the literature study, it

transpired that there might be a paradox between Matlosana Local Municipality, Dr Kenneth Kaunda District Municipality and DWA with regard to some responsibilities when it comes to management of bulk water supply to Khuma Township. Less public representation and participation and other sectors in the management of potable water supply in this area are also signs of poor management cooperative governance in the area.

5.3 RECOMMENDATIONS

To ensure improved management of potable water supply to the residents of the Khuma Township, the following recommendations are made based on the logical conclusions from the research study:

5.3.1 With reference to the underground mining activities and dolomite (Karst area)

Based on the impact of the underground mining, the effect of the dolomite rock in the area as well as adherence to the Koekemoer Spruit flood lines, residents of Khuma Township, especially in the new extensions 6, 7, 8, 9, 10 and 11, should not have been settled in the area. It is, therefore, recommended that:

- Public awareness campaigns and information sessions to Khuma Township residents around areas that are vulnerable to underground mining activities, the underlying dolomite rock, as well as being inside the flood lines of the Koekemoer Spruit should be undertaken. People around these extensions should be made aware of the dangers and possible disasters that could result in their lives and with respect to their properties. This could be realised by means of, *inter alia*, news-letters, road shows or information sessions facilitated by ward councillors.
- Mining companies around Khuma Township together with Matlosana Local Municipality should take reasonable action when implementing settlement developments in this area, especially building of houses close to mining shafts, tailings dumps, sinkholes and within the flood line of the Koekemoer Spruit. The areas of extensions 6, 7, 8, 9, 10 and 11 should have been

abandoned long time ago because it is an environmentally devastated area. The said area in these extensions is high risk area for humans and animals to settle. Both children playing and animals drinking and grazing along extension 6, 9, 10 and 11 could become sinkhole victims if proper human settlements in these areas are not provided.

- Since this Township is located in a dolomite area, all the pipes that transport both potable water as well as grey-water should not be placed underground but instead be located and constructed on-top of the ground surface to prevent leakages of water into the underlying dolomite rock.

5.3.2 Legislation applicable to potable water supply by municipalities

The management of potable water supply to the residents of Khuma Township need to be comprehensively addressed whereby the Constitutional rights and acts related to water supply are not only formulated but also implemented and enforced.

- Matlosana Local Municipality should assess, analyse, review and resolve all water related policies within its area of jurisdiction including management of potable water.
- Matlosana Local Municipality should ensure that implementation of all water related regulations will enable them to manage their water supply as well as alleviate poverty, improve the quality of peoples' lives, and conserve the environment.
- The various management responsibilities of water services by the Dr Kenneth Kaunda District Municipality as well as Matlosana Local Municipality should be clearly defined and demarcated to avoid a paradox with regard to water services management.
- The residents of Khuma Township should be informed that, although they are constitutionally entitled to adequate potable water supply, they should also act responsibly and pay for the services to their local municipality.

It should also be noted that, in order to comply with legislation and basic human rights in accordance with the Constitution of the Republic of South Africa, (RSA,

1996), the management and distribution of the potable water supply within South Africa needs to be addressed comprehensively (Nealer & Raga, 2008:158). According to Tempelhoff (2008:14-15), since the 1990s, water in South Africa and the history of water usage have received much more attention than in previous years; new legislation has been put in place to promote more sustainable usage of water and access of safe drinking water to all citizens of the country. The question now in relation to these new legislations is whether municipalities are really implementing them effectively and efficiently to the benefit of the public it serves?

Furthermore, the South African Disaster Management Act, 2002 (RSA, 2002: Section 20(1)(a), with regard to prevention and mitigation, organs of state, communities and individuals needs to prevent or reduce the risk of disasters by:-

- Determining levels of risk.
- Assessing the vulnerability of communities and households to disasters that may occur.
- Increasing the capacity of communities and households to minimise the risk and impact of disasters that may occur.
- Monitoring the likelihood of and the state of alertness to disasters that may occur.

