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Evaluation of Disaster Risk Management in Flood Prone Areas: A Case Study of Bramfischerville

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0600124N

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

Johannesburg, 2017

DEDICATION

To the late Dr. Krisno Nimpuno

DECLARATION

I, Nhlanhla Mkhulisa declare that this Research Report is my own unaided work. It is being submitted for the Degree of Master of Science in Development Planning at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

_____

(Signature of candidate)

_____day of _____ 20 _____ in _____

Abstract

Throughout the 21st century, floods have caused major disasters in urban areas worldwide and especially in Africa. Several factors influence the ability of government to manage flood disasters through the phases of, preparedness, mitigation, response and recovery at a local level. The vulnerability of poor communities to flood disasters exacerbates the impact of the flooding on their livelihoods. The inability of governments to communicate effectively with communities about preparedness strategies for flood mitigation has resulted in much damage in urban areas. The study used semi-structured interviews with Disaster Management officials and community members involved in flooding to evaluate the Disaster Risk Management in Bramfischerville. The fieldwork took place in Bramfischerville that was affected by the 2009 floods. The research revealed that the 2009 Bramfischerville floods were caused by heavy rains, the building of RDP housing on a floodplain and ineffective implementation of Disaster Management strategies by the CoJ. This research argues that in order to understand flood disasters, cooperation between all stakeholders involved in Disaster Management is vital in knowledge accumulation. The 2009 floods had negatively impacted the livelihoods of people in Bramfischerville. Their houses were damaged and they had difficulty traveling to work and school. In this view, the costs associated with floods are continuously being a debt for the people living in Bramfischerville. This research found that the disjuncture between the community and the City of Johannesburg (CoJ) officials exacerbates the negative impacts floods have on people's livelihoods in Bramfischerville.

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List of acronyms used in the study

CBO	Community Based Organizations
CDMP	Corporate Disaster Management Plan
CM	Crisis Management
CoJ	City of Johannesburg
CPO	Community Post Office
CRED	Centre for Research on the Epidemiology of Disasters
DM	Disaster Management
ECPC	Emergency Coordination and Planning Committee
EM- DAT	Emergency Events Database
EMS	Emergency Management Services
GIS	Geographical Information Systems
HMD	Hydro-Meteorological Disasters
IDP	Integrated Development Plan
IT	Information Technology
KPA	Key Performance Areas
LUM	Land Use Management
MDG	Municipal Disaster Grant
NDMC	National Disaster Management Centre
NDMF	National Disaster Management Framework
NGO	Non-Government Organizations

PDG	Provincial Disaster Grant
RDP	Reconstruction and Development Programme
RM	Risk Management
SALGA	South African Local Government Association
SAPS	South African Police Services
SAWS	South African Weather Services
SMS	Short Message Services
UN	United Nations
WHO	World Health Organization

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Chapter 1 Introduction to Disaster Management

1.1 Overview-setting the Scene

"*Floods play a predominant role among all disastrous natural occurrences. They have affected us in the past, they are a part of our present, and they will continue to occur in the future*" (Majewski, 2005:30).

In recent years, flooding has severely impacted on the lives of people throughout the world. Floods can have a devastating impact on people and property (Sene, 2008). Joakim (2011) claims that history likened hazardous events as acts of God. The victims of hazardous events were seen as passive observers who had no influence or ability to counteract the damages caused by the hazards. Lumbrosso *et al*. (2016) argue that low-income countries are more vulnerable to natural hazard risks as compared to higher income countries. Higher income countries have developed better response and post disaster strategies as compared to low–income countries thus making them less vulnerable to natural hazards (*ibid.*).

The approach that has been used by disaster management in the event of a flood in many countries around the world has been reactive, in that both the government and the community only acted after the flood event (Tingsanchali, 2012). In this sense, more proactive approaches are needed in order to minimize the effects of floods on people (Price & Jovinovic, 2008; Bosher *et al.*, 2009). The strength of proactive measures is on their ability to prepare people to stay alert and equip them with the necessary skills to protect themselves during the flood event. Therefore, an emphasis on basing disaster management on proactive measures is favourable due to their preventative nature as opposed to reactive measures that are more curative in nature. Furthermore, flood forecasting, preparedness, and mitigation are the aspects of flood disasters that need further attention and implementation, especially in poor countries (du Plessis, 2002). This is merely because the effective implementation of these aspects of flood disasters could assist in better managing their impacts in the future.

1.1.1 Floods

Floods destroy households, people and livestock globally (Few, 2003). In this context, people are often relocated elsewhere (Douglas *et al., 2008)*. Therefore,

businesses are negatively affected by floods because people's movements are restricted during flooding events and transportation of goods to an area is negatively affected (Sene, 2008). In the United States, floods continue to be a threat to the well-being of people and their property (Brody *et al*., 2009). In 2010, Pakistan was hit by flooding that resulted in 1980 people dying, 1.7 million homes damaged and 2.2 million hectares of crops destroyed (Malik, 2011). Floods are caused by human vulnerability, poor development planning and climate variability (Alam *et al*., 2008). In this sense, the settlement of people in flood prone areas makes them more susceptible to flooding (Price & Jovinovic, 2008). The motive behind people's poor settlement is influenced by unorganised and informal settlement issues in South Africa. People's plans and livelihoods are furthermore impeded after these disasters. Few (2003) expounds that research is gravitating towards local scale in dealing with floods. The role that is played by the local communities in flood disasters is of interest in research. The local people are mostly affected and should be at the forefront in dealing with floods.

Douglas *et al*. (2008) note that most African countries are vulnerable to flooding as a result of the occupation of floodplains. In these situations the poor are often the most vulnerable group. West Africa has also been widely affected by floods. Karley (2008) writes that people died in Ghana in 1999 due to floods, with Accra being most affected. Navesse (2004) expounds on Maputo's 2000 floods as a case in point where the city's infrastructure was devastated. The vulnerability of Lake Victoria to flooding threatens people in Kenya, Uganda, and Tanzania (Li *et al*., 2009). In 2002, 60 000 Kenyan people were displaced from their places due to flooding (*ibid*.). One of the impacts of the 1997-1998 El Niño floods in Kenya, was that a high dropout rate of learners from school occurred (Gadain *et al*., 2006). Therefore, flooding affects education, an important asset to any nation; any disturbance to it should be mitigated as a matter of great urgency.

South Africa also experiences floods in many areas. In Gauteng province it is the heavy rainfall that occurs frequently that is responsible for flooding (Dyson, 2009). Mayson *et al*. (1999:255) found that 'there was an increase in the intensity of rainfall in South Africa between 1931-1960 and 1961-1990'. Furthermore, in 2000

heavy rainfall caused floods in the north-eastern parts of South Africa. Economically and socially these floods had an adverse effect (Dyson & van Heerden, 2001). Areas affected in South Africa were the Limpopo, Crocodile and Sabie rivers in Mpumalanga (*ibid*.). du Plessis (2002) notes that the cost of the flood that struck South Africa in February 2000 was estimated around 300 million rands. In 2009, heavy flooding affected areas such as Mofolo, Meadowlands, Dube, Mmesi Park and Bramfischerville in the south of Johannesburg (City of Johannesburg, 2009). Bramfischerville will be used as a case study for the purposes of this research study.

1.2 Background

Bramfischerville is located in the southern part of the city of Johannesburg. According to Moola, *et al*. (2011) Bramfischerville Township was established around 1996. The study focuses on phase one (Bramfischerville proper) precinct, because the houses around that particular area were built on a floodplain (City of Johannesburg, 2009). The area is deficient in requisite amenities and infrastructure due to its peripheral nature (Figure 1 provides locality details). This statement means that this area is situated further from the City of Johannesburg and its infrastructure.

This precinct comprises of state subsidised housing containing an average of 4-5 people per dwelling with dwelling sizes an average being $34\ m^2$ (Mathee *et al*., 2009). Some people from the area were relocated from Alexandra township because of flooding of the Jukskei River. Following the 2009 floods in the area, it was reported that houses in Bramfischerville were derelict with cracked walls, leaking roof tops and water pipes (Sowetan, 2009). According to the City of Johannesburg, (2009) this rainfall affected infrastructure and housing development. As a result, the Red Cross supplied the populace with food and blankets as a relief mechanism. Considering Bramfischerville's status as a poor and particularly vulnerable small township prone to natural disaster, it is timely to assess the work done by the City of Johannesburg in managing the risks associated with flooding in the community.

1.3 Problem Statement

The importance of managing the impact of floods on communities in South Africa has long been realized (du Plessis, 2002). The role played by communities in disaster management has not been adequately explained in previous disasters (*ibid*.). Communities largely remain passive stakeholders, mostly uninformed about possible measures to undertake before and after a disaster (Hossain, 2013). This is notwithstanding that communities are an important stakeholder in both proactive and reactive scenarios in order for disaster reduction measures to be successful (Bayek, Marsuda, and Okada, 2008). The significance of this statement points to the need for communities to be vigilant so that they can minimize the impact of their vulnerabilities (*ibid.).* In this sense, communities can be empowered by being provided with knowledge and information to deal with foreseeable hazards (Pandey & Okazaki, 2005). As argued by Collins (2009), most research about disasters has focused on computer predictive models and more research is needed in integrating physical and social research. Moreover, the extent of vulnerability of communities to disasters should be noted so as to ensure that the community is ready to deal with the effects of disasters.

As alluded to earlier in this report, flood disaster management in developing countries remains reactive rather than being proactive (Tingsanchali, 2012). The statement explains that Disaster Management focus is based on relief and recovery after the floods while the preparation and mitigation plans and strategies have received less attention. In the case of Bramfischerville, CoJ Disaster Management reacted through aid (food and shelter) after the flood disaster. There is no clarity in terms of the preparedness and mitigation measures taken in Bramfischerville before the flood of 2009.

1.4 Rationale for the Study

The aim is to bridge a gap that exists between policy-making and policy implementation in disaster management. According to the City of Johannesburg Corporate Disaster Management Plan (2003), measures are in place to deal with disasters. However, the role of the community on those measures is not clearly defined. Therefore, this study intends to contribute to the rich context of knowledge

production of disaster management as well as community participation in South Africa today. In that sense, the findings in this research seeks to guide community and government officials' partnership in a bid to espouse the ethos of effective disaster management. Furthermore, the researcher makes recommendations elaborating how the community and municipal officials can work together to minimize the mentioned impacts. The importance of the study is even more urgent in light of the many flood disasters affecting Bramfischerville (Osti, 2004).

1.5 Research objectives

The main objectives that the research aims to achieve are the following:

1. To describe issues of urban flooding and find out appropriate ways of dealing with them.

2. To describe flood events of 2009 that occurred in Bramfischerville.

3. To assess the actions of the City of Johannesburg disaster management officials during and after the disaster.

4. To identify in case that there were policy documents regarding disaster management and if so, evaluate if the stipulated procedure was taken in their implementation during after the flood event.

5. To provide guidance to the community of Bramfischerville to establish how to effectively incorporate risk assessment into the process of urban strategy formulation in their area.

1.6 Research Questions

What is the role of community participation in Disaster Management in conjunction with the actions by the CoJ in the flood prone area of Bramfischerville?

1.6.1Subsidiary Questions

- What was the state of disaster management in Bramfischerville before, during and after the floods of 2009?
- How did the disaster management officials handle the flood disaster of 2009?

- Were there policy documents informing Disaster Management applicable to Bramfischerville? If such policies existed, were they followed accurately and precisely while dealing with the disaster?
- How does flooding affect the living conditions of people in Bramfischerville, and what are the future implications thereof?
- What was the role of community participation in Bramfischerville disaster management before, during and after the disaster?

1.7 Significance / rationale of study

The reason for choosing Bramfischerville is that it highlights the issues of flood and disaster management in the South African context. The area as a case study offers a better understanding of a flood-prone area because the area flooded again several times after 2009 (City of Johannesburg, 2011). People are located in a floodplain in the area. Bramfischerville was declared a disaster area by Mayor Amos Masondo after the 2009 floods (City of Johannesburg, 2009). Also, the area has been victim to floods for a couple of years since it came into existence. Therefore, the 2009 floods were chosen for research purposes specifically because of the magnitude of damage they caused to property and people's livelihoods. Furthermore, the researcher seeks to offer guidance to the community and the municipal officials in better ways of managing floods.

1.8 Research Methods

This study adopted the qualitative approach in evaluating disaster risk management in previous flood experience in Bramfischerville. Bell (1987) argues that in qualitative approach researchers are more concerned with individual insight than statistical analysis of information. Bryman (2004:20) argues that ‘qualitative research can be construed as the research strategy that usually emphasizes words rather than quantification in the collection and analysis of data’. The reason for choosing a qualitative approach is that the qualitative approach better serves the interests of social groups to interpret their social world (Bryman, 2004). That is achieved through the qualitative approach concern of interpreting the meanings that people bring to their own actions and specific focus on a study area (Payne & Payne,

2004). This study investigated the role of community participation in disaster management of floods.

Maxwell (2009) argues that qualitative researchers typically study a small number of individuals or situations. This tendency of utilising small numbers allows the qualitative researchers to explore data and extract ideas form it (Payne & Payne, 2004).

This research focused on the specific manner in which disaster risk management officials and relevant stakeholders dealt with the flood events of 2009 in Bramfischerville. Maxwell (2009) emphasizes that in a qualitative study the interest is in the manner in which participants make sense of the physical events that take place and the way their understanding influences their behaviour. In the Bramfischerville study, the focus was on how people understand the issue of floods and the manner that it influences their behaviour during and after flood events.

Firstly, this study required information about the Bramfischerville floods that occurred in 2009. Secondly, it required details about the community's capacity in handling floods in the area. Finally, it needed records from the CoJ Disaster Management officials about their role in handling the flood impacts in Bramfischerville. In order to obtain the necessary information for this study, this research includes both primary and secondary sources of information. The primary sources of information are original documents or manuscripts that are used in preparing a published or unpublished work (Driscoll, 2011). Whereas, secondary sources of information includes published and unpublished work that relies on primary information (*ibid*.). This research used newspaper articles as its primary source of information, while it used articles analysed in journals as secondary sources.

Newspapers are important in providing information in an open and transparent manner that relates to events that happened. For this research, important sources of information are the newspapers that captured the story of the 2009 floods in Bramfischerville. Policy documents are important also because they give direction in the way that government is handling the situation. The relevant Act for this

research is the Disaster Management Act 57 of 2002. While, the applicable policies for this research are the National Disaster Management Framework (NDMF) and the CoJ's Disaster Management Plan. In this sense, the role of the National Disaster Management Framework is to provide an inclusive policy on Disaster Management that is appropriate to South Africa (NDMF, 2005). This means the NDMF informs the development of provincial and municipal Disaster Management Frameworks and policies. Whereas, the role of the CoJ's Disaster Management Plan is to develop mitigation measures and deal with potential impact of disasters that affect the city (CoJ IDP, 2012-2016).

1.8.1 Data collection, analysis procedures, and instrumentation

Purposive sampling was used for the research study, targeting only the people that were directly involved in the 2009 floods of Bramfischerville. The people that experienced the floods are relevant to the study because they have information that is specifically required by the study. However, participants were selected based on their location, only people that stay in the Bramfischerville phase 1 were selected. The main reason for choosing Bramfischerville phase 1 is that it was the most affected section by the floods as compared to other sections in the area. In addition, participants were asked whether they have stayed in Bramfischerville for 10 years or more. The significance of the question was to ensure that the participants were already staying in Bramfischerville in 2009 during the flooding. In case the residents have not stayed in the area for 10 years, they were not considered for participation in the study.

In terms of interview type the research used a semi-structured interview. In this sense, the questions are open ended and answers can be probed by the interviewer for clarity on items if needed (Payne & Payne, 2004). Data was collected using face to face interviews with residents of Bramfischerville. Nevertheless, the selection only included residents that were affected by floods in the community on the basis of their willingness to participate in the study. However, before any interview people were required to explain whether they were affected by the floods or not. The interview is the appropriate data collection method for this study because it provides detailed information from a few specific people (Driscoll, 2011). Around

11 households were interviewed. This is because it is easier to analyse information from fewer households in greater detail as compared to a larger number of households (Payne & Payne, 2004). The community of Bramfischerville that was interviewed is of mixed ages as well as academic abilities. Greyling and Mears (2014) conducted a study on the demographics of Soweto between 1993 and 2008 and found that the area is characterised by different age groups ranging from 0 to 71 years old. A noticeable trend from 1993-2008 is that the population from 16 to 30 years has increased as compared to the older population of 51 to above 71 years old in Soweto (*ibid*.). Furthermore, voice recordings were used to capture additional comments of the residents.

Data was analysed by reading the interview transcripts or any other document to be analysed, (Maxwell, 2005). Therefore, the researcher utilized the interviews from the data to corroborate with the findings of related research to identify similarities and differences. The researcher developed ideas about categories and relationships while reading notes made during the interviews. In addition, the researcher listened to interview tapes prior to transcribing. Only the passages that are perceived to be related to the key research issues were summarized.

Evidence of flooding in the households is based on images that were taken during the flooding period of 2009 in the particular area and information from newspaper articles and the City of Johannesburg website. Moreover, municipal officials who dealt with disaster management during the disaster period were interviewed to find out their views related to possible solutions regarding flood disasters in urban areas. It is appropriate to seek information from the officials since they work with information relevant to the study question. Municipal officials are involved in compiling the disaster management plans and organize community participation gatherings. The director of disaster management is appropriate to interview because he occupies a higher position than all disaster management officials in the municipality. In addition, he is at the helm of the decision making body regarding disaster management in the municipality. The other important stakeholder in this flood disaster issue is the ward councillor who is a mediator between community and government, although not necessarily neutral is an appropriate person to

interview to find out the extent and various strategies that have been used to enhance participation. Moreover, interviewing the ward councillor ensured that the status quo of the area is understood and appropriate recommendations are given in the report of this research.

1.8.2 Single case study

For the purview of the study, the focus was on Bramfischerville phase 1 instead of the whole township. This research used a single case study method. The surrounding areas are (Dobsonville, Meadowlands, and Snakepark) that consist of similar challenges of demographics that Bramfischerville is experiencing. These townships also experienced floods in the year 2009, and the community's property was damaged resulting in loss of assets. The above areas did not continually experience flooding damages post 2009 as compared to Bramfischerville, which has been vulnerable to flooding (CoJ, 2011).

Feagin *et al*. (1991) quoted in Djuric, Nikolic and Vukovic (2010) argue that a case study is an ideal method when an in-depth investigation is needed. Djuric *et al*. (2010:175) explain that 'case studies are designed to bring about details from the viewpoints of participants by using simple sources of data'. They further emphasize the point that case study research is not a sampling research. Instead, a case study should be used to deepen the understanding of processes already accepted in the particular discipline as significant. This research used a case study for a representative purpose of a community having flooding vulnerability in the South African context.

Yin (1994) explains the importance of the inspection of the research question in differentiating among various research strategies. Yin also argues that case studies are a preferred strategy when the how and why questions are being posed in the research. This is particularly relevant to this study because it asks the question of 'how can the community and the CoJ officials together participate in disaster management?' Furthermore, 'the how and why questions favour case studies because they deal with operational links needed to be traced over time' (Yin, 1994:6). Yin (1994:8) furthermore argues that 'another important condition for choosing a research strategy has to do with the extent to which the investigator has

control of actual behavioural events'. Case studies, in particular, are preferred in examining present-day events, but when the relevant behaviours cannot be manipulated (*ibid*.).

According to Yin (1994) case studies cannot only be the exploratory strategy but can also be descriptive and explanatory. This research chose an explanatory or narrative case study because it tells a story about the issue of flooding in Bramfischerville. This research discusses the people involved in flooding, and the time and place the flooding occurred (Rule & Vaughn, 2011). Bell (1987) says that a case study approach allows a researcher to concentrate on a specific instance. For this research, a case study is useful because the focus is on a particular area with a specific challenge of floods and community participation. This research uses an explanatory case study method. The reason a case study is a favourable strategy for this research is that it seeks to explain community participation in disaster management. This research was concerned with also exploring and analysing the actions of the CoJ disaster management officials in dealing with the 2009 floods in Bramfischerville.

