

**THE HAZARD OF SINKHOLE FORMATION IN THE CENTURION CBD  
AND SURROUNDING AREAS: PRETORIA, GAUTENG**

By

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Submitted in partial fulfilment of the requirements for the degree

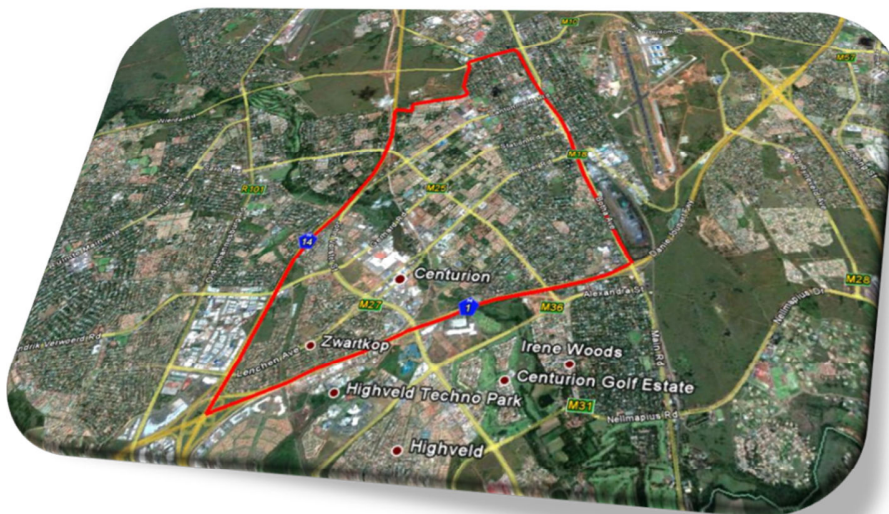
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## ABSTRACT

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*The greater part of land in the area south of Pretoria is underlain by dolomite from the Chuniespoort Group of the Transvaal Supergroup. In South Africa dolomite rock has a notorious reputation for the formation of sinkholes and subsidences. Thousands of people reside and work in the Centurion area, where numerous sinkholes have occurred causing damage and in some instances loss of property. Centurion has rapidly densified over the last 40 years. This study deals with the hazard of sinkhole formation in the Centurion CBD and surrounding area as well as comparing the Method of Scenario of Supposition by Buttrick and van Schalkwyk (1995) based on an 'abused' land use situation to this 'managed' area in Centurion.*

*Various classification systems have been proposed since the 1970's in an attempt to evaluate the stability of sites on dolomite in South Africa and a summary of each are provided in the dissertation. The classification system that is currently used in South Africa is the method proposed by Buttrick (1992) which is known as the Method of Scenario Supposition.*

*A total of 119 sinkholes have been recorded in the Centurion CBD area since the early 1970's. Three lives have been lost as a result of a sinkhole in the area and a total of seven houses or units had to be demolished.*

*Draft guidelines for allocation of each hazard class has been developed, which is referred to as the proposed 'Modified Method of Scenario Supposition'. This is mainly based on the dolomite bedrock depth and the mobilization potential of the overlying horizons. Eight Inherent Hazard Classes are present which classify an area into having a low, medium or high hazard of sinkhole formation. After each borehole was assigned its specific inherent hazard class, the information was recorded in ESRI ArcGIS<sup>®</sup> software. The Spatial Analyst<sup>®</sup> extension of ArcMap<sup>®</sup> was used to create a map showing the areas of low, medium and high hazard of sinkhole formation. The map generally indicates a medium to high susceptibility to sinkhole formation in the Centurion CBD area with pockets of low hazard areas. This hazard map was then used to make recommendations for each of the eight Inherent Hazard Classes on suitable development types as per the draft SANS 1936-1:2012 guidelines.*

*Various methods are used to calculate the hazard of sinkhole formation using data such as the historical occurrence of sinkholes, geological information and the hazard map. These results are used to compare this 'managed land' to the 'abused land' scenario used by Buttrick and van Schalkwyk (1995). Overall, the hazard for sinkhole formation in the Centurion CBD area does not correlate well with the method proposed by Buttrick and van Schalkwyk (1995). According to the anticipated number of events by Buttrick and van Schalkwyk far more sinkholes should have occurred in the high hazard areas. In contrast, the most sinkholes in the Centurion CBD area occurred in the areas classified as having a medium hazard for sinkhole formation.*

## DECLARATION

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I, ANNA CATHARINA OOSTHUIZEN declare that the thesis / dissertation, which I hereby submit for the degree M.Sc. Engineering & Environmental Geology at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

**SIGNATURE:** .....

**DATE:** .....

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## LIST OF ABBREVIATIONS

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CBD	-	Central Business District
CGS	-	Council for Geoscience
CTMM	-	City of Tshwane Metropolitan Municipality
GIS	-	Geographic Information Systems
IHC	-	Inherent Hazard Class
Mamsl	-	Metres above mean sea level
PDS	-	Potential Development Space
SANS	-	South African National Standard