5.3.3 Nature and extent of management of potable water supply in Khuma Township

An integrated water management will be the best approach towards the management of potable water supply in Khuma Township. Water supply should not be the responsibility of only one party but rather a more collaborated effort must be encouraged. The rationale behind this will be to have sustainable usage of water resources and the following approaches should be adhered to:

- Dr Kenneth Kaunda District Municipality and its subservient Matlosana Local Municipality in collaboration with the mining companies should prevent or eliminate chemical pollutants to the surface and groundwater in this area by enforcing all laws related to prevention of water and air pollution.

- Tlokwe Local Municipality, which is located to the north-east of Khuma Township, should also be alerted that their waste dump into the Koekemoer Spruit or even Vaal River has detrimental effects on the lives of people and animals in Khuma Township.
- There should be no further development such as housing on dolomite areas that are exposed to underground mining or which lie inside the flood lines of the Koekemoer Spruit. Alternative sites for new housing should be identified and awareness campaigns and road shows on the dangers of settling in Karst areas should be initiated by Matlosana Local Municipality in collaboration with Khuma Township residents.

5.3.4 Improved potable water supply by Matlosana Local Municipality to Khuma Township

In order to improve service to the residents of Khuma the following recommendation are to be adhere to:

- Two water reservoirs are urgently needed in order to regularly supply the entire community of Khuma Township with adequate potable water.
- Cooperative and participatory governance should be implemented by the DWA in collaboration with Matlosana Local Municipality and the residents of Khuma Township at all times as a way of sustainable development in the management of potable water supply.
- Public-Private-Partnerships between all relevant partners in the management of potable water supply are also recommended whereby all relevant institutions within the region and private sector should be identified and facilitated to work hand-in-hand to manage water resource in the area.

5.3.5 Role-players and Stakeholders

Relevant role-players in water should all play an active and effective role in the management of water resources and the following should be taken into account by all role-players and stake-holders:

- Public awareness campaigns relating to the management of potable water such as the importance of service payments, prevention of water pollution and conservation of potable water should also be jointly undertaken by all role-players.
- Water forums by community leaders (ward councillors); water managers from local and district municipalities, business, environmental sector, the residents of Matlosana Local Municipality and Midvaal Water Company should start to review and optimise their actions towards the future of potable water supply and possible pollution and contamination into the underground and surface water.
- All role-players should also start thinking of building a dam in this area, especially to increase source of water to assist the Vaal River.

5.4 FURTHER RESEARCH

The research identified several challenges that hinder the improved management of potable water in Khuma Township and some of these challenges will need to be undertaken as soon as possible. The following valuable research areas with regard to the potable water supply in Khuma Township are identified below:

- Active and visible participation by all role-players in the management of potable water supply as a means of ensuring sustainable usage of water by the Matlosana Local Municipality in its geographical responsibility area.
- Undertake geological and geo-hydrological research in the Matlosana Local Municipality's area of jurisdiction to bring about stability and secure settlement of urbanising.
- The imperative that the residents of Matlosana Local Municipality pay regularly for their services to ensure that improved and sustainable service delivery is always rendered.

LIST OF SOURCES

African National Congress (ANC). 1994. The Reconstruction and Development Programme: *A policy framework*. <http://www.anc.org.za/rdp/rdpall.html>. Date of access: 27 July 2012.

Akintonye, A., Beck. & Hardcastle, D. 2004. Public-Private-Partnerships: Managing risks and opportunities. Blackwell Science Ltd.

Alder, R.A., Claassen, M., Godfrey, L & Turton, A.R. 2007. Water, Mining and Waste: An Historical and Economic Perspective on Conflict Management in South Africa. *The Economics of Peace and Security Journal*. 2(2): 33-41

Anon. 2010. What is a Literature Review/? [Web:] <http://unimeb.libguides.com/lit-review/>. Date of access: 3 January 2011.

Anon. 2011. Water Reticulation Network – Midvaal Water Company. [Web:] www.flownex.com. Date of access: 9 March 2012.

Bassette, G. 2006. People, Land & Water: *Participatory development communication for natural resources management*. London: Earth scan.

Baumgartner & Recheil. 1975. www.waterfootprint.org Date of access: 10/07/2012.

Bekink, B. 2006. Principles of South African Local Government: Law. Butterworth; LexisNexis.

Bekker, T.S. 2010. A More Effective Management of the Gerhard Minnebron as Important Resource of Potable Water for Potchefstroom. North-West University. (Mini-Dissertation – Masters in Development and Management).