Yin (1994) asserts that the significance of case studies is to understand complex social phenomena. Djuric *et al*. (2010) offer a comparison of case studies and other methods and explain that case studies are more than a technique for conducting research they can be also a strategy for selecting a topic. In addition, Djuric *et al*. (2010:183) describe the main focus of case studies as describing, understanding, predicting and controlling the individual. Yin (1994:8) says that the appropriate research techniques for case study strategy include direct observation and systematic interviewing.

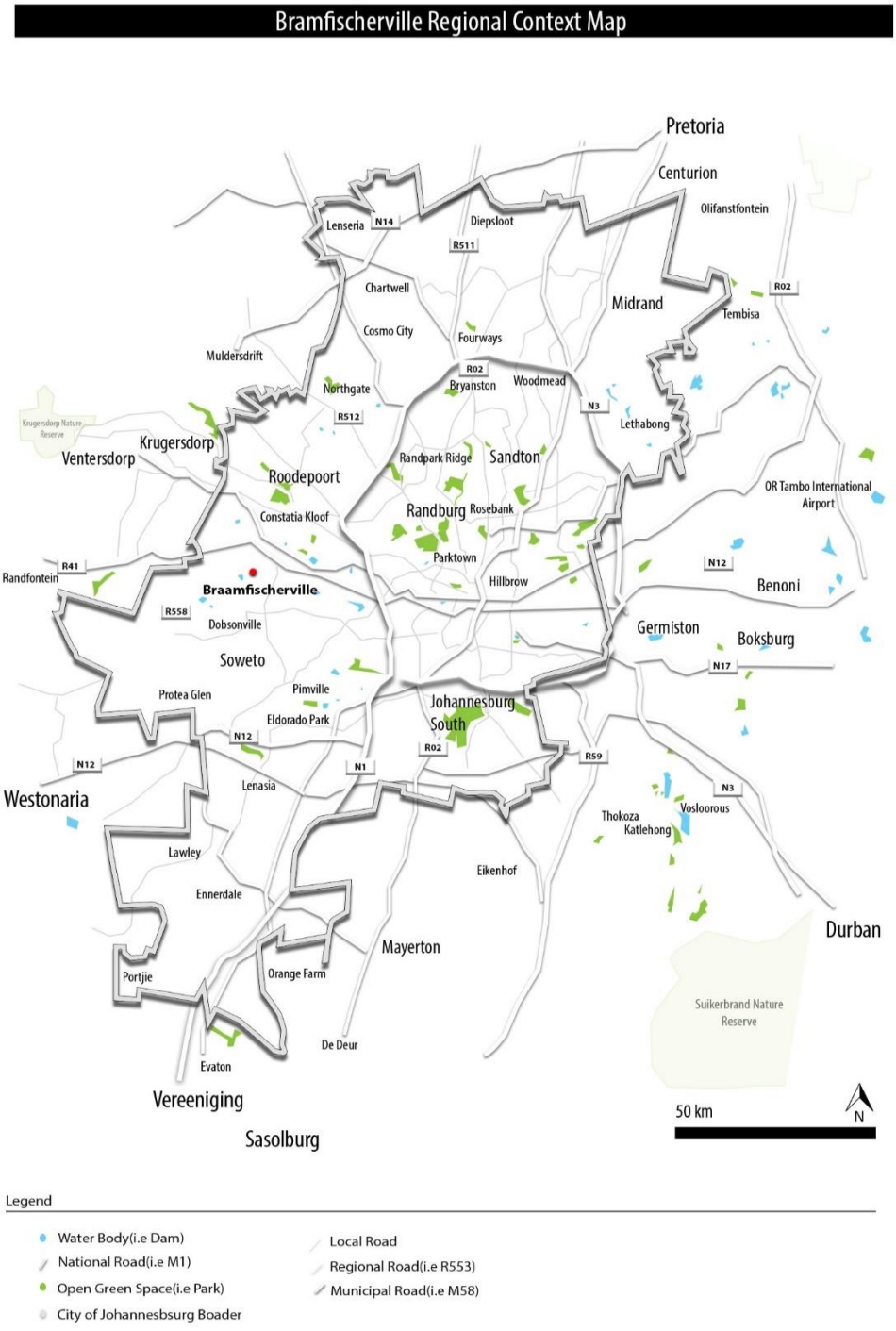


Figure1: Map of Bramfischerville in the context of Gauteng Province
Source: N. Mkhulisa, 2017

The above map illustrates the location of Bramfischerville to other areas in the context of Gauteng province, South Africa.

1.8.3 Ethical considerations

The researcher ensured that the research follows all requirements for the University of the Witwatersrand ethical standards. The researcher ensured that the standards of writing the research (i.e. research report structure and research methods) are not compromised, by attending academic workshops organized by the university. A pilot project was conducted to ensure that the community members of Bramfischerville understand the intentions of the study well.

During data collection, the consent form was signed by the participants to give them assurance that their rights will not be violated in the process. The participant information sheet provides the participant with information regarding the purpose of the research and it explains the participant's role in the research.

Participation in the study was voluntarily and individuals had the right to ask questions whenever they seek clarity on some questions. The participants were told that the interview can stop at any time if they were unable or unwilling to continue answering questions. Should the individuals seek the report after completion it can be made accessible to the individual concerned. In cases where the participant discloses confidential information, it is the responsibility of the researcher to protect such information for the participant (Creswell, 2003). Pseudonyms were used in place of the individual real names in order to ensure anonymity in research.

The study did not subject participants to any psychological abuse and legal jeopardy. The researcher did not exploit research participants for any personal gain. Information from the research won't be released in a way that links specific individuals to specific responses to ensure confidentiality of the participants (Neuman, 2006). The researcher protected the participants' information from public disclosure in order to protect their privacy (Neuman, 2006). The researcher made interpretation of the results to be consistent with the data to ensure accuracy.

1.8.4 Limitations of the Study

Firstly the research does not provide findings that generalize the situation for all townships in South Africa. Secondly, the selected township has its specific context; therefore it provides research findings based on its situation. Lastly, the time and

scope of the research do not allow the researcher to dwell in the process for longer in order to make adequate comparisons with other research.

1.9 Outline of chapters

This research has been structured into five chapters. Chapter One is the introduction and background of the study and it also establishes the research problem and rationale. The research methods and design are presented in chapter one. Chapter Two provides a review of the literature. The review of literature is dedicated to understanding the physical context of floods and the community context of local knowledge in flood management. It outlines the conceptual framework for the research exploring flood vulnerability of the community and provides advice on coping capacity strategies. Chapter Three gives a description of the study area and discusses the issue of flooding in Bramfischerville. Chapter Four constitute the presentation of findings and analysis. The results are discussed in order to evaluate the work done by the Disaster Management of the CoJ. Chapter Five is the conclusion and it also identifies knowledge gaps and recommendations for further research.

Chapter 2: Literature Review

2.1 Introduction

This chapter reviews relevant literature on disaster management and urban flooding. It first describes the key concepts and then assesses their contribution to the understanding of flood vulnerability.

Ward (1978) denotes flooding as a body of water which rises to overflow the land. Chow (1956) conceptualized flooding as a relatively high flow, which overflows the natural channel, provided for the runoff. Every year floods cause enormous damage all over the world. Statistics indicate that floods have a large impact on human well-being on a global scale (Jonkman, 2005). Consequently, they have a potential to lead to economic damage and disturbance to eco-systems, historical and cultural values (Jonkman, 2005). Indirectly floods can cause the loss of economic production and a decrease of socio-economic welfare. More directly, floods can lead to degradation of human health and loss of life. According to the International Disaster Database, the twentieth century saw the death of about 1000, 000 people due to floods (IFRC, 2010). Developing countries seem to be more affected by floods than the already industrialized ones (*ibid*.). Data from the World Disaster Report in 2010 suggest that the Asian region, as well as the Central and Southern African regions, has proved to be the most affected (*ibid*.). For instance, cyclones continue to cause flooding in countries such as India, Bangladesh, and other South Asian regions. Floods caused tens of thousands of people to leave their homes in Rwanda, Kenya, Burundi, Tanzania and Uganda in 2002 (BBC News, 2002).

Recently the effects associated with global warming and Climate Change has increased the frequency and the extent of flooding (Mirza, 2002). Furthermore, global population growth, more intensive urbanization in flood prone areas and the limited development of sustainable flood-control strategies have increased the impacts of floods (Swan, 2010). Climate Change and urbanization continue to increase the vulnerability of the urban poor, particularly in Africa. The urban poor often cannot afford homes in the well located land but also habitable land is limited in urban areas due to increasing populations. As a result, many people have opted to build their dwellings on flood plains in cities and towns (Mendel, 2006).

Moreover, poorer people tend to be marginalized socially, politically, geographically and may often not receive early warnings about hazards. However, poor people should not intentionally locate themselves in flood prone areas and accuse government of neglecting them.

2.1.1 The international disaster database

Since 1988, the World Health Organisation (WHO) collaborating with the Centre for Research on the Epidemiology of Disasters (CRED) has been maintaining an Emergency Events Database (EM-DAT).CRED aims to enhance the effectiveness of developing countries' disaster management capabilities as well as fostering policy-oriented research. Therefore, the EM-DAT database is one of CRED's initiatives which should contribute towards realizing the objective of improved disaster management internationally. Compiled from various sources, including United Nations (UN) agencies, Non-Governmental Organizations (NGO), insurance companies, research institutes and press agencies, the database is to serve humanitarian action at national and international level. It is an initiative that aims to rationalize decision-making for disaster preparedness, as well as providing an objective base for vulnerability assessment and priority setting (Jonkman, 2005).

Nonetheless, of all natural disasters, floods are considered to be the most hazardous, frequent, costly and wide reaching throughout the world (Dar and Nadargi, 2002). They are responsible for up to 50 000 deaths and adversely affect some 75 million people on average worldwide every year (Nott, 2006). The flood in Pakistan city of Rawalpindi damaged people's property and disturbed some people's livelihoods by hindering their business establishments (Mustafa, 2003). In China, floods are a common hazard and a huge number of people have been affected (Wong & Zhao, 2001).

However, floods are caused by several factors either natural or man-made. One of the important factors is ponding, a situation in which stagnant water collects on plots of land during heavy rainfall. Rainfall is considered an integral part of describing flooding. The type of flood, which this report is concerned with, is flash flooding specific to urban areas.

The impacts of floods are exacerbated by the urbanization in floodplains and lack of sustainable flood control strategies (Jonkman, 2005). Furthermore, the unique characteristics of the area such as land use, population density, and emergency systems influence the loss of life caused by a flood in that area (*ibid*.). If people ignore the Land Use Management (LUM) of their municipality, and build in flood prone areas, the likeliness of them experiencing flooding increases. Flash floods are the deadliest of all floods. Jonkman (2005) concludes that many people across the world die of floods and mitigating policy is essential.

2.2 Conceptual Framework

Maxwell (2009) describes a conceptual framework as a model or conception of what a researcher plans to study. A relevant conceptual framework for this study is the United Nations International Strategy for Disaster Reduction (UNISDR). It addresses the relevant concepts that are used in Disaster Management. This framework is mainly about vulnerability as a major factor in determining risk (Birkmann, 2006). Vulnerability refers to the characteristics of a community that make it susceptible to damaging effects of hazards (UNISDR, 2009:30).

Figure 2 below shows a diagram representing various concepts significant to the study. It also illustrates the interconnectedness of the concepts through the use of arrows.

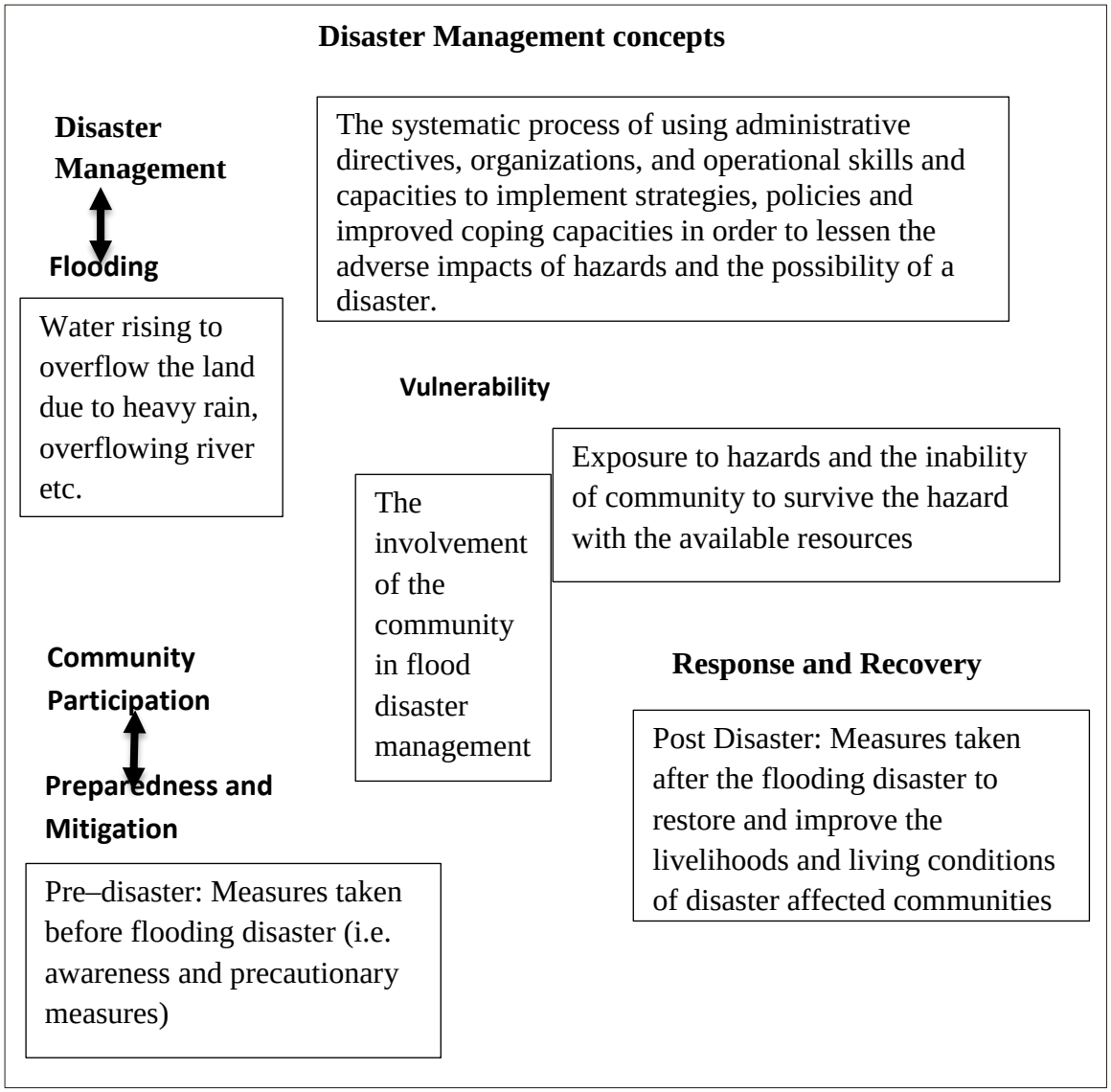


Figure 2: Conceptual Framework Diagram

Figure 2 above provides the disaster management conceptual framework diagram. This diagram shows the existing connections between concepts that are used in this research.

In this context community participation refers to processes of community involvement and the community managed processes. In this sense, the community involvement is about the recognition of the importance of the affected people's opinions in Disaster Management activities. Whereas the community managed processes refers to the skills and knowledge that the community needs so that they can deal with flood impacts with their available resources (UNISDR, 2009). It is

important for the community to build partnership with the Disaster Management officials as a way of reducing risk (Wisner *et al*., 2014:21). This partnership can be enhanced by the CoJ in this context to offer training as a means of capacitating the community with flood preparedness skills. The significance of the community gaining these skills because their goal is to assist in anticipation of floods in this case and better respond and recover from these disasters (UNISDR, 2009).

This framework explains the concepts of disaster management and their intention in disaster risk reduction. Disaster Management aims to avoid or lessen the effects of hazards through activities and measures for prevention, mitigation and preparedness (UNISDR, 2009:10). Disaster Management is different from emergencies in the sense that it focuses on both preparation and response while emergencies only focus on response. While the aspect of vulnerability that the conceptual framework explains is the lack of public information and awareness in dealing with flood disasters (UNISDR, 2009). This lack of information needs to be understood and addressed by all affected stakeholders. However vulnerability is increased by the settlement of people in areas prone to disasters (Vasilescu *et al*., 2009).

Furthermore, the preparedness and mitigation concepts are about the knowledge and capacities that are developed by communities in this case to anticipate, respond and recover from flood hazards (UNISDR, 2009). The capacitation and the use of information is an important step in disaster mitigation because people can be able to manage the floods their own.

Disaster Management Cycle

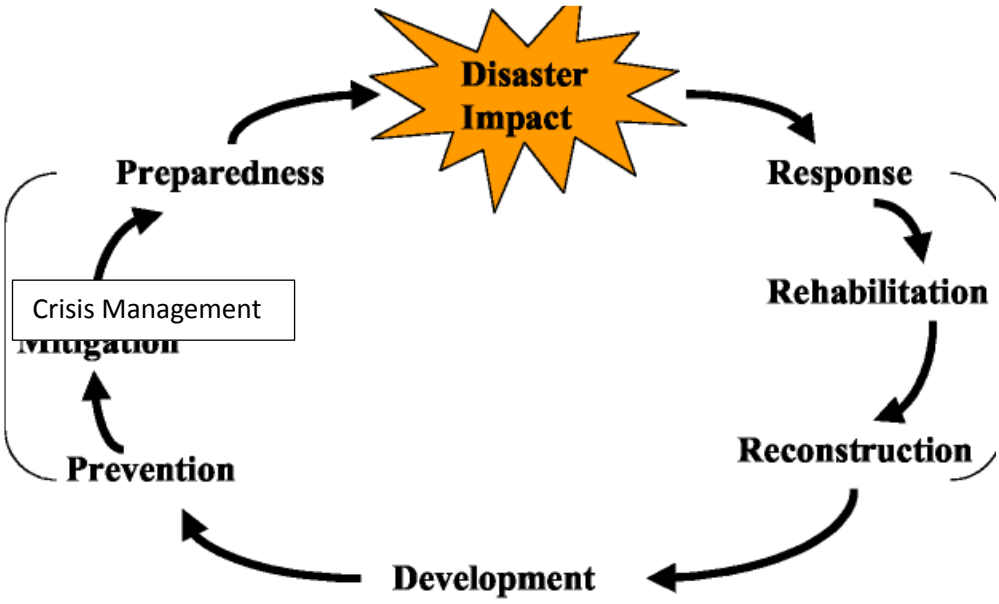


Figure3: Disaster Management Cycle Adapted from Vasilescu *et al*. (2008)

Figure 3 above is the Disaster Management cycle and it explains the processes involved in dealing with disasters.

The Disaster Management cycle includes all the measures that can be taken before and after a disaster in order to minimize its effects. The measures can be separated into risk management and crisis management. Risk management measures include preparedness, mitigation, and prevention. The crisis management measures include response, rehabilitation, and reconstruction. It is useful to use the Disaster Management cycle in understanding the overall work done by CoJ during the floods of 2009 in Bramfischerville. The cycle explains the interconnectedness of all the measures and activities that are taken in disasters. The Disaster Management cycle in this context is addressing the flood disasters through its stages.

In terms of the stages of the disaster management cycle, development has an impact on the people's vulnerability to disasters due to its technological advancement that detach people from nature (Vasilescu *et al*., 2008). Therefore disaster management pre stages of the Risk Management are a prerequisite for minimising the disaster

impacts as explained in detail on Figure 2. Nonetheless the Crisis Management stage has three concepts as shown in Figure 3. Disaster response is about the immediate intervention that takes place after the hazard had struck. That can include the services of the Emergency Management Services (EMS). The rehabilitation concept is about the restoration of the affected basic services and functions. In addition the reconstruction concept refers to the full resumption of services after the hazard.

A disaster results from a combination of hazard, vulnerability and insufficient measures to reduce the capacity of the risk (Vasilescu *et al*., 2008). A hazard can only be referred to as a disaster if it affects people's livelihoods (*ibid*.). However the community and the CoJ should be involved in both the Risk Management (RM) stage and the Crisis Management (CM) stage of the disaster management cycle. The importance of the disaster management cycle for this research is that it assists in the understanding of the concepts used in analysing the flood disaster.

2.3 Urban Flooding causes and implications for Risk Management and Crisis Management

Urban flooding may be generated by various factors. 'Supernatural' factors are amongst the factors that contributed to flooding mentioned by the respondents in Nigeria's flooding research (Adelekan, 2009). Primarily, floods are caused by meteorological conditions through weather phenomena and events associated with precipitation (Andjeilkovic, 2001). This is the case when more precipitation and associated run-off is brought into the drainage basin than what can be absorbed or stored within the basin. According to Andjeilkovic (2001), such a condition is likely to occur when a severe thunderstorm or a rainstorm is accompanied by a long-lasting moderate rainfall that saturates the soil.

Floods occur on both urbanized surfaces (streets, parking lots, yards, parks, etc.), and in small urban creeks. Furthermore, improper land use contributes to the exacerbation of floods (Oguntoyinbo and Oguntala, 1982; Chan, 1997; Scu et al, 1998; Lo & Diop, 2000; Campana and Tucci, 2001). Improper land use refers to the neglecting of the legal land use provided by the municipality by the people for their

own illegal use. The same can be said regarding poor storm water infrastructure design or maintenance. Storm water refers to that portion of precipitation that does not naturally percolate into the ground or evaporates but flows via overland flow, pipes and other features of a drainage system into a defined surface water body, or a constructed infiltration facility (Parkinson, 2003). Other factors aggravating flooding include an excessive load of waste due to the blockage of drains and street inlets by silt and garbage and inadequate street cleaning practices (Kolsky and Butler, 2002). Musyoki, Thifhulufhelwi, and Murungweni (2016) claim that flood disaster frequency is growing because of both the environmental and human factors. Human impact on flooding requires relevant authorities to educate people on correct methods of cleaning streets and on handling garbage.

In areas with large dams, flooding can occur if there is a failure of dam walls due to heavy rains. There are other natural triggers of flooding which include tropical cyclones, hurricanes and tidal surges in coastal areas. However, heavy rainfalls remain the most common cause of flooding. The magnitude (determined by the depth and velocity of water), the speed of onset and duration of the flood are influenced by factors such as topography, vegetation and soil storm water channel or river alteration and infiltration rates which are related to land and urbanization.

Urbanization exacerbates flooding by reducing the permeability of ground surfaces and increasing the rates of run-off (Miller, 1997 and Parker, 2000). According to Marcus et al. (1972), urbanization results in population increase in the city, resulting from internal growth and immigration, as well as the spatial expansion of the city. It is essentially intertwined with the development of habitats and associated infrastructure facilities required for economic and social activities necessary for the livelihood of growing population in the area concerned.

Thus, it brings changes in land use with the construction of buildings, roads, parks and other facilities, and increases the supply of water for consumptive use and release of wastewater. The natural hydrological processes that prevail in the area are therefore seriously affected due to urbanization. Urbanization increases impermeable surfaces and thus increasing the speed of drainage collection while reducing the carrying capacity of the land and sometimes overwhelming sewer

systems (Seyoum, 2011). The understanding of causes of urbanisation can assist affected people to deal with the issue and avoid its impacts on flooding. As more areas are converted to urban and suburban areas, the amount of surface area available for water infiltration into the soils decreases. Residential plots, parking lots, buildings, and roadways all decrease the surface area of soil on earth's surface.

Floods have also been worsened in areas where floodplains are constrained by dwellings, concrete, earthworks and other infrastructure (Smith, 2004 & Wisner et al., 2004). An example of the effect of a general lack of space in the CoJ, due to a high rate of urbanization, is the floodplain settlement evident in areas such as Alexandra, Diepsloot, and Bramfischerville (CoJ, 2012-2016). This situation is sometimes exacerbated by deliberate settlement on the floodplain in order to take advantage of government housing initiatives (*ibid*.). Therefore government should be stricter by not allowing illegal occupation of land, especially land not suitable for human habitation. An example from the United States shows that by 1975 more than half of the floodplain land in the USA was developed and urban areas were spreading onto floodplains at the rate of 2% per year (Mossa & McLean, 1997). This example explains that developing floodplain areas can cause people to continuously moving into those spaces in numbers.

With the frequency and variability of flood events changing due to urbanization, coupled with rapid urban population growth and potential climate change, it is expected that the number of people vulnerable to devastating floods will rise (IFRC, 2010). Also, these disasters are inevitable if the weather changes and if the population densities increase in flood plains. An example of this is the Diepsloot and Bramfischerville townships. Inhabitants of these settlements have arrived mostly through relocation and in migration from Zevenfontein and the banks of Jukskei River in Alexandra. The relocation was forced by Gauteng Department of Human Settlements because the Jukskei River floods were very dangerous to the lives of the people in Alexandra (News24, 2001).

The indiscriminate choice for settlement sites by the poor sometimes exposes them to hazards that could be avoided through proper urban planning. One of the main response measures towards flood management has often been relocating the

population to other areas. This trend of relocating people is unlikely to continue since land for housing is limited in South Africa. The limited land is faced with development pressures which are changing the natural functionality (Van Huyssteen et al., 2009). The available land in South Africa has its specific uses that are described by the Land Use Management (LUM) of various municipalities across the country. According to Spatial Land Use Management Act (SPLUMA) no 16 of 2013 Section 24(1) a municipality must adopt and approve a single land use scheme for its area within 5 years after the commencement of the Act. Furthermore Section 24(3) of the SPLUMA Act 16 of 2013 argue that the land use scheme may include provisions relating to the use and development of land only to the written consent of the municipality. The land uses can be for agriculture, industrial, and recreation. According to SPLUMA no 16 of 2013 Section 26 (2a) land can only be used for the purposes permitted by the land use scheme.

2.4 Dealing with Floods in CoJ

Floods do not always have a negative impact on their surroundings; in Pakistan, floods had a positive contribution to people. Mustafa (2003:75) reports that 41% of female respondents on the flooding of Islamabad and Rawalpindi cities claim that flooding cleans their cities. The clean up those women were referring to is related to the Lai floodplain in Pakistan (Mustafa, 2003). The flood washed away all the waste people had thrown into the area to dam streams and the sea. Alam *et al*. (2008) emphasize that floods are expected in some parts of the world to provide rich soil, water, and means of transport. The Kenyan fisheries population benefited unduly from the El Niño flood of 1997-1998 due to an increase in fish population in their area (Gadain *et al*., 2006).

In the South African context, Limpopo province is also affected by floods; the 2010-2011 floods damaged around 246 houses of the Thulamela local municipality. According to the Centre for Research on Epidemiology of Disasters (CRED Disaster Database), about 90% of natural disasters in Southern Africa are weather-related. Of these, floods are causing the most damage and result in more human fatalities as compared to any other natural disaster in South Africa. South Africa is said to be experiencing an annual flood risk to which most population remains

highly vulnerable due economic factors (such as employment opportunities and very low-income brackets) and geographic locations (Zuma *et al*., 2012). South Africa has a total population of approximately 52 million inhabitants; most of them are concentrated in urban areas which generally experience rapid population growth (Stats SA, 2011). As such, high population growth rates especially in urban areas place pressure on public services. This means that government needs to offer services to a large number of people with limited resources. Furthermore, overpopulation increases the chances of flood risk due to the inadequate resources to assist during such events. To effectively deal with the flooding problem the national government, provincial government and communities needs to clearly identify all institutions that are directly involved in disaster management and their responsibilities formulated (du Plessis, 2002).

Dyson (2009) studied rainfall events in Gauteng province and found that the rainfall that results to flooding occurs frequently. The heavy rainfall causes damage to infrastructure and loss of lives (*ibid*.). The issue of floods is critical in the province; on the 9th of November 2016; Johannesburg was hit by flash floods. The floods caused mayhem and washed away cars in the M16 road in Johannesburg. Seven people have died in January 2017 at Mpumalanga, Limpopo, and Gauteng because of flash floods (Davies, 2017). A three-year-old child was washed away by the floods in Alexandra and was found dead after several days being searched by the emergency services and police (City News, 2016). The mayor of Johannesburg Herman Mashaba said that "national government should provide short-term housing for people with immediate effect" (*ibid*.).

Measures for tackling the negative impacts of floods have been taken by relevant Disaster Management officials in the CoJ office of Emergency Management Services. This is based on the 2013 Provincial Disaster Management Centre (PDMC) report submitted to the NDMC that showed CoJ as the best city in the implementation of the Disaster Management Act (NDMC, 2013). This is mainly because of the CoJ had a higher number of staff per centre as compared to other cities in Gauteng (NDMC, 2013). As a result, the process of enhancing preparedness including forecasts, warnings, and public awareness has improved and

continues to improve. The ability of forecasts to effectively improve preparedness is important in protecting the population from flooding risks (Grimmond *et al*., 2010). In this sense, it is the timing and warning about the future thunderstorms or heavy rain that enables people to prepare in advance for any disaster (*ibid*.). These improvements are largely based on Information Technology (IT) remote sensing advances (Mcvicar *et al*., 2003). This remote sensing offers the capability to monitor a wide range of landscape biophysical properties whereby flood areas are a part of them (*ibid*.). Therefore creating awareness and ongoing adaptation measures are crucial in informing policies aimed at promoting successful adaptation strategies regarding floods.

2.5 Disaster Management and Development

The idea of integrating disaster prevention and mitigation into development became a part of the mainstream discourse on disaster management since the 1990s (Wisner *et al*., 2003). It is convenient to prepare for a disaster and develop prevention strategies than to deal with its effects (Christoplos *et al*., 2001). Nonetheless, the world community is gradually becoming aware of the need for disaster and emergency plans at many levels. Thus, there is a move away from set piece roles for stakeholders such as the state, NGO's and local institutions in dealing with disasters (*ibid*.). The objective of these plans is to bring hazards under control as far as possible with a complementary role of all stakeholders (*ibid*.). Such plans are guided by legislation and they require the revision, dissemination and exercising on a cyclical basis (Alexander, 2014). These plans are general and could be applicable to all hazards, anticipated (flooding and earthquakes) as well as special events. This statement means that the general plans can be used as a guide to developing hazard specific plans. However, these plans should include chapters that outline specific provisions for each type of hazard.

2.5.1 The South African Disaster Management Legislative Framework

Before 1994, disaster management activities in South Africa were governed by Civil Protection Act (No. 67 of 1977). However, the framework of this Act proved to be deficient and this required additional legislative and organizational efforts for improvement and integration in disaster management (Zuma *et al*., 2010). The first

cohesive policy on disaster management was the 1998 Green Paper on Disaster Management which enshrines a proactive, cooperative and integrated approach to disaster risk management. It also promotes the creation of awareness through the participation of affected and interested stakeholders. Furthermore, the Disaster Management Act (No.57 of 2002) was enacted to clarify the guiding principles and responsibilities. This Act required that a National Disaster Management Framework (NDMF) be developed. The NDMF was subsequently promulgated in 2005. The framework gives explicit prominence to risk and vulnerability assessments and reduction, cooperative governance in meeting disaster management objectives through disaster management plans at national, provincial and municipal level. Furthermore, the framework accentuates the need for consistency across interest groups and gives priority to developmental measures, disaster prevention, and mitigation.

In addition, the South African Weather Service Act (No. 8 of 2001) required that only the South African Weather Service (SAWS) should provide weather and climatic forecasting and warning services over South Africa for the general benefit of the population and benefit of life and property (The Presidency, 2001). In addition, the 2002 Municipal Systems Act and the Disaster management Act requires that disaster risk and vulnerability reduction efforts must be incorporated into ongoing IDP projects, processes and programmes, and structures. IDP plans have to ensure that all disaster risk management activities are aligned with government policy. IDP plans are strategic development plans which should be drawn up every five years, with the consultation of the community. This lays a foundation for incorporation of local knowledge into disaster management. Additionally, the National Building Regulations and Building Standards Act of 1977 and the Town Planning Ordinance Regulation specify the flood lines in land use management (Van Bladeren *et al*., 2007).

The policy does not necessarily translate into practice. Despite a comprehensive disaster management legislative framework in South Africa, problems exist in disaster management at the local level (Zuma *et al*, 2012). Institutional capacity remains fundamentally weak in the country. For example, it was established that

50% of municipalities lacked disaster management structures in 2011 (*ibid*.). Moreover, stakeholder involvement was impossible due to lack of advisory forums. However, the situation may have improved lately in the country to date. According to the department of Cooperative Governance and Traditional Affairs, (2016) there has been an increase in funding from the National Disaster Management Centre associated with institutional capacity from R10 990 in the 2013/2014 years to R41 596 in the 2014/2015 years. In addition, the institutional development programme has an objective of strengthening the relationship between community and local government through the improved citizen engagement mechanisms (Cooperative Governance and Traditional Affairs, 2016).

The Green Paper on Disaster Management emphasizes that its policy should dwell on proactive rather than reactive measures to disasters. Loss of life due to disasters can be prevented through better planning, warning system, control measures and community preparedness (Provincial Affairs and Constitutional Development, 1998). South Africa lacks adequate policies that can integrate existing strategies in achieving sustainable development and risk reduction (*ibid*.). Implementation of the existing policies might be a challenge, particularly ensuring all stakeholder involvement. Improving development planning can effectively reduce disaster losses (*ibid*.). The importance of the statement is that if development planning has been done according to stipulated policy and involves relevant stakeholders disasters severity can be reduced.

The City of Johannesburg's plan for minimisation of disaster risks lies on the enhancement of management's response decisions (CoJ, 2012-2016). However, the White paper (1999) focuses more on preventative measures as compared to relief and recovery in disaster management. Therefore, the Southern African region should collaborate to develop early warning systems to minimize the impact of disasters. Awareness about disasters amongst community members needs to be created in order to ensure that risk is reduced.

2.6 Flood Disasters

The concept of hazard is generally used to refer to the latent danger or an external risk factor of a system or an exposed subject (Cardona, 2004). It denotes a

potentially damaging event, phenomenon or human activity which may cause loss of life or injury, property damage, social and economic disruptions or environmental degradation. Hazards become disasters when the loss exceeds the capacity of the population to resist them. According to section 1 of the Disaster Management Act (57 of 2002:6), 'a disaster is a sudden or progressive, localised or widespread, natural or human induced occurrence which can threaten to cause injury, disease or death (to living things), damage to property, infrastructure or the environment, or disruption to the life of a community'.

2.6.1 Vulnerability

Vulnerability may be referred to as an internal risk factor of the subject or system that is exposed to a hazard and corresponds to its intrinsic predisposition to be affected or to be susceptible to damage (Cardona, 2006 as quoted in Singh *et al*., 2014:71). In addition, vulnerability refers to the exposure to hazards and inability of recovering from its effects with the use of available resources. It denotes the physical, economic, political or social susceptibility or predisposition of a community to damage in the case the destabilizing phenomenon of natural or anthropogenic origin (Cardona, 2004). Adger (1999: 249) provides a similarly 'downstream' definition: 'the exposure of groups or individuals to stress as a result of the social and environmental change, where stress refers to unexpected changes and disruption to livelihoods'. Hazard and vulnerability are mutually conditioning situations. There are two kinds of vulnerability to disasters i.e. people's vulnerability and institutional capacity vulnerability. People's vulnerability deals with the rate at which people are at risk to a disaster, while institutional discussions about the level in which key institutions such as hospitals and water supplies are able to handle the effects of a disaster (Kamanga *et al*., 2003).

The main concern in urban areas is the disposal of storm water since the lack of efficient storm water disposal systems may result in the flooding of houses, properties and roads (Alexander, 2000b). Concerned by the increased number and impact of disasters, the International Decade for International Disaster Reduction was initiated during the 1990s. This initiative was meant to serve as a catalyst for disaster and vulnerability reduction. To this end, the initiative required a concerted

and coordinated effort of governments, the UN organizations, educational institutions, civil society as well as communities at risk (Heijmans, 2004). The international community was cautioned about the importance of vulnerability assessment in disaster reduction.

Musyoki *et al*. (2016) argue that an increase in household income, as well as levels of education, reduces the community's vulnerability to flooding. A higher income can assist the community to afford resources for dealing with flooding. Moreover, the improvement in education is important in the building of knowledge and improvements in the capacity to deal with floods (*ibid*.).

Kamanga *et al*. (2003) emphasize the point that the poor are mostly affected by disaster effects such as injury and loss of property. Musyoki *et al*. (2016) conducted research at the Thulamela municipality and found that it is prone to droughts, fires, and floods. The cause of disaster vulnerability within the municipality can be associated with issues of landlessness, poverty as well as inadequate infrastructure. Wisner (2003) emphasizes that disaster events are merely caused by vulnerability and exposure because there is a lack of information and access to resources in society. Additionally, the people affected by the disaster events are the marginalized with inadequate resources. Manyena *et al*. (2013) conclude that disaster risk reduction legislation has not significantly changed from focusing on hazards to vulnerability. In essence, the challenge of losses due to disasters remains a challenge.

The stakeholders for urban areas are municipal governments, city departments, community-based organizations and non-government organizations and residents especially the poor. Musyoki *et al*. (2016) claim that the flood defence measures such as land use planning are often not implemented. Government units are mostly involved after the disaster had struck in disaster management activities (Musyoki *et al*., 2016). The approach of government units needs to be proactive and embrace prior planning of strategies to tackle disasters.

Alderman *et al*. (2012) investigated the effect of floods on human health. Floods are responsible for increased number of diseases, morbidity, mortality social and

economic disruptions. Poorly resourced countries will experience a greater health challenge than higher income countries. The El Niño flood that occurred in 1997 to 1998 in Kenya reduced the food intake of people and their incomes, especially those that relied mostly on livestock trading (Gadain *et al*., 2006). The significance of this statement is that areas that have low rainfall tend to have poor drainage infrastructure and coping strategies (*ibid*.).

Human health impacts of flooding are directly affected by the vulnerability of communities (Alderman *et al*., 2012). The key principle of disaster management is that the vulnerable are at the forefront and need assistance (Provincial Affairs and Constitutional Development, 1998).

2.6.2 Community Participation

People are not passive, and vulnerability is not externally determined (i.e. is a direct consequence of inability to utilise available resources to respond to a disaster event, it is the intrinsic failure of a community's capacity using its available resources to minimise disaster effects. Explanations for vulnerability need also to recognize the role played by human agency, whether people are seen to resist, cope with or succumb to environmental stress. Adams (1995) highlights the importance of access to information in shaping people's relationship with hazardous environments. Information is also central to local decision-making and those individuals who hold information are likely to be best placed to access resources and enhance security for themselves or others. Information defines the ways in which actors relate and is a means of legitimating authority in, or of excluding groups from, decision-making. There is a growing consensus that grassroots actors should be involved in development projects if they are to succeed (Gaventa & Valderrama., 1999).

Community-based disaster risk reduction and community-based disaster management can be traced back to the rise of the concepts of community development and participatory development in the 1960s and 1970s. It was assumed that placing people at the main role of development would minimize the imposition of instructions to be used in dealing with disasters from above and encourage the local people to actively participate in risk reduction. While national governments have a mandate to develop disaster management and risk reduction plans,

communities have to come up with their plans as well (Wisner *et al*., 2004). As such, people have to attend workshops where they set goals and determine objectives to reduce risks at various stages of the disaster. Community participation becomes effective if people are organized. For example, being organised by the people can serve as an instrument for different activities to be done during disaster risk management. Local committees are established to tackle the challenges posed by disasters. In his research, Dufty (2010) stresses the need for community's own plans for flooding as opposed to plans provided for awareness to them. Therefore, governments should assist and promote people's own methods of preparing, response and recovery to flooding. Participation of local population in the recovery process ensures that their needs are correctly reflected in the process (Joakim, 2011).