Biswas, A.K. 2004. Integrated Water Resources Management: A Reassessment. IWRA, Water International, Volume 29, number 2: 248-256.

Bouguerra, M.L. 2006. Water Under Threat. Alliance of Independent London & New York. Publishers: ZED BOOKS.

Brown, A. 1983. Golden Heritage. Printforme. Stilfontein, Transvaal.

Brynard, P.A. & Hanekom, S.X. 2006. Introduction to Research in Management-Related Fields. Second Edition. Cape Town. Van Schaik

Chamber of Mines of South Africa. 2001. Statistics of Chamber of Mines of South Africa. Johannesburg.

Charmbers, R. & Conway, G.R. 1991. Sustainable Livelihood: Practical Concept for the 21 Century ID'S Discussion Paper, 296 Sussex: Institute for Development Studies.

City of Matlosana. 2007. Khuma Bulk Water Supply. Phase 2: Technical Report:1-15. Prepared by: MAXIM Planning Solutions in Association with BIGEN AFRICA.

City of Matlosana. 2012. Draft Project Proposals Khuma Township. Prepared by: MAXIM Planning Solutions in Association with BIGEN AFRICA.

Craythorne, D.L. 2006. Municipal Administration: The Handbook. Cape Town. Juta & Co, Ltd.

Darcy Groundwater Scientists and Consultants (DARCY). 2002. A catchment Management Plan for the Schoonspruit and Koekemoer Spruit Catchments: A Groundwater Situation Analysis. Bloemfontein: DWAF.

Department of Public Service and Administration (DPSA). 2003. The Machinery of government: Structure and Functions of Government. Pretoria: Government Printer.

Department of Water Affairs. 2009. Dolomite Guideline: A short guide to available documents on procedures for developing dolomitic land. Pretoria: Government Printer

Department of Water Affairs (DWA). 2012. Blue-Drop Certificate Draft for North West. Pretoria: Government Printer

Fuggle, R.F. & Rabie, M.A. 2005. Environmental Management in South Africa. Cape Town Juta & Co, Ltd.

Gildenhuys, J.S.H, & Knipe, A. 2000. The organisation of government: An introduction. First edition. Western Cape: Van Schaik publishers.

Glazewski, J. 2005. Environmental Law in South Africa. Second Edition. Butterworths: LexisNexis.

Gleick, P.H. 1998. Water in Crisis: Paths to Sustainable Water Use. *Pacific Institution for Studies in Development, Environment and Security. Ecological Application*, 8(3), 1998: 571-579. USA.

Gleick, P., Loh, P., Gomez, S. & Morrison, J. 1995. California Water 2020: A Sustainable Version. Pacific Institute Report. Oakland, California, USA.

Hlalele, M.J. 2012. Community Member of Khuma Township. Verbal communication with the Researcher. Khuma (Stilfontein). (Audio recording in possession of the author).

Institute for Water Quality Studies (IWQS). 1995. The impact of diffuse load reduction from the Vaal Reefs, Hartebeesfontein Gold Mine, Buffelsfontein and Stilfontein mines on the water quality in Vaal River: *Report to the Department of Water Affairs: Pollution Control (Highveld Region)*.

Ismail, N., Bayat, S. & Meyer, I. 1997. Local Government. South Africa: International Thompson Publishing (South Africa).

Labuschagne, P.F. & Human, C. 2009. Estimating the Impacts of Site Hydrogeology on Groundwater Liability, Closure and Rehabilitation: Abstract of the International Mine Water Conference on 19-23 October 2009. Pretoria.

Lehasa, B.C. 2012. Community member in Khuma Township. Verbal communication with the Researcher. Khuma (Stilfontein). (Audio recording in possession of the author.)

Leedy, P.D & Ormrod, J.E. 2001. Practical Research: Planning and Design. Seventh Edition. New Jersey. Merrill Prentice Hall.

Monashane, S.C. 2011. Water Supply and Sanitation Delivery Problems as Practiser, Limpopo Province. North-West University. (Mini-Dissertation – Masters in Development and Management).

Midvaal Water Company. 2011. Annual Report.