Tall, Patt and Fritz (2013) say that African countries are facing a threat of what they refer to as 'Hydro-Meteorological Disasters' (HMD). HDM means the disasters that are associated with water and climate change. The HMD are causing problems for African countries; however, the HMD risks that African countries face differ per country (Tall *et al*., 2003). Nonetheless, African countries use different strategies and methods to address disaster trajectories. In this sense, Dufty (2010) points out that education is one of the ways to strengthen flood resilience in communities.

The recovery process is there to serve the people not the needs of officials of private organizations offering support. This statement means that the recovery process is not to be used for political or marketing reasons but solely for the benefit of the affected people. Furthermore, Whitmarsh (2008) highlights the view that flood victims view climate change and flooding as separate issues. Issues such as road resurfacing, blocked drains were considered as primary sources of flooding while weather patterns were only thought as an indirect contributor to flooding (Whitmarsh, 2008).

2.6.3 Disaster Reduction

An existing challenge is the willingness of people to relocate to non- hazardous areas. Hamilton (2000) highlights strategies for disaster reduction, including the location of people away from hazardous areas and warning of possible hazardous

conditions through technological devices. In Bramfischerville the relocation proposal has unforeseen circumstances such as moving people to areas far from their workplace thereby increasing transportation costs.

Manyena *et al*. (2013) analysed examples of disaster legislation in South Africa, Zimbabwe, India, and the United Kingdom and found that the countries do not clearly specify the role of the community in their legislations. Therefore, it is difficult to implement disaster reduction strategies because the community does not understand their approach (Hamilton, 2000). In this sense the community seeks clarity regarding the implementation of their role in disaster reduction.

The implication is that the ordinary citizen in the community still cannot participate in reducing disaster vulnerability; rather the government's centralized approach still predominates. Disaster legislation developed by South Africa and the United Kingdom are similar because they both integrate disaster and development in a single framework (Manyena *et al*., 2013).

During the Bramfischerville floods there was a major contribution by government providing aid while in Netherlands residents individually clean and repair their homes after a flood (Linnekamp *et al*., 2011). Linnekamp *et al*. (2011) found that households in low-income areas tend to assist each other during a flood than in higher income areas. This statement means that there is not much community development in Bramfischerville to ensure that the community is well equipped in assisting themselves and each other during flooding.

2.6.4 Flood Forecasting, Preparedness and Mitigation

This research focuses on non -structural measures in dealing with the flood disaster in Bramfischerville. "The non-structural measures are flooded preparedness, response, legislation, environmental impact assessment, reconstruction and rehabilitation" (Andjelkovic, 2001:25). The importance of non- structural measures is their contribution in reducing losses of life and damage to property that may be caused by a flood.

However, the issue of uncertainty in temperature and precipitation trends makes it difficult for disaster managers to prepare for an outcome that might suffice (Braman

et al., 2013).The knowledge of disaster managers on prospective flooding can enable them to prioritize allocation of the limited resources on strategic preparedness and improved response (Braman *et al*., 2013)**.** According to CRED (2015) flood disasters had an insignificant decrease in occurrence around the world from 50.6% in 2004-2014 to 46.5% in 2015.

In this sense, Borga *et al*. (2011) write about the 'HYDRATE' project aimed at flood forecasting, advancing early warning system and an innovative flash flood observation strategy in Europe. Borga *et al*. further analysed the Hydro-meteorological project on flash flooding and concluded that an integrated approach combining top down and bottom up strategies can strengthen flood management in Europe. The top-down approach has flood disaster managers and officials providing policies to be implemented by the local people. The bottom-up approach gives the local communities the upper hand in making decisions and influence their actions on flood disasters. However the top down and bottom up approaches can combine in an integrated approach to disaster management. This combination can be achieved through the effective institutional arrangement that specifies the responsibility of a particular government department and a relevant unit (Lin Moe & Pathranarakul., 2006). In addition this institutional arrangement includes collaboration and coordination among key stakeholders at the project level (*ibid*.).

2.7 Preparedness and early warning

In South Africa, in the early 2000's there is very little flood warning available (du Plessis, 2002). South Africa has inadequate flood prevention and mitigation and ineffective institutions associated with integrated catchment management problems in the country (du Plessis, 2002). The institutional problems in South Africa are that the roles and responsibilities of various stakeholders in the institutions are not clearly identified (*ibid*.). Flood prevention and reduction actions may include placing demountable barriers and reinforcement of flood defences (Sene, 2008). This statement means that the construction of wall such as the retention walls can be a strategy that can be used to prevent flooding.

The most important aspect of disaster management is the reduction of risks. "The risk of disaster is a compound function of the natural hazard and the number of

people, characterised by their varying degrees of vulnerability to that specific hazard, who occupy the space and time of exposure to the hazard event" (Wisner *et al*., 2003:49). In equation form $R = H \times V$, where R is the Risk of a disaster H is the hazard and V is the vulnerability to the specific hazard (*ibid*.).Kamanga *et al*. (2003) assert that in order to successfully reduce risks disaster specialists need to collaborate with the communities and other relevant stakeholders. Furthermore, the risk reduction measures such as flood protection devices, adopted building use and the purchase of insurance that are taken before disaster strikes are called mitigation and preparedness activities (Vasilescu *et al*., 2008; Bubeck *et al*.,2012). The mitigation and preparedness measures should be the responsibility of all stakeholders affected by the flood disaster in this case.

The benefits of flood preparedness include reduced recovery, increased property prices and keeping important items safe (O'Sullivan *et al*., 2012). O'Sullivan et al. (2012) argue that if the roles of all stakeholders in flood risk management were to be publicized the public would be enabled to differentiate their responsibilities from that of other authorities. The public would be less confused about their expected contribution in protecting themselves against floods.

Prior to warning signs about the possibility of a flood disaster assist people to be ready and place valuables in safe places on time. Borga *et al*. (2011) suggest that official and unofficial warnings on hazardous signs as well as personal observations are vital for flood preparedness. O ' Sullivan *et al*. (2012) recommend that multiple channels of communication are required for a flood message to reach all recipients it is intended for. In order to contribute to the preparedness of a community for a disaster the raising of networks and informal groups is a good strategy (Quaranteli, 2008 quoted in Borga *et al*., 2011:839). Their emphasis is on the sharing of strategies to mitigate flash floods by communities and officials in Europe.

O' Sullivan *et al*. (2012) noted that an SMS messaging can be suitable for both general flood information and disseminating warnings in a crisis. In addition, the SMS can include information of important websites that provide advice on preparation and contacts of persons for emergency (*ibid*.).The methods used in the provision of information to people are sometimes difficult for people to understand

and act upon. O' Sullivan *et al*. (2012) suggest that only providing information to people would not automatically trigger response, rather an undesirable inappropriate action might occur from a misinterpretation of the information. Similarly, Wong and Zhao (2001) emphasize the policy attitude of embracing non-structural approaches such as flood warning and land use planning to reduce people's vulnerability.

The disaster management officials need to come with comprehensive plans of ensuring that people are informed of places at risk to flooding. Gadain *et al*. (2006) insist that flood inundation maps are useful for flood warning to people. Alam *et al*. (2008) assert that the relevance of early warning relies on the people's ability to respond to warnings. A lack of the ability of people to respond signifies little relevance of early warning system. O'Sullivan *et al*. (2012) considered flood information and warnings as a resource to pass knowledge from different stakeholders concerned in a flood hazard in a manner that will positively influence the actions of those actors. The impact of the information provided by flood warnings might be out of context in some actors, therefore, could result in an unprecedented influence on practices. Paul and Routray (2010) argue that households with higher education level can better understand flood forecasting and reduce their vulnerability to flooding as compared to less educated households.

The result of a survey on the effectiveness of early warning system claims that in Africa the level of access to early warnings is far lower than East Asia and the Caribbean (Lumbrosso *et al*., 2016). Lumbrosso et al. also found that in South Africa, Cameroon and Djibouti stakeholders perceived that early warning systems for floods were effective in their countries. The main barrier to effective warning systems in the regions of South Asia, Africa, and the Caribbean was a lack of quality data (*ibid*.). Lumbrosso *et al*. also noted that many stakeholders thought that the sharing of data across international borders can improve the effectiveness of early warning systems. They furthermore suggest that data availability can be improved with the use of remote sensing and wireless sensors as examples. The implementation of the remote sensing and wireless sensing would depend on plans and budgets by various government institutions.

2.8 Response and Recovery

Vasilescu *et al*. (2008:47) define post-disaster response and recovery as ‘initiatives taken in response to a disaster with a purpose to achieve early recovery'. Mustafa (2003) asks a critical question about disaster recovery after a flood in Rawalpindi town of Pakistan in 2001. Based on the levels of poverty injustice and environmental degradation in the study area, the question is "recovery to what"? (*ibid*: 71). The question is asking whether returning a place to its previous state after a flood disaster assists people in any way from future flooding. The main concern with recovery is that communities return to their status quo that is susceptible to flooding. The challenge is that the proneness to flooding disasters will prevail after the recovery process. Joakim (2011) explains that the concept of 'better' in disaster recovery means that future vulnerabilities of disasters must be reduced by the recovery processes.

Communication between community members and officials is important in addressing other members about flooding. Sene (2008) suggests that the use of word of mouth and raising a flag to indicate that there is flooding are still relevant methods in this day to be used by communities in response to a flood. Paul and Routray (2010) researched flood proneness and coping strategies in Bangladesh. They found that people’s indigenous coping strategies have assisted them to reduce flood vulnerability in Bangladesh. Some people in Bangladesh elevated their beds using bricks as a coping technique against floods (*ibid*.). A country like South Africa could adopt strategies applied to countries like Bangladesh and implement those considering contextual factors. Haase (2013) notes that a barrier for adaptation is a lack of knowledge for non-structural flood protection measures.

Temporary relocation to places that are safer is an option that many flood victims opts for in flooding days. In Suvagacha village some people migrate during a flood disaster and choose to own portable accessories for their vital needs (Paul & Routray, 2010). Higher earning household heads are less vulnerable to flooding than poorer household heads having lower earning jobs that sometimes are terminated during the flooding period. Paul and Routray (2010) found that occupation of household head has an influence on the coping strategy in a flood

event. External assistance after a flood, especially with the provision of food, drinking water and the reconstruction of houses are important for household's coping strategies (*ibid*.).

The issue of urbanization as discussed earlier has a great influence on the severity of floods in the area. Adelekan (2009) recommended the Nigerian government to restrict land reclamation activities in developing areas, to construct more drainage systems and to monitor urban development. Some flood victims suspect ward councillors offered assistance to their friends and relatives only after the flood of 2001 in Pakistan (Mustafa, 2003). Acts of corruption hinder development in many places across the world because the needy suffer the most.

Flood victims require assistance from government and other stakeholders in minimizing the effects of flood disasters. Alam *et al*. (2008) claim that support from family members, neighbours, and other networks is vital for people with flooding problems. Gadain *et al*. (2006) analysed the result of the flood and found that assistance should be in the form of free food and work activities to the affected people. In Pakistan, during the 2010 floods, the Ahmadi people were denied flood relief because they were regarded as not pure Muslims (Malik, 2011). Culture and religion have influence in human relations everywhere in the world. However, the socio-economic status of people also determines their importance in receiving services from governments.

Joakim (2011) stresses that recovery initiatives should not degrade the environment, they should enhance environmental quality. Joakim further notes that continued monitoring and evaluation is required to ensure that the recovery processes continue effectively with fewer blunders.

Time delayed in the arrival of relief can cost people's lives, increase health problems and slow the community's recovery ability (Braman *et al*., 2013). In the context of West Africa a challenge of limited capacity for implementing disaster management strategies such as lack of financial resources to transport non-food items, and differing levels of accessing technology and communication tools (*ibid*.).

Government in West African countries should prioritise disaster relief in their budget, so that more people can get assistance on time.

The UR Flood done in Finland, Ireland, Italy and Scotland project found various methods of disseminating information during a flood. The information can be disseminated for example through newspapers, radio, television, post, council offices and libraries (O'Sullivan, 2012; Sene, 2008; Braman *et al*., 2013). Trust between stakeholders is a key element in flood risk communication and communications without trust would have little impact (O'Sullivan *et al*., 2012). Trust can be fostered in constructive dialogue between stakeholders (*ibid*.). Sene (2008) argues that accuracy regarding flood warnings can be attained through education of people as well as public awareness exercises.

In Lagos households' sand filled their rooms as a coping strategy during a flood, however, the costs of buying the sand was too high for others (Adelekan, 2009). Paul and Routray (2010) conclude that traditional coping strategies improve people's adaptability to floods. A strategy for business to minimize risks due to flooding is to advise employees to stay at home or leave early at work during flooding days (Sene, 2008). Sene furthermore suggests that a major flood event requires multi-agency response offering different required assistance by the people affected. Haase (2013) stresses the need for intervention intended to be implemented as adaptive measures to take into complaisance the sociocultural context of an area. Tisa valley residents depend on the church, individual households and social networks for assistance during a flood, therefore, support for these institutions would bring about greater stability (*ibid*.).

In this context drainage systems are viewed as essential in urban areas where the flooding of properties and roads needs to be avoided. Nonetheless, Padi *et al*. (2011) recommend floodplain mapping as a solution to discourage development of settlements in flood-prone areas.

2.9 Conclusion

The literature has argued that globally, flooding is considered as one of the leading causes of disaster as well as economic and infrastructure damages undermining the

coping capacities of communities and authorities at the local level (Dar and Nandargi, 2001; Few, 2003; Jonkman, 2005). Poor communities in urban areas are vulnerable to flood disasters because of building in floodplains. Urbanization is another factor contributing to human-induced flood disaster. Flood forecasting, preparedness, and mitigation strategies are key elements of successful flood disaster management. The marginalized in society cannot guarantee that they will receive flood warning in methods that they can comprehend and utilize. The community needs to be empowered to effectively participate in flood management initiatives. Jonkman (2005:173) argues that 'improved land use planning, early warning system development and use of financial economic tools can assist in the mitigation of flood damages'. However; Bramfischerville has its own characteristics and vulnerabilities that have to be evaluated.

Chapter 3: Bramfischerville's history and challenges

3.1 Introduction

Previous chapters have highlighted that disasters have increased in numbers and in the way they affect human lives. Victims of disasters wish for ways to mitigate the effects but they don't know how. This chapter will provide an introduction to the chosen case study Bramfischerville. The chapter will attempt to provide the background of the study area and its challenges over the years. This will be done through providing the history of the place and specifically highlighting the flood events that have occurred over the years. The chapter goes further to outline the status quo of the township and some of the dynamics and challenges the area encounters.

3.2 Bramfischerville and its distinguishing characteristics

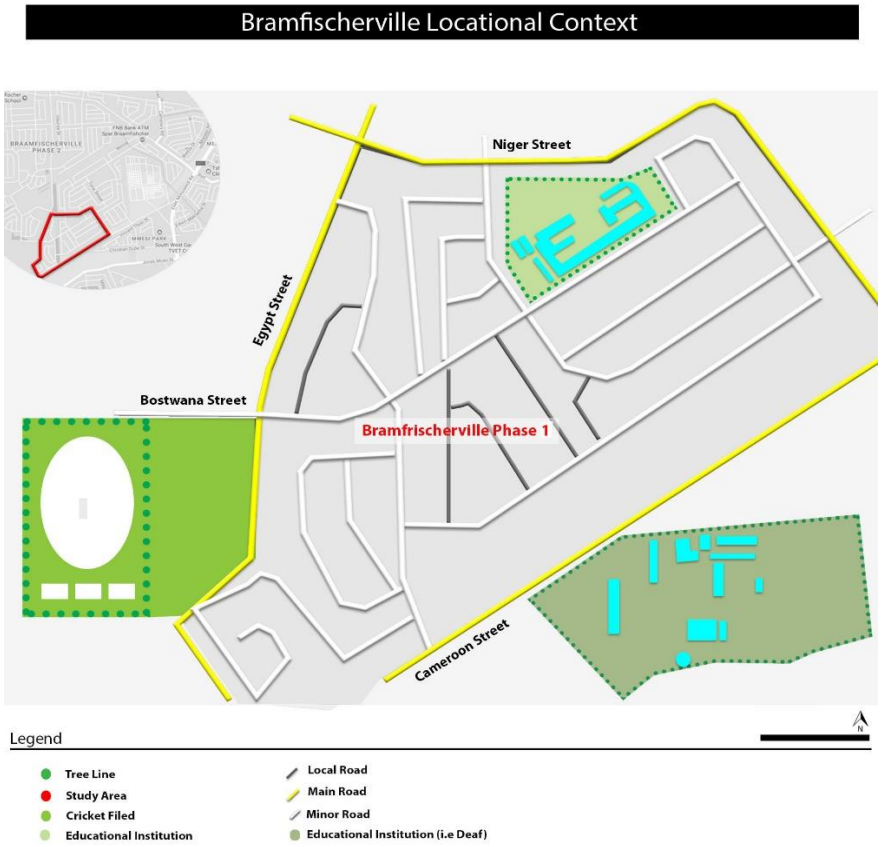


Figure 4: Map of Bramfischerville in the context of Johannesburg

Source: N. Mkhulisa, 2017

Bramfischerville is situated in the south western part of Johannesburg. It is closely linked to Elias Motsoaledi road in Dobsonville Township, the main road joining it to Johannesburg. The area can be categorized by its ten extensions. This research focuses on the initial area referred to as Bramfischerville phase 1. Bramfischerville area comprises mostly of low-cost RDP housing. The RDP houses are on the border of Roodepoort and Soweto respectively. The houses in the area are distinguished by their numerical house numbers (Moola *et al*., 2011). Bond houses are mushrooming in the area since 2009 until the present day, mostly in extension 9 and 10. There are also a number of zozos or backyard shacks in the area. Despite government initiatives to build houses accommodation is still a challenge in the Bramficherville's context. There are discrepancies in RDP houses from different municipalities in South Africa (Pottie, 2003 quoted in Moola *et al*., 2011). These discrepancies exist because of differing specifications by each municipality regarding the RDP house structure. The houses in Bramfischerville consist of an open plan bedroom, lounge, and kitchen. The open plan house has an impact on the wellbeing of people living in the area. The outcome of openness is that children and young adults end up sharing a bed or sleeping space with their parents. It compromises the adults' privacy and exposes children to diseases such as Tuberculosis. A maximum of ten people lived in a housing unit in Bramfischerville since people started staying there (*ibid*.).

In 2011 the housing department demolished around 100 houses in Bramfischerville because of faulty construction (Mail and Guardian, 2011). The impact of the demolition is that government has to spend more time and money on one project instead of focusing on other developments. Since its inception, the area has three high and primary schools with a fourth high school proposed in the bond houses of phase 4. There is overcrowding in schools due to the rapid growth of the area.

The area is one of the most densely populated in Johannesburg. The study area had 12 720 people on an area of 1.32 km^2, thus the population density of the area is 9 636 persons/km^2 (Stats SA, 2011). It depicts high levels of social inequalities. In this sense the majority of the Bramfischerville community is included in the

1 379 842 black people that received no income per month in the CoJ in 2011 (CoJ, 2013-2016). Around 52 % in 2007 of these people in Bramfischerville were on government social grants. Whereas within the same CoJ there were 3 881 African people that earned around R102 401 per month (*ibid*.). Furthermore, a study conducted by the World Health Organisation indicate that by the year 2006 there were around 40% of people in Bramfischerville that received no income (Mathee, 2009).

The rationale for choosing Bramfischerville is that the section to be studied is located on a floodplain. Some of the people in the township live on a 1:100 floodplain. This floodplain probability statement means that this extent on the floodplain would be reached once in 100 years based on the historical flood event data. These attributes make Bramfischerville a distinguished example to examine the effect of floods in a township.