Momba, M.N.B., Thompson, P. & OBI, C.L. 2008. *Guidelines for the Improved Dissatisfaction of Small Water Treatment*. Gezina: Water Research Council.

Motsewnyane, R. G. 2012, Principal of Thuto Thebe Secondary School in Khuma Township. Verbal communication with the Researcher. Khuma (Stilfontein). (Audio recording in possession of the author.)

Nealer, E.J. 2009. Municipal Governance and the Environmental Crises: Threats and Thoughts. *The Journal for Transdisciplinary Research in Southern Africa*. 5(2) 73-85.

Nealer, E.J & Raga, K. 2008a. Knowledge about the Origin of a Municipality's Potable Water: A Prerequisite for Consolidation of More Effective Local Governance. *Journal of Public Administration*, 43. (3.1) 294-307.

Nealer, E.J. & Raga, K. 2008b. A Physical Environmental Management Perspective on Municipal Water Supply: Proposals for Tlokwe City Council. *The Journal of Transdisciplinary Research in South Africa*, 4(1): 157-173.

Nealer, E.J. & Van Eeden, E. 2010. The Essence of Water Services Management According to Surface Water Catchment Regions: A Case Study of Delmas Local Municipality. *Administratio Publica*: 18(3): 133-148.

Ngcobo, T.A. 2006. The Risks Associated with Mines in Dolomitic Compartments: *The Journal of The South African Institute of Mining and Metallurgy*. Vol.106: 251-264.

Ouyahia, M.A. 2006. Public-Private Partnership for Municipal Drinking Water Infrastructure: What are the Challenges. *Discussion Paper*. PRI Project. PH4-35/2006 E-PDF 0662-43362-9.

Perret, S., Farolfi, S. & Hassan, R. 2006. Water Governance for Sustainable Development. UK: Earth scan.

Pienaar, G.J. & Van der Schyff, E. & Tempelhoff, J. 2005. African Water Histories: Transdisciplinary Discourses. Vanderbijlpark. Creda Printers.

Potgieter, D.J., Spies, J.J. and Hiemstra, L.W. 1974. Standard Encyclopaedia of South Africa: Volume 10 SLE-TUN. Library of the Congress Catalogue. Port Elizabeth.

Pretorius, J.A. & Dennis, I. 2003. Development of Internal Strategic Perspectives: Groundwater Overview for Middle Vaal Catchment Management Area. Appendix D. *Groundwater Report Prepared for Directorate Water Resource Planning DWAF*. Pretoria.

South Africa. 1996. Constitution of the Republic of South Africa as adopted from the Constitutional Assembly on 8 May 1996 and amended on 11 October 1996.

South Africa. 1998. Municipal Structures Act 117 of 1998. Cape Town: Government Printer.

South Africa. 1998. National Water Act, Act no.36 of 1998. Government Gazette 398, No. 19182. Pretoria: Government Printer.

South Africa. 2000. Local Government: Municipal Systems Act no. 32 of 2000. Government Gazette No. 21776. Cape Town. Government Printer.

South Africa. 2000. Municipal Service Act, 32 of 2000. Pretoria: Government Printer.

South Africa. 2002. Disaster Management Act 57 of 2002. Assented to 30 December, 2002 and commence on 1 July 2004. (26228). Pretoria: Government Printer.

South Africa. 2003. Department of Public Service and Administration: *The Machinery of government structure and functions*. Pretoria. Government Printer.

Sibanyoni, R.G. 2012. Assistant Manager- Water Section Matlosana Local Municipality. Verbal communication with the Researcher. 28 Jul., Klerksdorp.

Strydom, G. 2013. Director Corporate Services Matlosana Local Municipality. Verbal communication with the author. Klerksdorp. (Cassette recording in possession of the author.)

Tempelhoff, J.W.N. 2008. An Introduction to the Water History of South Africa Manuscript. Vanderbijlpark. 5-16p

Thompson, H. 2005. Water Law. A Practical Approach to Resource Management and the Provision of Services. Cape Town: Juta & Co Ltd.

Turton, A. & Henwood, R (ed). 2002. Hydropolitics in the developing world. A Southern African perspective. African Water Issues Research Unit. Pretoria. University of Pretoria.