Flood prone areas in Soweto

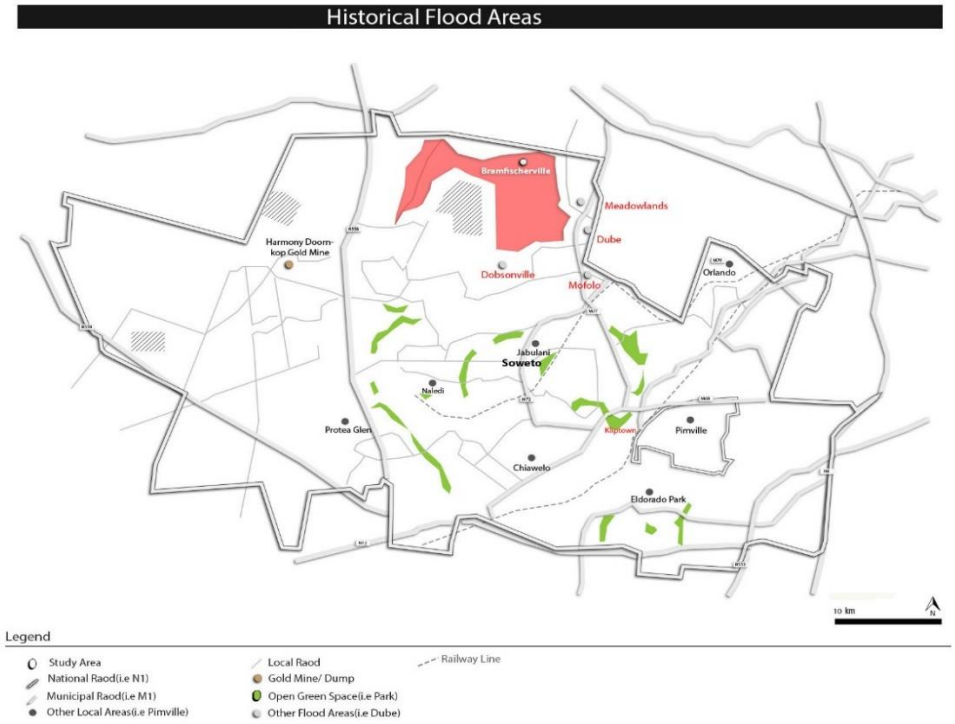


Figure 5: Areas affected by flash Flooding in Soweto in 2009

Source: N. Mkhulisa, 2017

The map above (Figure 5) highlights all the areas that were affected by the 2009 floods in Soweto.

The areas that were affected by flooding are Dube, Dobsonville, Kliptown, Meadowlands, Mofolo, and Bramfischerville. The flooding impacts still persist in the communities minds. In all the areas flooding caused severe damage to infrastructure and their well-being. In Kliptown 80 people from the shacks were left homeless after the floods of 2009 (Mail & Gurdian, 2009).

The area of Bramfischerville has been affected by other floods apart from the 2009 flood disaster. In March 2017 a school girl drowned in a drain because of flash floods and was later found in a stream in Bramfiscehrville (Serumula & Naik, 2017). This incidence is evidence that the Bramfischerville area is prone to flood disasters.

In terms of responding to the disaster management issues the CoJ, the city has to establish disaster prevention programmes and to establish and maintain multidisciplinary cooperation and partnerships (CoJ, 2003).

3.3 The History of Bramfischerville

The history of Bramfischerville reveals that its development started in 2001 with its first RDP houses. The area is predominantly occupied by 98% black people and other races make a very small percentage (Stats SA, 2011). People that stayed near the Jukskei River in Alexandra were relocated to Bramfischerville due to the renewal project. The relocation was a result of flooding in Alexandra caused by the Jukskei River during rainy days. However; upon arrival in Bramfischerville, the people realized that the same situation prevails. This does not mean that these people were capacitated in dealing with flood conditions. Bramfischerville developed further in 2002 with the addition of more phases (phase 2 and 3) to the existing phase 1 (Moola *et al*., 2011). The growth of the area has been exacerbated by the relocation of people from other parts of Johannesburg.

3.4 Key challenges (Poverty, unemployment, urbanization, vulnerability to floods, and crime)

The City of Johannesburg mayoral committee on finance included Bramfischerville's extension 9 and 10 on its budget for Stormwater Management. The area has had problems in stormwater management hence it is flooding on rainy seasons. The 2008 research held in Bramfischerville revealed that most households were unsatisfied with their houses (Moola *et al*., 2011). The ultimate cause of non-satisfaction amongst house owners was the quality of the house construction (i.e. faulty doors, leaking roofs, etc.). Bramfischerville has inadequate infrastructure and services, such as roads and its own clinic.

People's survival strategies in Bramfischerville differ per household. Makaya (2006) found that most people in the area are reliant on social grants for survival. The statement signifies that people lack jobs in the area and necessary skills to create them. The Bramfischerville area is an example of a poverty-stricken township in South Africa. There is a challenge of a mine waste dump called Durban Roodepoort Deep in the area causing dust in the summer time. Nkosi *et al*. (2015) found that people residing in close proximity to a mine dump contract chronic respiratory diseases. People's health is at risk in the area so better strategies to deal with the situation are needed before it turns into a disaster.

Bramficherville area is one of the many townships battling with crime in South Africa. Mendes *et al*. (2011) found that crimes such as rape, shooting, and stabbing were high in the area during the year 2006-2009. The consequence of crime is a decrease in investments in the area. The area does not have its own police station yet hence incidences are reported at Dobsonville police station. The lack of a police station could be the reason criminals continue offending without fear.

There is a problem of sewerage spillage that is of concern in Bramfischerville from its inception to date (Daily Sun, 2015). The issue is prevailing despite many reports by residents to the municipality. The impact of a spillage is a health hazard on nearby households. Children are the most vulnerable because most of them play on the streets where the spillage had occurred.

The issue of flooding is of a great concern in Bramfischerville and residents have been complaining for years. The Mail and Guardian (2011) report claims that there was a contractor that was appointed by the department of housing named Emba Project Management. The contractor recommended that houses be relocated to other areas that are not vulnerable to floods. People refused to relocate to a place called Lakeside near Orange Farm. The reason behind the refusal was that some people worked in Krugersdorp so commuting from Lakeside was going to be a challenge. Furthermore, residents complained about the transport of their children who study in Johannesburg if they were to move to Lakeside. Some people were moved to Doornkop, Greenfield–Lufhereng project. The engineers who inspected the area before the erection of houses asserted that the area had 1% chance of flooding in 100 years (Mail and Guardian, 2011).

Poor people are the most vulnerable in the case of Bramfischerville because they do not have resources and necessary information to deal with the flood issues. According to Stats SA (2016) from 2009 to 2016 the number of households in Gauteng Province has increased from 11 694 000 to 13 543 000. Thus, in areas such as Bramfischerville the poor tend to be located in areas that are prone to flooding.



Figure 6: Bramfischerville 2009 flooding picture

Accessing homes and schools becomes a serious problem after rain in the area, other people experience difficulty reaching their homes. The water on the muddy streets during floods makes it difficult for people to go outside.



Figure 7: Sewage spillage in Bramfischerville

Source: Adapted from Malaka 2015

3.5 Description of the flooding event of 2009 in Soweto and Bramfischerville

Soweto has been battling with poor stormwater drainage systems prior the 2009 flood disaster. The drainage system of the CoJ is changing drastically and flooding needs to be understood in those terms. The CoJ (2008a) argue that intense development from land use including loss of open space and infilling of wetlands increases surface runoff. This is all because of urbanization in the CoJ. However, people need economic opportunities in the CoJ; therefore it is somewhat unavoidable for them to influx the city. Thus, Bramfischerville is no exception in the case of people influx to the city to seek economic opportunities.

On 26 February 2009 flash floods took place in Soweto and affected many communities and the catchment area that is feeding the river streams to Soweto had more rain hence causing floods (City of Johannesburg, 2009). About 15 wards were reported to be affected by the rain in Soweto. The damage caused by the floods resulted in the loss of lives of two children with more than 200 households left without shelter (Mail and Guardian, 2009).

The disaster management and emergency services had to respond to flooding incidences to many areas around Soweto on short notice (City of Johannesburg, 2009). Informal settlements of Dlamini and Kliptown were badly affected (*ibid*.). It is reported in the City of Johannesburg website that a baby, cyclist, and a taxi driver were swept away by the flood and were declared to be lost. Bramfischerville was affected severely by the 2009 floods. The 2009 flood event in Bramfischerville required state and organizational interventions for assistance with recovery from the disaster. This suggests that the emergency response to floods was ineffective and was further hindered by flooded roads to reach affected areas in the few hours after the flood has hit (McNamara, 2013).

Bramfischerville's Flood affected Roads

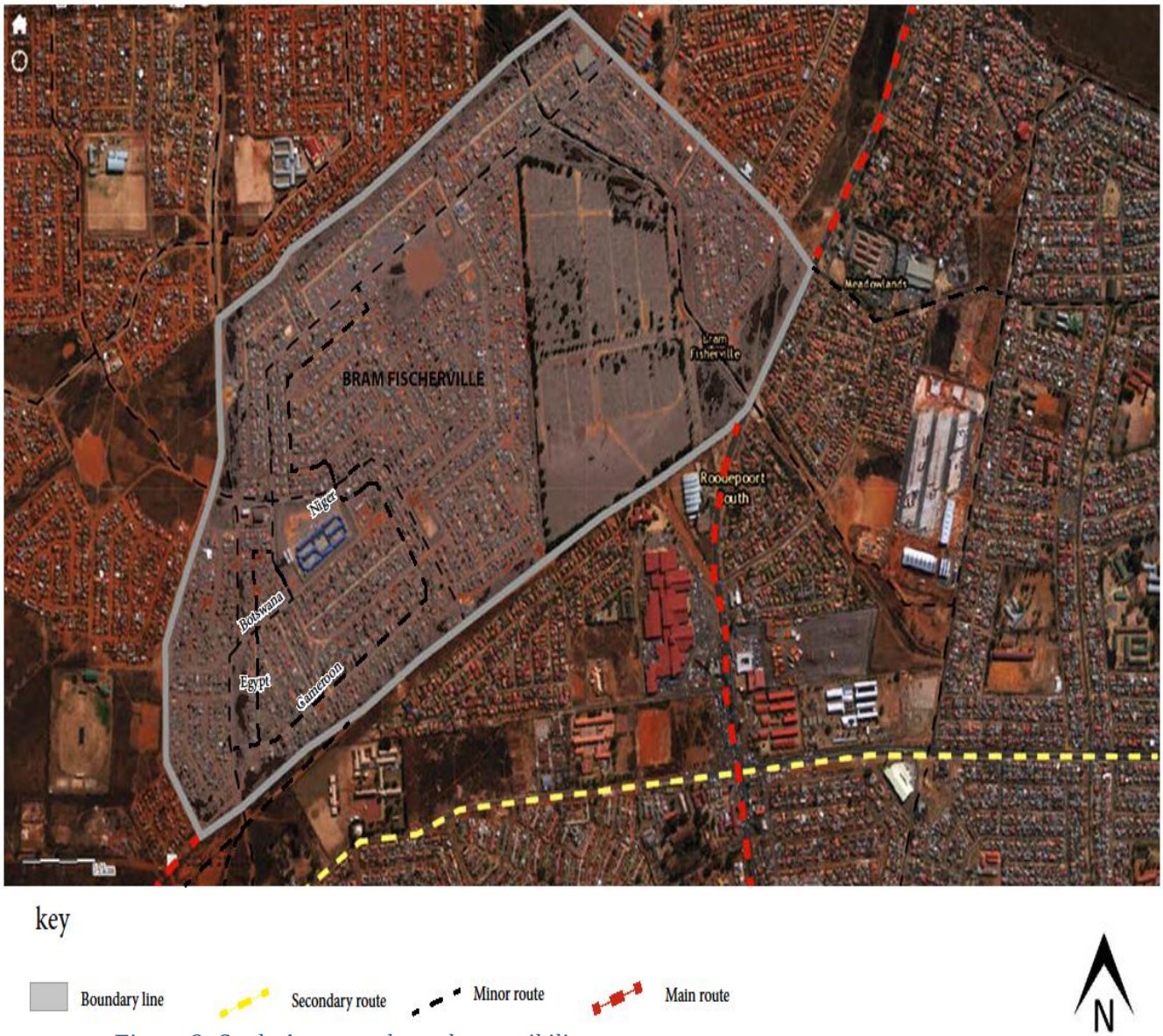


Figure 8: Study Area, roads, and accessibility

Source: Google Maps, 2017

Figure 8 above shows the streets within the study area. The area has a single entrance point that is near Dobsonville. The roads above lead to the study area only and not to all of Bramfischerville extensions.

In the broader study area, the most profound change is the establishment of mortgage bond houses in extension 9, showed significant impact on the area. A mortgage bond house is a long term borrowing of money contract between a person

and a finance company usually a bank with a purpose of getting a house (Frankel et al., 2004). There are several amenities in the area such as the Bramficherville Multipurpose centre.

The transport system is dominated by taxis and is not a challenge in Bramfischerville. Other modes of transport such as trains and Bus Rapid Transit (BRT) do not have the infrastructure in the area yet. Shoprite store has been open since 2015 in phase 2. The area is developing significantly with market stores.

3.6 Conclusion

The above brief outline indicates how communities of previously disadvantaged people continue to live in vulnerable conditions. Floods, drought, and fire continue to haunt people in townships around South Africa in the 21stcentury. These conditions further hinder local economic development in Bramfischerville. There is a need to strengthen mitigation and preparedness for sustainable disaster management. The issue of floods is of concern for Bramfischerville residents and it has been prevailing. Government policies on disaster management emphasize that pro-active measures should take preference from reactive measures that were used in the past events. The vulnerability of the people in Bramfischerville due to flooding needs to be evaluated and a proposal of methods to be used to minimize flood effects.

In the South African context every municipality must submit their copy of the disaster management plan to the National Disaster Management Centre (NDMC). This centre is advocating for disaster risk reduction and early warning to be municipal priorities when dealing with disasters (NDMC, 2013). In the case of the CoJ they submit to the NDMC of the Gauteng Province (CoJ, 2003). According to the CoJ the Corporate Disaster Management Plan (CDMP) should identify communities at risk. Moreover, the plan should provide prevention and mitigation strategies. It should nonetheless establish the emergency management policy framework (*ibid.*). The important role of the disaster management plan is to establish community partnerships that combine the access and attributes of everyone with a stake in disaster resistance (*ibid.*).

Chapter 4: Research Findings and Analysis

"The municipality is busy fixing graveyard instead of assisting people that are still alive" (Respondent A from the community).

4.1 Introduction

The objective of this research was to understand the causes of floods, CoJ responses to flooding, and the vulnerability of people in Bramfischerville. Discussions in this chapter will illustrate the manner in which findings will provide answers to the research question. Besides the literature, this research makes use of two data sets, the community perspective, and the municipal perspective. Each data set is first described and thereafter a thematic analysis derived from the themes emerging from the disaster management concepts is undertaken. The themes found across the data sets are used to assess whether the findings support each other or not. The themes are disaster preparedness and mitigation, vulnerability, response, recovery and adaptive capacity.

The first task during fieldwork was to walk around the area identified as vulnerable to flooding. Thus, walking around the area assists the researcher to be familiar with it before approaching residents for interviews. During fieldwork, the researcher approached residents politely and respectfully to gain access into their houses. The selection was random and people that were available in a house were approached. After approaching the respondents they were greeted in vernacular and were told to indicate the language of preference for their interview. Most respondents used Setswana and isiZulu to answer the interview questions. Participants were not asked to specify race.

4.2 Socio-economic background of interviewees

Although the demographic set of data was not part of the purpose of the study, it was intended to describe demographic variables of the sample. Moreover, the study assesses any influence that the demographic data may have on the findings. Not all respondents answered the questions provided to them; however, most questions were answered adequately and clearly.

Socio-economic status gives an indication of the sampled population. A household survey was used in investigating the socio-economic status as well as coping strategies for reducing the flood impact. Indicators such as household size, the age of people, and employment were prioritized because they indicate the vulnerability level of the community. The data had a purposely sampled population of 11 households. In addition, the people should have been present at Bramfischerville when the 2009 floods occurred. There were 4 male and 7 female respondents. This was merely due to volunteering from the respondents and no particular ratio of male and female was targeted. The combined sample's families were 61 people altogether. Most households approached were willing to participate in the study and were having females and some were single parents. 5 of the respondents were single, 4 were married and one was a widow. The respondents were diverse, from grandparents, parents and at some point a young adult above 18 years.

Participants were asked to tick the age category that is applicable to them (See annexure D).

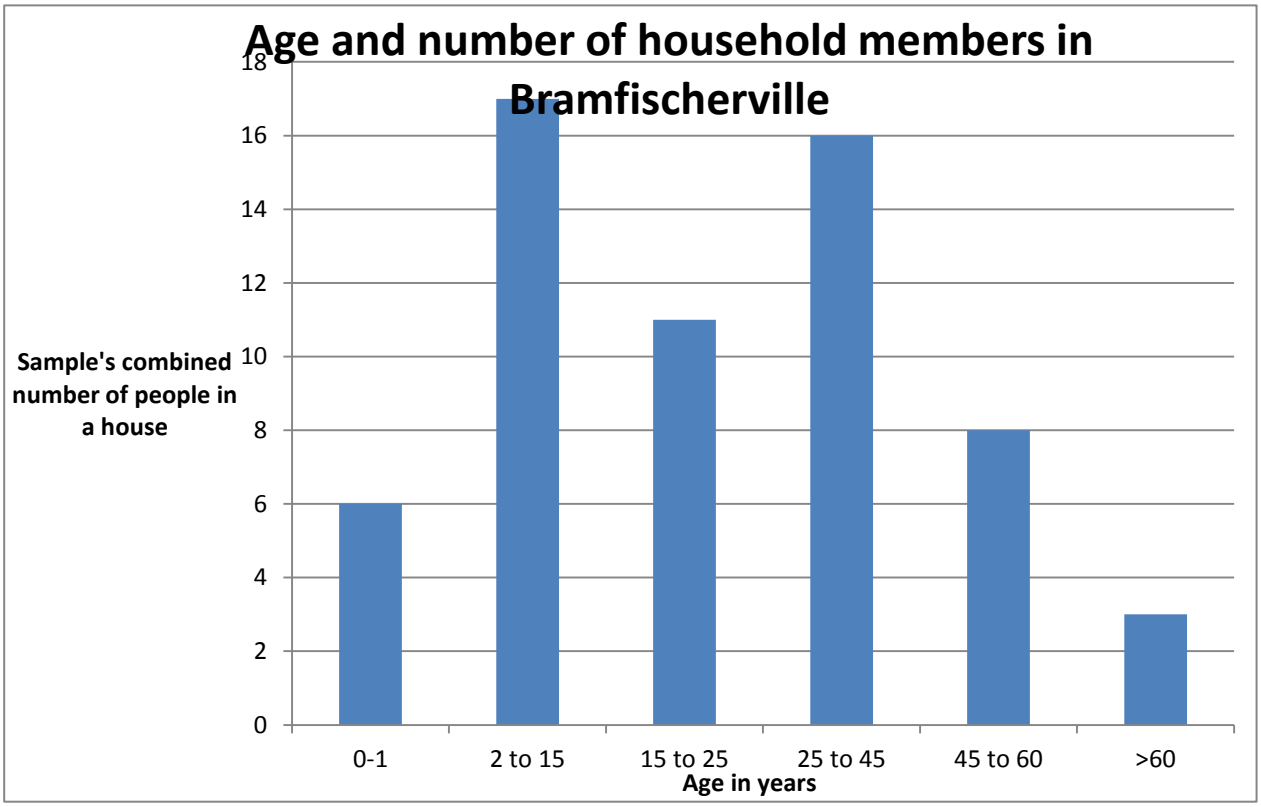


Figure 9: Age of household members

Data (Figure 9) shows that most people of household members interviewed were between the ages of 2-15 and 25-45 years old. This suggests that the area of Bramfischerville is mostly dominated by young people. However, 71% of the population in Bramfischerville and other areas in Soweto comprise of the working age of 15-64 years old (Stats SA, 2011)

Around three people were found to be greater than 60 years in the sampled population's households.

Table 1: Reasons for residents coming to stay in Bramfischerville

What prompted you to come and stay in this particular area?	Frequency of reasons for coming to stay in Bramfischerville
To be next to school and work	0
To be next to relatives and friends	0
It is cheaper to stay here	0
To have my own place and not stay with parents	7
I had nowhere to go	2
Other (e.g. Relocation)	1

The reasons that prompted people to stay in Bramfischerville are different. These reasons include firstly RDP house given in Bramfischerville. Secondly, a respondent argued that it was his parents that told him to come and stay in Bramfischerville. Thirdly a respondent claims that she was staying in town and

couldn't afford rental anymore. Lastly, seventy percent of the respondents were prompted to stay in Bramfischerville because they wanted a place of their own and not live with parents. Twenty percent of the respondents had nowhere else to go. This twenty percent of the people were relocated from Alexandra because of the floods caused by the Jukskei River.

4.3 State of Disaster Management prior and after the 2009 floods in Bramfischerville

According to the CoJ, there is an administrative unit that is a dedicated to deal with Disaster Management it includes, planning, response, and rehabilitation. The main focus is on Key Performance Areas (KPA) described on the South African National Disaster Management Framework. The KPA's are Integrated Institutional Capacity for Disaster Risk Management, Disaster Risk Assessment, Disaster Risk Reduction, and Response and Recovery (NDMF, 2005). Each and every stakeholder has a role to play, e.g. ESKOM takes a responsibility for switching power off. Traffic department should also lead in managing traffic caused by floods. There is also physical or paper and table top exercise for awareness. Table top exercises are the cost-effective methods of testing plans and procedures by the municipalities EMS (Chi et al., 2001).The exercise is conducted through pamphlets making a scenario and giving various methods to deal with the situation. The pamphlets also contain emergency numbers that the community can use in times of need. The officials also compile emergency lists for other stakeholders that need to be contacted during an emergency. In response to a question regarding the availability of awareness campaigns by the CoJ. Respondent K from the municipality claims that currently, the municipality is conducting seasonal assessments in an ongoing process to the community. Furthermore, respondent K from the municipality insists that after a paper and table top exercise, then the value of the impact and success of the awareness strategy is gauged. The resilience preparation follows after the table top exercise. This resilience intends to improve the capacity of a community affected by the disaster to adapt to the situation and receive better strategies in dealing with disasters.

The list of stakeholders for ensuring processes is in place for dealing with flooding include traffic management, housing department, planning department, South African Police Services (SAPS), Community Based Organisations (CBO), NGO's businesses ward councillors and community leaders. The information provided by CoJ suggests that administrative measures (i.e. the multidisciplinary approach of many initiatives related to DM, as well as details of mitigation and capacity building must be clearly asserted) were well in place in tackling flood disasters in 2009. However, community's responses differ significantly to the CoJ officials' responses. The community disputes that the CoJ was ready for the flood of 2009 in Bramfischerville.

4.4 Community's vulnerability to flooding

The community was requested to provide their understanding of flooding and its meaning. This is important because it assists in gauging the knowledge of the community regarding the topic of flooding. Several responses were provided in defining and explaining the term flooding by community members. The list below gives the explanations and definitions of flooding as a natural disaster, lots of water, too much water and lots of water closing the house. Flooding is anything to do with roof leakage, uncontrollable water. Furthermore, flooding is water in people's houses and it is lots of rain thunderstorms forming lots of water. Moreover, it refers to a lot of water and sewerage and water coming to the house unnecessarily.

The explanations above show a link between flooding and water. Respondent B thought that the flooding water is uncontrollable. Ward (1978) defines flooding as a body of water which rises to overflow the land.

CoJ officials were asked to explain in detail the flooding history of Bramfischerville. The argument was that Bramfischerville doesn't necessarily have a history of floods. *Respondent L of the municipality argued that 'the occurrence of 2009 floods was 'supernatural' that happened on a single day and spread to Dobsonville across the poor storm water system'. The area referred to as Bramfischerville proper was built on a wetland, it is a low-lying area there was no proper planning involvement. It is a political issue that the area got built on a wetland. The politicians overlooked the CoJ town planning expertise for not*

approving the area for human habitation. Instead, they continued to build in order to provide people with houses regardless of the conditions they might experience.

The utterances of the respondent L from the municipality emphasize an important aspect of township establishment that is the involvement of town planning. The mere omission of a town planning's significant view is a problem in itself because important surveying of the land and its appropriateness for habitation also omitted. Nonetheless, political interference also played a role in the persuasion of the people to settle in a flood-prone area. Thus, it is through the powers of politicians to influence decisions about settlements of people in South Africa.

Participants were asked to identify the causes of flooding in Bramfischerville.

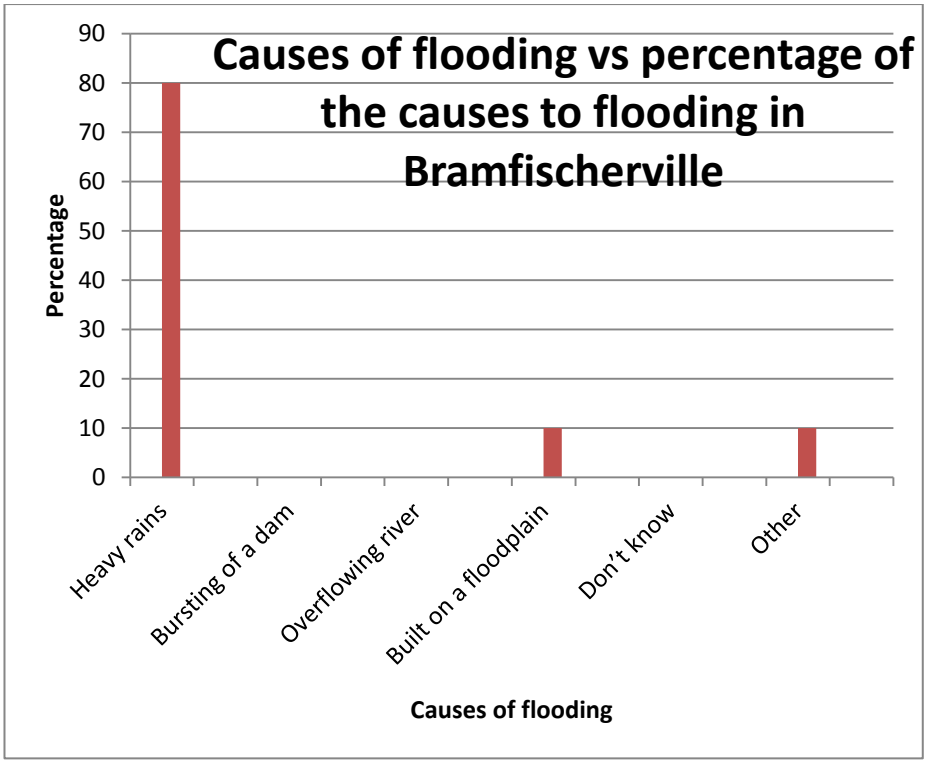


Figure 10: Graph of causes to flooding as perceived by interviewees

Respondent E from the community complained about the smallness of the drainage system pipes and said they got blocked easily. From figure 10 above it is shown that most residents believed that flooding is caused by heavy rain in Bramfischerville. This result is similar to the finding by Dyson and van Heerden

(2000) that explain the causes of flooding in the north- eastern parts of South Africa as a result of heavy rains.

The community respondents were asked about the manner in which flooding affected them. The responses below are some of the ways respondents argued how flooding affected them.

Household products were damaged in the sense that people lost documents related to their work. Their furniture was damaged. In addition, mealie meal and other foodstuff got wet. Peoples gardens were destroyed and houses sustained cracks. The water uplifted the houses and damaged them. Water was at a high level. House was built underneath a low slope and water would flow towards it. The roof of the house and furniture was destroyed. Books were damaged; rebought furniture, a very costly exercise.

The costs of repairing damaged items after a flood were said to be very difficult by the respondents. It is clear that proper measures of responding to the flooding were not communicated to the community by the CoJ. In this sense, if the CoJ communicated these measures effectively the community would have saved some of their belongings.

4.4.1 Capillary action by floods in Bramfischerville



Figure 11: Flood damage to houses in Bramfischerville

Source: Photo taken in Bramfischerville, 2016, by N. Mkhulisa

Water's electrical conductivity has a tendency to form electrochemical reactions that can damage buildings by destroying render and paint (Kelman & Spence, 2004). The picture above shows a house that has been damaged by floods. It is evident in the picture that the paint is destroyed and the actual brick can be seen. Kelman and Spence further commented on the impact of the capillary rise of water inside the building's components during a flood and note that the water to cause contact damage that is beyond the flood contact. People affected by the capillary rise end up spending lots of money to repaint the building.

4.5 Community participation in Bramfischerville's Disaster Management strategies

The research findings (Figure11) show that the biggest impact was on the people's houses in particular. Most houses were cracked and some were completely destroyed by the 2009 flood in Bramfischerville. For effective Disaster Management, the community needs to be active participants in the process.

4.5.1 What is Disaster Management?

Participants were asked to explain the meaning of Disaster Management in their own understanding. 10 participants responded to the question above.

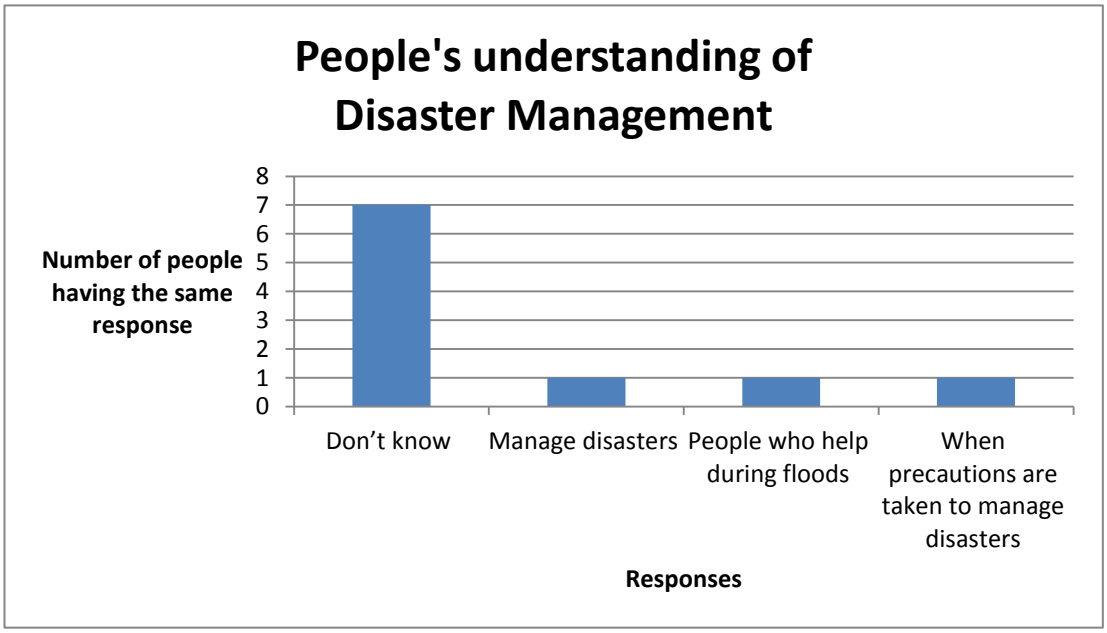


Figure 12: Understanding of Disaster Management by the people

From the responses given in (Figure 12) above it is clear that people do not know the meaning of disaster management. It is, therefore, difficult for people to utilize the services of disaster management if they don't even know what it is. More information dissemination by the municipality is required to enlighten its residents about disaster management services. The higher number of people that do not understand Disaster Management indicates that they are not active in the process. However, that might not be the case with some members that did participate in DM without much knowledge. The researcher explained the concept of DM to the respondents and explained the role of the stakeholders that are involved in the process.

The results show that flooding in Bramfischerville was caused by heavy rainfall that affected several areas in Johannesburg in 2009. Respondent K from the municipality said that 'the 2009 flood was caused by supernatural happening'. The impact of the flood was horrible and perpetuated by poor drainage system in the area of Bramfischerville. Similarly, Adelekan (2009) also found that some community members believed that supernatural event caused the flood in Lagos. A single respondent associated the effects of floods as being perpetuated by climate change. However, Whitmarsh (2008) suggests most people do not consider the effects of climate change as responsible for the flooding. This is necessary with regards to the mitigation of floods by understanding the causes in order to choose adequate methods of dealing with them.

The community was informed by the municipality on the causes of floods in the area. Respondent K from the municipality explained that the municipality uses radio and television to send information about flooding possibility to the people. Respondent B asserts that he heard from a municipal official that the area was built on a floodplain and that they are requested to relocate immediately. This research showed that human impact on flooding was their resistance to relocating as requested by the municipality. Figure 13 below shows a contradiction to the argument that residents were aware of the susceptibility of the Bramfischerville area to flooding and cause thereof.

The community respondents were asked about their participation in Disaster Management activities. They had to indicate whether they agree, moderately agree and not agree to have participated in Disaster Management activities especially concerning flooding in Bramfischerville from 2009 up to date.

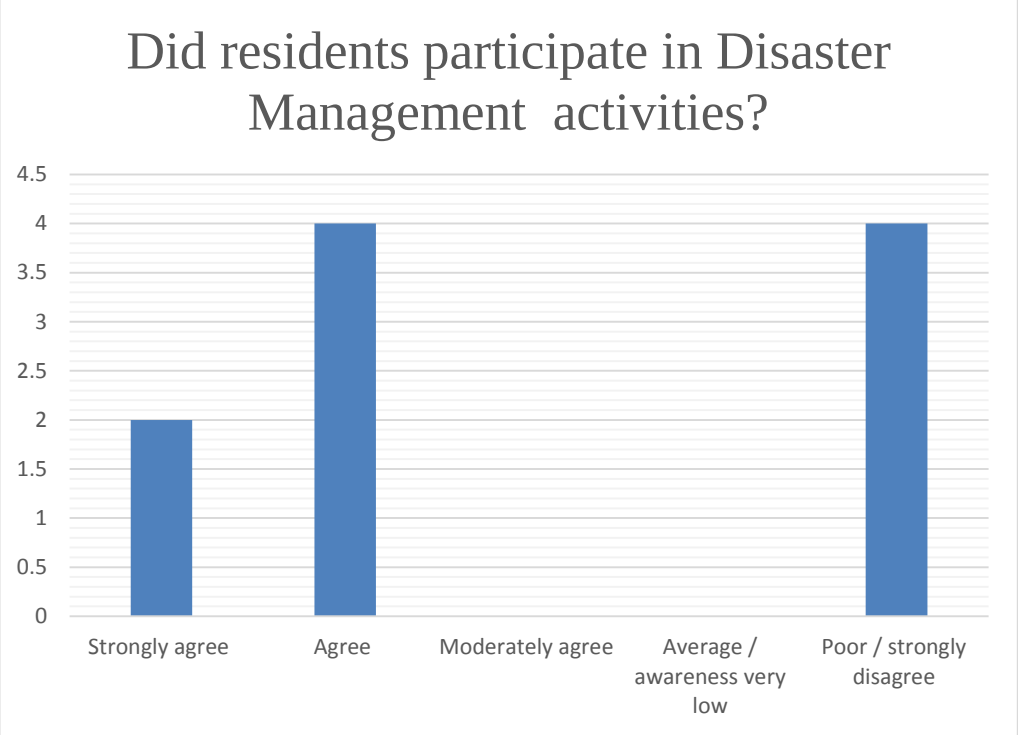


Figure 13: Whether residents participated in Disaster Management

Figure 13 offers resident experiences of participating in Disaster Management activities. After an explanation of disaster management given by the interviewer, the participants said the following about participating in disaster management activities. Similar research by Mustafa (2003) stresses the need for effective participation of the flood victims and state and civil society partnerships for effective disaster relief and recovery. Respondent C said that 'we even attend meetings concerning Disaster Management issues such as flooding'. Residents indicate their concerns in meetings and offer their assistance to officials if they are requested.

Regarding the ease to travel to important places during floods, residents were asked whether it was possible for them to reach those places. The graph below (Figure 14) gives the responses of respondents regarding their ability to travel to places

(clinics, shops, schools, and work) during and after a flood. Respondents claim that it took three to four days for the water to settle on the streets for them to travel to essential places.

Respondents were given a tick box having yes or no, where yes means they were able to travel while no means they were barred from traveling by the floods.

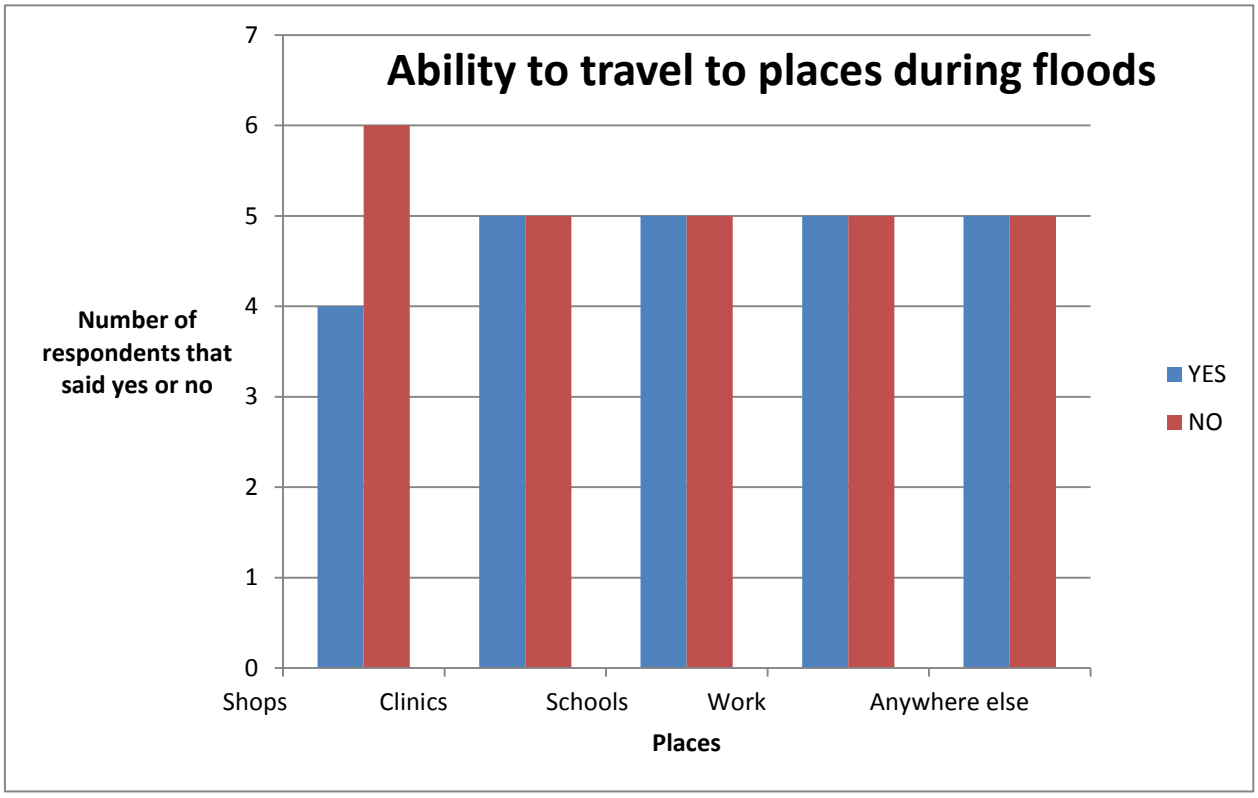


Figure 14: Effects of floods on livelihoods

Floods have a negative effect on people's livelihoods. 50 % of the people could not go to shops, work and anywhere else during flooding days. 60% of the people could not go to clinics; moreover, the nearby clinic was only in Dobsonville. People could not access these places indicated in figure 14 because the roads were flooded. It was a problem to lack access because most of these places (Figure 14) are important places to residents. Respondent D from the community *"They did not make drains at that time so that is why the area got flooded"*. Community participants were asked to elaborate on their specific belongings that were affected by the floods.