Twigg, J. 2004. Disaster Risk Reduction: Mitigation and Preparedness in Development and Emergency programming. United Kingdom. HPN

United Nations. 2009. World Water Development Report 3 (UNWWD). Water in the Changing World. United Kingdom. UNESCO Publishing.

Veltman, S. & Wilke, A.R. 2008. Groundwater Flow Mechanism at Margaret Shaft, KOSH Gold Mining Area.

Van der Walddt, G. 2004. Managing Performance in the Public Sector. Landsdowne: Juta.

Van Niekerk, D. 2008. Study material for a five (5) day skills course on disaster risk management strategies. Potchefstroom : North West University.

World Conference on Disaster Reduction (WCDR). 2005. Hyogo Framework For Action 2005-2015. Building the Resilience of Nations and Communities to Disasters. www.unisdr.org/wcdr. Date of access: 27 July 2012.

LIST OF ANNEXURES

- A. Mooiriver Catchment (Displaying areas with Dolomite including Khuma Township).
- B. Google Earth of Khuma Township
- C. Questionnaire regarding the management of potable water supply in Khuma Township.
- D. Interview Schedule with the Role players in the management of Potable Water Supply in Khuma Township

The map illustrates the West Rand region, highlighting the primary surface water divide that separates the Orange River basin to the west from the Tugela River basin to the east. Key features include:

- Settlements:** Major urban areas like Johannesburg, Ekurhuleni, and Midrand are shown in orange. Other towns include Benoni, Boksburg, and Alberton.
- Roads:** Various road types are indicated by different line styles and colors, including arterial roads, freeways, main roads, national routes, and secondary roads.
- Water Features:** Perennial rivers (blue lines) and non-perennial rivers & streams (light blue lines) are shown. Springs and eyes are marked with blue stars, and dams are marked with blue squares.
- Administrative Boundaries:** District and local municipality boundaries are shown with dashed lines.
- Geographical Features:** The primary surface water divide is marked with a thick black dashed line. Other features include the City of Johannesburg, City of Ekurhuleni, and City of Midrand.

The map is compiled by P de Plessers and GPM.

ANNEXURE B: GOOGLE EARTH OF KHUMA TOWNSHIP



ANNEXURE C:

Questionnaire regarding the management of potable water supply in Khuma Township

Date: 27-07-2012

Dear Sir/Madam

I am Kagisho Simon Monnahela, Masters Student in Disaster Management at North-West University (Potchefstroom Campus). I am investigating the state of "Potable Water Supply in Khuma Township, Matlosana Local Municipality". It is very important that we obtain your opinion regarding this aspect.

You are kindly requested to complete the following short questionnaire regarding the state of Potable Water Supply in this Township. The purpose of this questionnaire is to provide us with your honest opinion on the state of affairs on the supply of potable water in Khuma. Approximately 5-10 minutes will be needed to complete this questionnaire.

PLEASE BEAR THE FOLLOWING IN MIND WHEN YOU COMPLETE THE QUESTIONNAIRE:

- Do not write your name on the questionnaire- your identity will be protected.
- There are no correct or incorrect answers- we require your honest opinion.
- Please answer all the questions.
- Your first spontaneous reaction is the most valid. So work quickly and accurately. Do not ponder too long on a particular question.
- If you would like to change an answer, do so by clearly crossing out the incorrect response and circling your intended response.

The information collected in this survey will hopefully assist us to make recommendations on more effective and better potable water supply in Khuma Township.

Thank you in advance for your friendly assistance.

Yours faithfully

Mr. SIMON MONNAHELA (Student)

Signature:.....

Prof. ERIC NEALER (Supervisor)

Signature:.....

TO WHAT EXTENT DO YOU AGREE OR DISAGREE WITH THE FOLLOWING STATEMENTS?

Statements	Totally disagree	Disagree	I do not know	Agree	Totally agree
1. Residents of Khuma Township have regular access to clean potable (drinkable) water.	1	2	3	4	5
2. The quality of potable water in Khuma Township is of acceptable standard.	1	2	3	4	5
3. The Khuma Township has adequate Water Reservoirs to supply the entire community.	1	2	3	4	5
4. The maintenance and cleansing of water reservoirs around Khuma is undertaken regularly.	1	2	3	4	5
5. The public is informed in advance by the Matlosana Local Municipality during anticipated interruption in the supply of water. .	1	2	3	4	5
6. The public is actively involved in matters relating to water management such as prevention of pollution.	1	2	3	4	5
7. Public service delivery such as education and health services are affected by inadequate supply of potable water.	1	2	3	4	5
8. Residents of Khuma Township are vulnerable to water related diseases due to frequent water cuts.	1	2	3	4	5
9. The supply of potable water in Khuma Township is in line with the population growth.	1	2	3	4	5
10. Matlosana Local Municipality is actively involved in the management of the resources of potable water in Khuma Township	1	2	3	4	5
11. Public-Private-Partnerships play an active role in the management of potable water in Khuma Township.	1	2	3	4	5
12. An Integrated Water Resource Management (IWRM) approach is necessary for effective management of potable water in Khuma.	1	2	3	4	5
13. The public is always made aware of the necessity of preserving water.	1	2	3	4	5
14. Potable water supply in the Matlosana Local Municipality is at risk of pollution by	1	2	3	4	5

mining activities.					
15.The underground lying dolomite rock in the area poses threats to the quality of water and lives of the people of Khuma Township.	1	2	3	4	5
16.Midvaal Water Company is committed to the provision of high quality potable water in the Matlosana Local Municipal area.	1	2	3	4	5

ANNEXURE D

INTERVIEW SCHEDULE: ROLE-PLAYERS (OFFICIALS) IN POTABLE WATER SUPPLY IN THE MATLOSANA LOCAL MUNICIPALITY

Research is currently being conducted to evaluate the management of potable water in Khuma Township (Matlosana Local Municipality). As one of the role-players/officials in the management of potable water in Khuma Township, you are kindly requested to complete the following questionnaire.

Your contribution to this study could assist in improving water service delivery by the Matlosana Local Municipality in Khuma Township.

Any enquiry can be directed to Kagisho Simon Monnahela.

Cell : 079 160 8479

Email : ksmonnahela@yahoo.com

SECTION A: PERSONAL DETAILS OF RESPONDENT

Full names.....

Date of interview/questionnaire.....

Department.....

Division.....

Section.....

Designation.....

SECTION B

2.1 Does your municipality have a water resource management strategy?

.....

2.2 Kindly rate the water resource management strategy of your municipality?

Not successful	Successful to some degree	Very successful
1	2	3

2.3 Does The Matlosana Local Municipality have a water committee? If so who are members of the committee?.....

(Members).....

.....

.....

.....

.....

2.4 In your opinion, do you think the Matlosana Local Municipality involves the residents of Khuma Township in the management of potable water supply?.....

.....

.....

.....

2.5 Do the residents of Khuma Township participate in the activities which involve the management of potable water supply such as (prevention of water pollution and preserving water)?.....

2.6 How do you rate the participation of Khuma Township residents in the management activities of potable water in their area?

Do not participate	Do not know	Fully participate
1	2	3

2.7 How do you rate the participation of the culture of service (water) payments by the residents of Khuma Township?

Do not participate	Do not know	Fully participate
1	2	3

2.8 The Matlosana Local Municipality has provided Khuma Township with adequate water reservoir to supply the entire community with water at all times.

.....

2.9 How do you rate the supply of potable water to Khuma Township compared to other residential areas in the Matlosana Local Municipality?

Poor	Good	Excellent
1	2	3

2.10 What is the level of poverty or unemployment in Khuma Township?.....

2.11 Does this level of poverty or unemployment in Khuma Township affect service delivery to the community? If so, explain how?

.....

2.12 What is the role of Dr Kenneth Kaunda District Municipality in the management of potable water supply in Khuma Township?.....

2.13 How do you rate the role and participation of Dr Kenneth Kaunda District Municipality in the management of potable water supply in Khuma Township?

Poor	Good	Excellent
1	2	3

2.12 Does the Matlosana Local Municipality know that the entire Khuma Township is located on Dolomite rock?.....

2.13 Does the Matlosana Local Municipality know about the dangers and risks that the residents of Khuma Township are exposed to due to the underlying Dolomite rock?

2.14 If so, why are new areas such as extension 6, 9 and 10, being developed for settlement on One-Year-Flood lines?