People's clothes and shoes were wet. The community had its food spoilt by the rain; Blankets were wet due to water that entered the house. There was low-level water at some parts of Bramfischerville. The heavy rains stopped people from going out of the house. Some household members in Bramfischerville caught influenza after the flood. Other respondents argued that they didn't have anywhere to pass because the water was all over their yards and the streets after flooding. A different view held by the respondents is that they could walk but it was difficult, because of the poor road infrastructure in the area.

This study found that people's food becomes impacted in the flood thereby living them hungry. Similarly; Gadain *et al*. (2016) found that after the El Niño event in Kenya that caused severe flooding made the food intake of people to decrease by destroying crops and causing diseases. The result of the decrease in the food intake was that diseases were acquired by the people. However, no respondent in the sample of this research on the 2009 floods reported any deaths or heard of any death related to diseases caused by floods from neighbours during the flood days.

Regarding early warning system, respondents were asked the question whether they receive any early warning systems from the municipality and given a yes or no option to answer (see Table 2) below.

Table 2: Early warning system

Yes	No
0	10

All interviewees from the community denied that they received an early warning from the municipality. They also didn't indicate whether there is any progress being made by the municipality recently.

Early warning system is very important because it reduces the impact of the floods on people livelihoods (Lumbrosso *et al*., 2016). Although the community was aware of the flooding possibility, they need to be warned on a regular basis by the CoJ is vital for their safety. According to municipal officials, the community is the first responder when they are affected by a flooding event.

The role of volunteers from the Non-Government Organisations (NGO) is to assist in the event where emergency relief is distributed to the affected people or the vulnerable community. Through the establishment of the Emergency Coordination and Planning Committee (ECPC) the officials are ready to teach communities about official flood warnings. This teaching has not yet been done by the ECPC. The strategy of the ECPC committee is to seek ward committee members to assist in teaching communities. The strategy of the ECPC is that they will train community members in order for them to pass information regarding actions and responses to be taken during a flood disaster.

The respondents were asked about their perceived flooding frequency in Bramfischerville from 2009. Several options were provided in a tick box to indicate the number of times that flooding occurs. Table 3 below gives the findings of the community's perceptions about flooding frequency in Bramfischerville.

Table 3: Flood frequency in Bramfischerville per year, over the last ten years

Frequency of Flooding in Bramfischerville	
Number of times floods occur in a year	Frequency in percentage of respondents perceptions
4.1 Once a year	50
4.2 Twice a year	0
4.3 Thrice a year	0
4.4 Four times a year	0
4.5 No flooding	0
4.6 Other (only during rainy season)	50

According to the responses, there are floods in Bramfischerville and 50% of the respondents perceived that they happen once every year. Respondent C said that during the rainy season the area of Bramfischerville used to be flooded, however, in this drought, there is no more flooding. There are different responses from the interviewees regarding the occurrence of floods in the area. Respondent D emphasized that floods occur many times and every year. Nonetheless, the South African Weather Services (SAWS) indicates that during the July 2009 until January 2010 Gauteng province received rain of 500-2000 mm (refer to Figure 15). This statement verifies the floods that impacted Bramfischerville in 2009 were associated with these rainfall patterns.

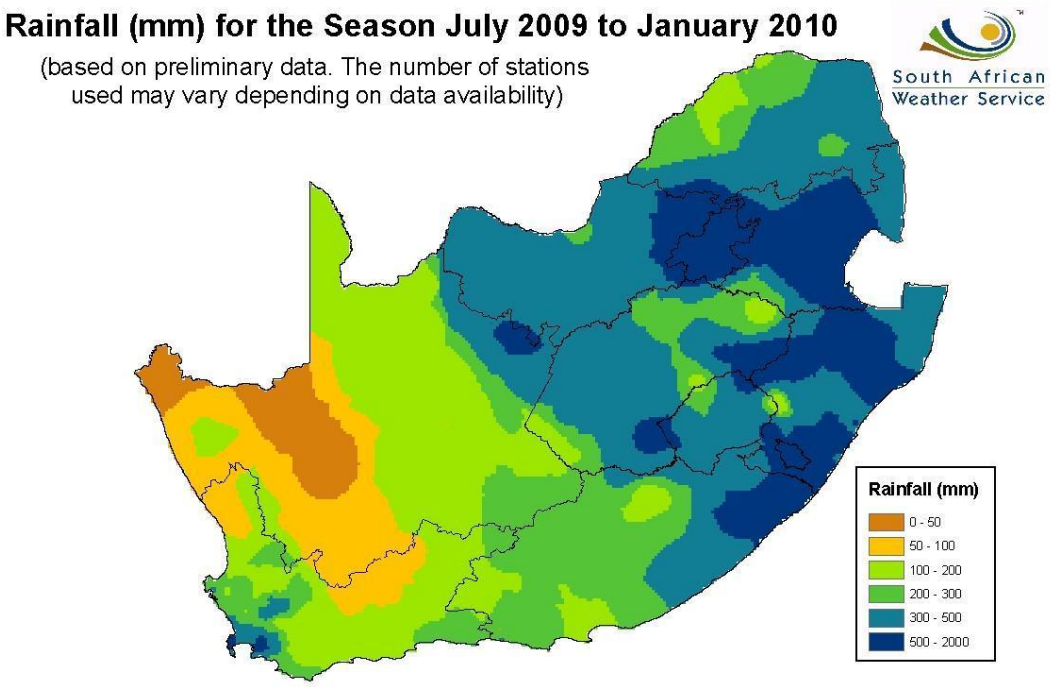


Figure 15: South African rainfall patterns 2009-2010

Source: SAWS Historical rain maps, 2009

Respondent E complained about the catchment system explaining that the poor drainage system and lack of appropriate pipes were responsible for the flooding. Floods do occur in Bramfischerville and the CoJ should stay alert at all times in order to minimise the damage that can occur.

4.6 CoJ flood preparedness, mitigation, response and recovery plans and their implementation in the 2009 floods of Bramfischerville

4.6.1 Preparedness and Mitigation

This section explores the city of Johannesburg readiness to deal with flooding in Bramfischerville. This study found that the CoJ had numerous awareness campaigns for dealing with floods prior 2009. The response given by all officials on the level of awareness of disaster risk was that the level of awareness by the community was very high at the time the floods occurred. These officials argue that the community was made aware through media channels such as radio and television about the possibility of flooding in 2009.

The information of risks from the people or level of risks is raised at a particular impact. Brody et al. (2009) found that contextual characteristics are determining the improvement of flood risk mitigation policies in US town of Florida. Disaster Management Policies that are relevant in Florida town might be irrelevant in Bramfischerville due to different contextual factors. The stakeholders in Bramfischerville should discuss their own applicable methods of mitigating floods.

Respondent L from the municipality argued that the South African Weather Service (SAWS) gives information about what is happening in areas around Johannesburg including Bramfischerville. The PRO of the department in areas around Johannesburg also speaks to media to alert people of a possibility of a flood disaster. Ward councillors in many areas had WhatsApp groups to inform the community about disaster events. However, in Bramfischerville the ward councillor on 2009 did not use any WhatsApp group to communicate with the residents about the possibility of a flood. A weakness of using SMS and WhatsApp is that in the case of a network failure the options of SMS and media sending warning signs would not work. Nevertheless, this was not the case in Bramfischerville flood situation. Another weakness of an SMS option is that in a community like Bramfischerville it is not easy to assume that people own cell phones. The interviewer asked respondents whether they had WhatsApp during 2009, the answer was no by all of them. However, recently almost all of the respondents have cell phones that have WhatsApp.

These research findings on Bramfischerville's flooding history revealed that the area did not experience floods of a high magnitude before 2009. The CoJ prepares a list of areas that are perpetually affected by floods based on previous flood occurrences. Respondent K from the municipality insisted that Bramfischerville did not have any mitigation, and response plans for floods before 2009 because it didn't belong in areas affected by floods according to the respondent. Surprisingly, the area was regarded as a low priority even though it was located in a wetland. After the 2009 floods, the Bramfischerville was also listed in the CoJ's areas affected by floods.

Municipal participants were asked about the availability of Disaster Management plans in the CoJ. The responses were that plans were there for the CoJ, a list of risks that are prevailing such as floods. There are both preparedness and contingency plans and strategies. The Emergency Management Services (EMS) argue that there is a total of four rainfall systems; i.e. Soweto, Alexandra, Ivory Park and Diepsloot. There is a service level agreement for the South African Weather Services that informs a directorate. With the information, the officials convey the message to communities using an SMS warning. This statement coincides with the assertion by O'Sullivan (2002) that SMS messaging is suitable for disseminating warnings in a crisis. However as alluded before in this research the assumption that all community members have cell phones by the CoJ officials, cannot be regarded as true.

Participants were asked to explain whether they have any strategies in dealing with floods at their homes. The community of Bramfischerville has its own preparedness strategies to minimize the flooding effects. The diagram below (Figure 16) shows some of the strategies the community embarks on in flood preparedness. These strategies work in assisting with flood mitigation according to the respondents.



Figure 16: Flood preparedness strategies by the community

Source: Picture was taken by N. Mkhulisa, 2016.

An example of flood defense mechanism by Bramfischerville community. The above pictures (Figure 16) show structural methods used by community members to mitigate the effects of floods. This aligns with the findings by Sene (2008) who identified a strategy of placing sandbags in the yard to protect properties during flooding can help reduce the impact and risk. However, Wong and Zhao (2001) stress the importance of non- structural measures in mitigating flood vulnerability. The non-structural measures include forecasting, flood insurance, and floodplain zoning.

4.6.2 Response and Recovery

Several entities such as government and NGO have assisted in the 2009 flood response and recovery in Bramfischerville. Interviews with CoJ officials reveal that the Red Cross (NGO) assisted in relief after the 2009 flood in Bramfischerville. The Red Cross provided food parcels, temporary tents and blankets were supplied to the affected people as a form of rehabilitation after the disaster. Interviewed community members concurred with the statements made by the CoJ officials that they received aid from the Red Cross (NGO).

Zuma et al. (2012) insist that local officials should be trained to handle disaster management at their municipalities by South African Local Government Association (SALGA). However, these officials have not received the training to date.

Respondent M from the municipality explained that there is work in progress for the unit of disaster management's Geographical Information System (GIS). Based on previous occurrences the evacuation plans will be developed in Bramfischerville. People need the training to read the evacuation maps otherwise, the maps would not provide intended assistance.

A strategy the CoJ embarked on as a solution to the flooding of 2009 in Bramfischerville was to relocate residents to Doornkop that were severely impacted by the floods. Figure 16 below shows remains of demolished houses due to floods of 2009 in Bramfischerville.



Figure 17: Relocation from Bramfischerville

Source: Picture was taken by N. Mkhulisa, 2016.

Figure 17 above shows houses that were demolished because of the flooding in Bramfischerville. Paul and Routray (2010) noted that people in Bangladesh

migrated to other places as an extreme coping strategy if they can't afford other means.The CoJ has spent money in building houses for people and they have to relocate people and build again. Disasters pose problems such as disturbance of development projects. Project failures cause a decrease in the economic development of the area. Floods are listed as the most prevalent type of disasters affecting the City of Johannesburg (CoJ, IDP: 2012- 2016). Social impacts such as trauma continue after a disaster.

Community respondents were asked to give their inputs about their knowledge regarding the municipality's disaster recovery work. There was a tick box in the questionnaire with yes and no options, respondents had to choose one. Table 4 below gives the responses on municipality disaster recovery provided by the participating community of Bramfischerville. This means that the community members give their personal experiences about the role of the municipality in disaster recovery during the 2009 floods in Bramfischerville.

Table 4: Community responses on knowledge about municipality's disaster recovery

Yes	No
50	50

The findings of this research show that half the respondents said that they were asked of their personal needs (i.e. shelter, food, clothes) in advance by the municipality whereas another half said they weren't asked anything. Another half of the respondents' clam that they were not asked about their personal needs in advance by the municipality. The following descriptions are the comments made by the community of Bramfischerville participants about their experience and knowledge of CoJ municipal disaster recovery actions in the 2009 floods.

"The Red Cross came and they gave us blankets. We built rooms to move away from the house that is collapsing. However, the officials asked us about the damages the rain has done and items that were destroyed. The municipal officials came and just checked and left. They asked us about a possibility of relocation to another place. Only those that were badly damaged received aid from the CoJ".

Overall the community respondents showed dissatisfaction with the assistance that was given by the CoJ during the 2009 floods. Disaster recovery did not reduce the negative flood impact as its mere role prescribes it to do (Joakim, 2011).

The community of Bramfischerville's respondents was asked whether they received any assistance from the CoJ during floods in their area. The question intended for understanding and evaluating the CoJ flood response effectiveness. Respondents had two options provided in a tick box that is yes or no.

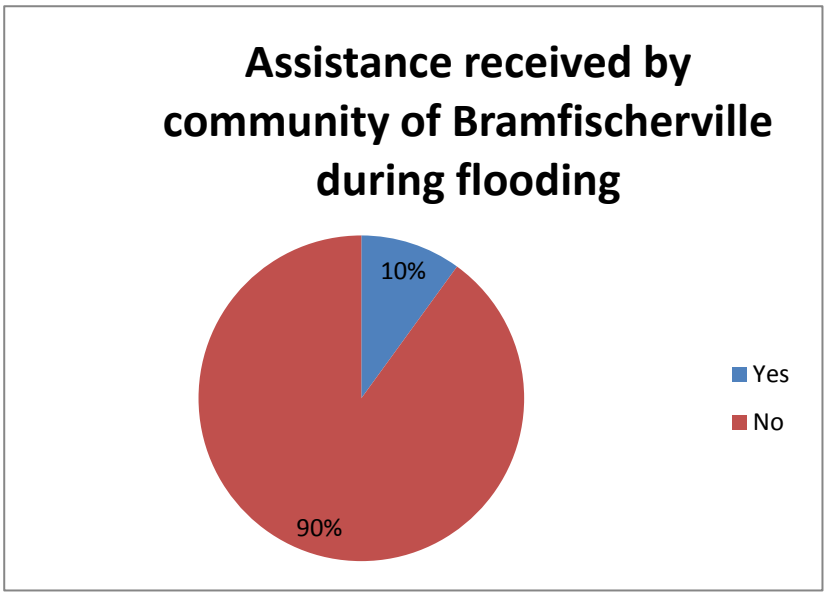


Figure 18: Flood assistance

Figure 18 above shows that 10% of the people say that they get help during floods in their area. Out of ten people interviewed nine said that they do not get help during floods in their area. Respondent F "Here you are on your own; you can't get assistance from anyone even the municipality". This clearly indicates that the people of Bramfischerville are being neglected by responsible officials of the CoJ. According to the NDMC, the people of Bramfischerville should have received assistance to deal with the floods. The assistance should have been in the form of funding the affected community by the national government and the municipality (NDMC, 2013). These grants are the Provincial Disaster Grant (PDG) and the Municipal Disaster Grant (MDG). These funds are there to fund infrastructure repairs and community shelter for the first 90 days of the disaster impact.

Contrary to the responses by participants in Bramfischerville; Linnekamp (2011) found that residents in low-income areas assist each other during floods. A resident said that the Red Cross offered assistance during floods in Bramfischerville.

After the 2009 flood disaster residents had an option to relocate to other areas such as Doornkop of Soweto, and Fleurhof on the main reef road. This research found that the move from Bramfischerville to other areas was initiated by the government for some residents. However, governments promise to relocate the houses built on the floodplain in Bramfischerville did not suffice.

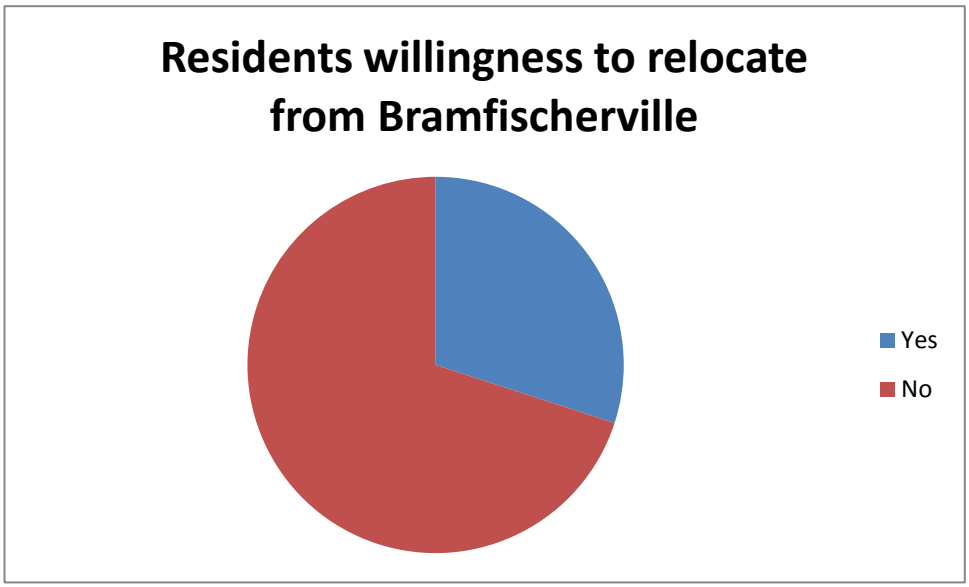


Figure 19: Relocation to other non-flooding areas

According to figure 19 above, seven out of 10 respondents were not willing to relocate to a non-flooding area. Only 3 respondents were willing to relocate to a non-flooding area. When asked about the time they wish to move the responses were the following. Respondent B said that he will only move when he is financially stable. Respondent C and F from the community both said that they are willing to move from Bramfischerville to a better area immediately. The reasons that community respondents gave for relocation are that Bramfischerville is on a floodplain and gets flooded often. Respondent G from the community said that she bought a house in Dobsonville, therefore, she will be moving soon. Respondent E from the community argued that his Bramfischerville house has no foundation and it is in bad shape after the 2009 flood disaster. Respondent H from the community

said that she will only move provided the CoJ told her and provide alternative accommodation. However, the urban land is congested due to increased urbanization so the movement of people will further increase possibilities of building in an inappropriate place.

4.7 Coping Strategies for Flooding

4.7.1Water Pathway



Figure 20: Flood coping strategies

Source: Picture was taken by N. Mkhulisa, 2016.

The Bramfischerville community has learned to devise their own coping strategies during a flooding event. The picture above (Figure 20) shows a path that has been dug after 2009 in order to redirect water flow outside of the yard to avoid flooding. In essence, this path represents an informal storm water drainage. According to the Disaster Management Act 52 of 2002 section 7(2b) 'the National Disaster Management Framework must establish prevention and mitigation as core principles of disaster management'. This research evaluates the implementation of prevention and mitigation strategies in reducing the vulnerability of the community to flood disaster in Bramfischerville. According to the Disaster Management Act 52 of 2002, prior to the flood event needs greater attention as compared to after the event. The act promotes the mitigation efforts done by the community of

Bramfischerville. Flood mitigation measures happen prior to the disaster, therefore, working harder at it minimises the disaster impact.

The community doesn't need to wait for the Disaster Management team and they can contact the City of Johannesburg through the ECPC committee. O' Sullivan *et al*. (2012) suggest that publicizing the roles of all stakeholders in flood risk management would assist them in classifying their responsibilities**.** The officials insisted that they use an open door policy and they work as a team ECPC and Disaster Management. This has been done subsequent to the 2009 floods. The role of community participation is a key principle in disaster management (Provincial Affairs and Constitutional Development, 1998). The collaboration of all stakeholders in attempting to hinder disasters in a community is paramount for survival (Kamanga *et al*., 2003).

When asked about the availability of resources in effectively dealing with flood disasters, the CoJ officials agreed that resources are well available. The CoJ has Emergency Management Services (EMS) that includes funds, equipment, and trained people for dealing with floods. In addition, the municipality has the South African Police Services (SAPS), 4×4 rescue teams and private rescue teams as part of the support structure. There is mutual assistance with all the NGO's, Community Post Offices' (CPO) and churches within the City of Johannesburg. The NGO's and churches mostly volunteer to give shelter and food to the flood-affected communities.

In a declared disaster all government entities are engaged to assist. The entities include the army, police, and firefighters that are engaged to assist any disaster situation. Furthermore, the entities assume their respective roles and specialization in assisting. The army and police would maintain law and order. Bramfischerville community respondents were given options with regards to their required assistance of flood coping strategies during the disaster times. A tick box was given and officials had to indicate their choices as strongly agree, agree (See Annexure D on appendices).

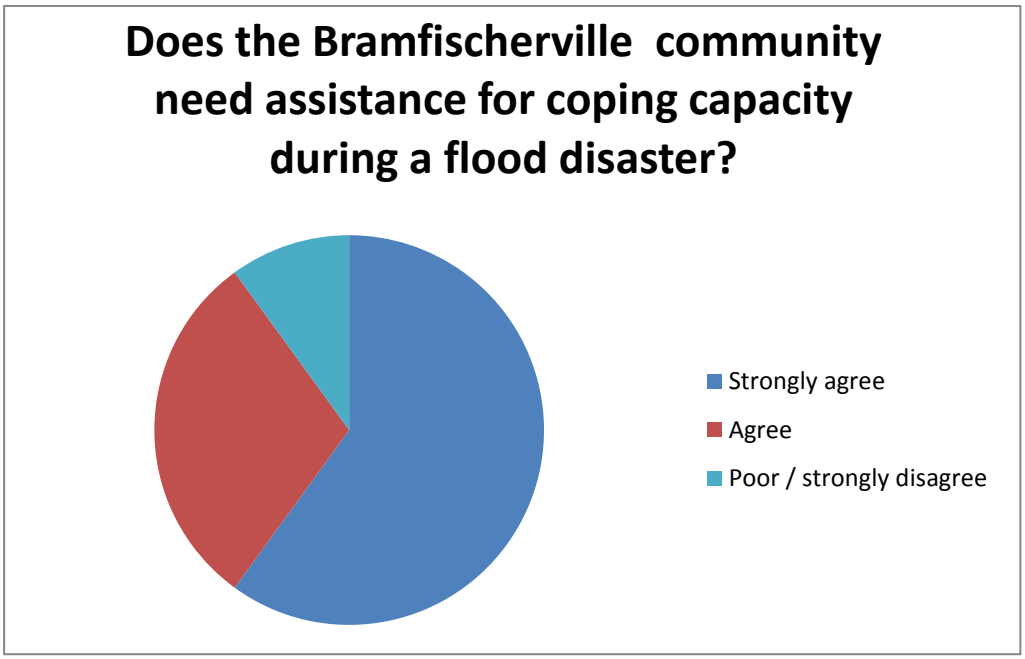


Figure 21: Coping capacity during flooding

The following responses were given by the community respondents regarding their views about assistance to cope with flood disaster.

Respondent D from the community said that they could manage on their own and they do not need any assistance from the government. It is rather a confusing statement because the same person cannot afford to replace household items that were damaged by the flood in 2009. Residents' need assistance with information to better cope with floods so that they know what to do when there is a disaster. Respondent B from the community said that flood assistance i.e. evacuation is needed for their survival and assisting children when there is a danger of flooding. However, respondent A from the community said that assistance with flood coping strategies is needed to assist neighbours when there are floods. These flood coping strategies are administered to people through education and capacity building (NDMC, 2013). Moreover, respondent E from the community emphasised that assistance with flood coping strategies is needed to avoid future unforeseen circumstances with regards to flood disasters. However, raising awareness and educating the community about flood disasters should be an ongoing process that should not end (*ibid*.).

Nonetheless, Dufty (2010) insists that communities should provide their own plans to deal with floods. The community can learn from other places and mimic their ways of tackling floods. People in Bangladesh villages stored their food in an area that is at a high elevation in the house to avoid floodwater from reaching the place (Paul & Routray, 2010). This strategy can be adopted by Bramfischerville residents that had their food spoilt because of the flooding.

When asked about the type of assistance that the Bramfischerville community requires the response was that there is a need for the supply of products. The products referred to by the community are the water pipes, food, and blankets to be provided by the CoJ. Furthermore, respondent E from the community said that the CoJ should rebuild the houses that were damaged by the floods. Respondent D from the community said that the CoJ should provide training on how to effectively deal with disasters for the people. This training can be advertised on media sites such as Television, Newspapers, Radio and the CoJ.

4.8 Conclusion

In this chapter data analysis, discussions of findings and study results have been presented. Findings from this study have been found to be consistent with related studies on flooding and Disaster Management. Data findings were described themes to the study variables and presented as tabulations and graphs.

The severity of a flood disaster was mostly felt by poorer households because they took longer to recover from the flood damages. Similarly, Musyoki *et al*. (2016) suggest that poorer households were most vulnerable to flooding impact in Thulamela municipality than the richer households. A house of one of the respondents still has cracks that were caused by the 2009 floods. The cost of repairing the damage is above the household's power because she is unemployed only dependent on social grants from the government.

In the next chapter, the conclusion on the evaluation of CoJ's Disaster Management officials on the 2009 flooding in Bramfischerville and the recommendations for further research will be presented.

Chapter 5: Conclusion and Recommendations

This research argues that the state of Disaster Management in Bramfischerville prior to, and after the 2009 flooding remained unchanged. The community of Bramfischerville continues to stay in a flood-prone area. This research finding asserts that after 2009, Bramfischerville continued to experience flooding and it forms part of disaster-stricken areas of the CoJ.

This study found that flooding in Bramfischerville is caused by heavy rainfall, poor drainage system, and an area being built on a floodplain. Flooding cannot only be framed on urban development, which means that CoJ officials are unaware of the changes needed to avoid climate change impacts of the future. CoJ EMS respondents outlined the 2009 flood event of Bramfischerville in terms of extreme weather that was unusual. The CoJ EMS officials claim that the 2009 flood event was an abnormal sudden change in climatic conditions and was not expected. There is no evidence that the situation is likely to recur, nonetheless, the CoJ EMS should be prepared in the future.

This research found that Bramfischerville community could not perform their daily chores for approximately three days during the flooding of 2009. The Bramfischerville streets were flooded, thus limiting the community's mobility in the area. Floods also caused severe damage to the livelihood of the people by destroying their homes physically and making food items (such as mealie meal) wet, and unusable.

The vulnerability of the community to flood disasters is high because they lack preparedness and mitigation strategies to respond to future flooding in Bramfischerville. Furthermore, the vulnerability of people to flooding is due to inadequate resources for dealing with flooding, and lack of information regarding strategies for dealing with floods. There is an increase in the vulnerability of Bramfischerville community to flooding disasters, especially those staying on a floodplain.

The community of Bramfischerville has a significant role to play in DM of the CoJ. The findings of this research suggest that the community of Bramfischerville played

a passive role in disaster preparation and mitigation of the 2009 floods. Most community members argue that they did not take part in Disaster Management activities in their area. Furthermore, some community members were not even aware of the function of DM and its duty for them. This research found that most residents require the municipality to play a leading role in providing flood assistance. However, it would be better for the municipality and the community to play a collaborative role in DM.

The community's suggested contribution from the municipality during a flood disaster is through the provision of food, fixing damaged infrastructure, and blankets. Moreover, the community suggested that the municipality should offer training related to ways of dealing with flood effects. The training from the municipality would assist the community to better cope with flooding in the future. Similarly, Diagne (2007) researched about flooding in Senegal (Saint Louis) and found that local stakeholders are required to be engaged in the process of solving problems.

The findings of this research show that the community of Bramfischerville has preventative plans of tackling future flood disasters. The initiatives for the community of Bramfischerville have taken include the building of water path to allow water to flow out of their yards during rain. The community also built a barrier in front of their doors with bricks to prevent water from entering their houses when it rains. Nevertheless, these initiatives are not sufficient and more strategies for dealing with floods have to be taught to the community.

In 2009, Disaster Management legislation (e.g. Disaster Management Act 52 of 2002) was in place in the CoJ, however, their implementation was inadequate. This study has shown that Bramfischerville is still prone to flooding and there is still a great improvement to be made in implementing the disaster management policies by the government.

The government, in this case, the CoJ has been unable to effectively teach the Bramfischerville community about the strategies to cope with flood disasters. This research has revealed the need for CoJ to better interact with the poor

Bramfischerville community in effective flood disaster management. The way the CoJ used to communicate and interact with the community of Bramfischerville should be altered to better comprehensive ways. The CoJ officials should provide the community of Bramfischerville with training in order for them to acquire the necessary skills to minimize their vulnerability to flooding. In addition, the study suggests a collaborative top down and bottom up approach in dealing with flood disasters (Borga *et al*., 2011). Both the community and the CoJ officials should participate and provide strategies of effective flood disaster management.

5.1 Area for further research

Research can focus on the success and failures of municipality and community in mitigating floods in Bramfischerville. Research can focus on survival of people in Bramfischerville living on a floodplain, after heavy rains in the next 5 years. Furthermore, the role of community in flood disaster management needs to be researched in the future. In addition, research can look at the effects of floods in people's houses more broadly and livelihoods in the coming years. Moreover, research can delve into how stakeholders can better organise their collective efforts, community-based initiatives, and knowledge sharing to curb floods.

5.2 Recommendations

The municipality should be cautious of areas they allow people to stay at, thorough surveys should be done to ensure that the area is not prone to disasters. Quantitative data is needed to provide a number of households affected by future floods. Padi *et al.* (2011) suggested that floodplain mapping is a strategy that can be used to discourage people from settling in flood prone areas. The CoJ can use floodplain mapping as a strategy to educate the people of Bramfischerville about the risk of staying in the area. However, it is not their choice to settle in flood-prone areas they are restricted by projects and constrained choices available to them

5.3 Conclusion

Bramfischerville has been affected by flash floods in 2009 due to heavy rain, poor stormwater drainage systems, and the housing area being built on a floodplain. This study has described issues of urban flooding and found that human impact and governments' lack of policy implementation is amongst the major contributors to

the community's vulnerability to flooding. However, policy implementation can only be achieved through strategic collaborations with civil society.

According to the Emergency Management Services (EMS) officials, the Disaster Management division was ready to deal with floods of 2009. The EMS officials' further claim that they utilized the media (radio) to announce to people that there is a possibility of flooding in 2009. The work that was done by the CoJ officials during the 2009 floods in Bramfischerville needs to be reviewed so that it can correlate with the DM policy's intentions. There is a discrepancy between the claims made by the community and the responses given by the CoJ officials regarding the city's role in the 2009 flood assistance in Bramfischerville.

Communities are not helpless victims of floods; rather they have some strategies to minimize the damage that might be caused by the disasters. Community's strategies to mitigate floods should be prioritized in disaster management plans for the municipality. The CoJ municipality together with all relevant stakeholders should empower the community of Bramfischerville in addressing their vulnerability to floods. The state of Disaster Management of Bramfischerville in 2009 was ineffective and unorganized. This study found that most respondents claim that there was no early warning system in place and they had received nothing from the CoJ during and after the floods. This research found that Disaster Management officials were reactive to the 2009 flood disaster in Bramfischerville. These study findings suggest that cooperation between CoJ officials and community of Bramfischerville would be of great importance in effectively dealing with future flood disasters. In addition, resilience and preparedness need to be reinforced for effectiveness and community needs to be made aware of available mitigations to curb disasters.

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Appendices

Annexure A

Bramfischerville in the context of Gauteng province



Source: GOOGLE MAPS 2017

Annexure B

List of Interviewees

Interviewee	**Date**
CoJ Emergency Management Services	
Bramfischerville community members including ward councilor	

Annexure C Ethics Clearance

SCHOOL OF ARCHITECTURE AND PLANNING
HUMAN RESERCH ETHICS COMMITTEE

LETTER OF ACKNOWLEDGEMENT
PROTOCOL NUMBER: SOAP43/18/05/2016

PROJECT TITLE:	Evaluation of Disaster Risk Management in Flood Prone Areas: A Case Study of Braamfischerville.
INVESTIGATOR'S:	Nhlanhla Mkhulisa (Student No. 0600124N)
SCHOOL:	Architecture and Planning
DEGREE PROGRAMME:	MSc Development Planning
DATE CONSIDERED:	18 July 2016
DECISION OF THE COMMITTEE:	Retrospective acknowledgement granted

CHAIRPERSON _____
(Professor Daniel Irurah)

DATE:

cc: Supervisor/s: Brian Bosh off

DECLARATION OF INVESTIGATORS
I'We fay understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to endure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

Signature **Date**

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Annexure D Questionnaire

RESEARCH QUESTIONS

Community members affected: Bramfischerville

1. How long have you stayed in this area?

1.1 Less than a year	
1.2 Two years	
1.3 Five years	
1.4 10 years	
1.5 More than 10 years	

2. What prompted you to come and stay in this particular area?	
2.1 To be next to work and school	
2.2 To be next to relatives and friends	
2.3 It is cheaper to stay here	
2.4 To have my own place and not stay with parents	
2.5 I had nowhere to go	
2.6 Other (specify)	

3. Do you experience flooding in your area?

3.1 Yes	
3.2 No	

4. How frequent is flooding in your area?

4.1 Once a year	
4.2 Twice a year	
4.3 Thrice a year	

4.4 Four times a year	
4.5 No flooding	
4.6 Other (specify)	

5. What causes floods in your area?

5.1 Heavy rains	
5.2 Bursting of a dam	
5.3 Overflowing river	
5.4 Built on floodplain	
5.5 Don't know	
5.6 Other (specify)	

6. How were you most affected by the floods?

_____

_____

_____

_____

7. What did you need most?

_____

_____

_____

_____

_____

_____

8. What did you actually receive?

_____

_____

_____

9. Were you asked about your needs in advance?

_____

_____

_____

_____

_____

10. Do you get help during floods in your area?

10.1 Yes	
10.2 No	

11. If yes, who do you get help from?

11.1 Neighbours	
11.2 Relatives	
11.3 Friends	
11.4 Local Municipality	
11.5 NGOs	

12. Do you manage to do your everyday chores during floods?

12.1 Yes	
12.2 No	

13. Give reasons for your answer in 12.

14. Do you manage to go to shops, clinics, schools during flooding days?

14.1 Yes	
14.2 No	

15. Give reasons for your answer in 14.

16. Were you warned that the area gets flooded before by the municipality?

16.1 Yes	
16.2 No	

17. Are you planning to move to a non-flooding area?

17.1 Yes	
17.2 No	

18. If you are planning to move, when can that be?

18.1 In less than 1 year	
18.2 In two years' time	
18.3 In three years' time	
18.4 In four years' time	
18.5 Immediately	

19. Why are you planning to move?

_____

_____

_____

_____

20. How are you planning to move?

_____

_____

_____

_____

_____

_____

21. Do you actively participate in the Disaster Management activities?

a) Strongly Agree	
b) Agree	
c) Moderately agree	
d) Average/awareness very low	
e) Poor / strongly disagree	

22. Do you need further assistance for capacity building of community (to cope with Disasters?

a) Strongly Agree	
b) Agree	
c) Moderately agree	
d) Average/awareness very low	
e) Poor / strongly disagree	

INTERVIEW QUESTIONNAIRES MUNICIPAL OFFICIALS (City of Johannesburg)

NAME: _____

POSITION: _____

GENDER: _____

YEARS OF EXPERIENCE: _____

EXPERTISE: _____

DISASTER PREPAREDNESS

(a) Do you have plans in place? For example, Preparedness, Emergency or Contingency plans and strategies for floods? If not, why not?

_____

_____

_____

_____

_____

_____

(b) Do you have any prevention measures in place in terms of mitigating the floods?

_____

_____

_____

_____

_____

_____

(c) Does your organizational structure provide for disaster management?

_____

_____

LEGISLATION

(d) Does your IDP, Service Delivery and Budget implementation Plan cater for disaster management issues?

AWARENESS

(e) Are there any awareness campaigns done? How effective are they, in terms of risk reduction?

(f) Does Bramfischerville have the history of floods? What has the municipality done to instil awareness?

(g) What is the level of awareness of disaster risk factors at the community level?

i) Low	
ii) High	
iii) Not existing	
iv) Other	

(h) What percentages of vulnerable areas have evacuation plans/maps?

i) All	
ii) None	
iii) Half	
iv) Other (specify)	

(i) Does topography perpetuates the floods in Bramfischerville?

_____

_____

_____

_____

PLANS

(j) Are there any mitigation, prevention and response plans for floods? Explain.

_____

_____

_____

_____

_____

(k) How can collaboration between the government and external players be enhanced?

_____

_____

_____

(l) What are the means of communications? (e.g. radio, normal phone lines). How dependable are these communication means?

_____

_____

_____

_____

_____

_____

RESPONSE

(m) Do you have enough resources for rescue? For example, funds, equipment, support, and trained people for floods.

_____

_____

_____

_____

(n) Do you have any intergovernmental relation (for example stakeholders, private sectors and businessmen) that provide aid during and after a disaster has occurred?

_____

_____

_____

_____

_____

(o) Which governmental entity has the mandate of assisting during a disaster?

Army	
Police	
Fire Fighters	
Other (Specify)	

INVOLVEMENT OF COMMUNITY IN DISASTER MANAGEMENT

(p) What is the community involvement; role played by the volunteers and the community during the floods?

_____

_____

_____

_____

_____

(q) How ready are communities to understand official warnings and react?

_____

_____

(r) What are the areas to be improved for better relationship between community and Disaster Management Team?

_____

_____

_____

_____

Annexure E Consent Form

Consent Form

Please indicate consent to the following statements by ticking yes or no.

I have read, or have had read to me, and I understand the Participant Information Sheet.	Yes ☐ No ☐
I have had the opportunity to use a legal representative, family support or a friend to help me ask questions and understand the study.	Yes ☐ No ☐
I am satisfied with the answers I have been given regarding the study.	Yes ☐ No ☐
I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time.	Yes ☐ No ☐
If I decide to withdraw from the study, I agree that the information collected about me up to the point when I withdraw may continue to be processed.	Yes ☐ No ☐
I agree to be audio recorded, during an interview.	Yes ☐ No ☐
I understand that my participation in this study is confidential and that no material, which could identify me personally, will be used in any reports on this study.	Yes ☐ No ☐
I know who to contact if I have any questions about the study in general.	Yes ☐ No ☐
I understand my responsibilities as a study participant.	Yes ☐ No ☐

Declaration by the participant

I hereby consent to take part in the study

Participant's name _____

Signature _____

Date _____

Declaration by the researcher

I have given a verbal explanation of the research project to the participant, and have answered the participant's questions about it. I believe that the participant understands the study and has given informed consent to participate.

Researchers name _____

Annexure F Audio Recording Consent Form



AUDIO RECORDING CONSENT FORM

CONSENT TO AUDIO- OR VIDEO RECORDING & TRANSCRIPTION

(STUDY NAME): Evaluation of Disaster Risk Management in Flood Prone Areas: A Case Study of Bramfischerville.

(RESEARCHER'S NAME & AFFILIATION): Nhlanhla Mkhulisa

University of the Witwatersrand Johannesburg

This study involves the audio or video recording of your interview with the researcher. Neither your name nor any other identifying information will be associated with the audio recording or the transcript. Only the researcher will be able to listen to the recordings.

The tapes will be transcribed by the researcher and erased once the transcriptions are checked for accuracy. Transcripts of your interview may be reproduced in whole or in part for use in presentations or written products that result from this study. Neither your name nor any other identifying information such as your voice will be used in presentations or in written products resulting from the study. By signing this form, I am allowing the researcher to audio me as part of this research. I also understand that this consent for recording is effective until the following date: _____.

On or before that date, the tapes will be destroyed.

Participant's Signature: _____Date: _____