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

By

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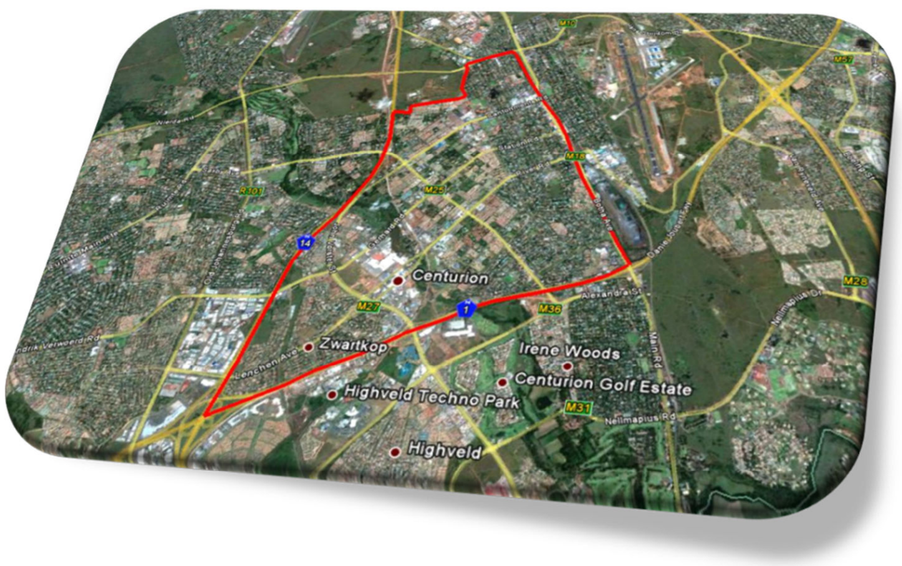

ABSTRACT

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® software. The Spatial Analyst® extension of ArcMap® 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

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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I would like to thank the following:

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LIST OF ABBREVIATIONS

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

1. INTRODUCTION

1.1. Background

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. Current standard practice is to execute a geotechnical investigation on all dolomitic land earmarked for development, whether it is residential or commercial.

As part of the Council for Geoscience's mandatory role to assist government authorities, the Dolomite Section has been involved in the field of sinkhole risk evaluation since the early 1970's in assisting local authorities such as the City of Tshwane Metropolitan Municipality (CTMM), to ensure safe development on dolomite.

Most of the dolomite stability reports that are produced for residential / commercial development in the Tshwane Municipal area are submitted to the Council for Geoscience (CGS) where they are stored in the National Dolomite Databank. From the available Dolomite Stability Reports that have been submitted to the CGS over the last 30 years, it is apparent that hazardous conditions exist in the Central Business District (CBD) area of Centurion, Pretoria. Centurion has rapidly densified over the last 40 years, as it has become a residential midway between Johannesburg and Pretoria. The Gautrain train route now traverses across the Centurion CBD area, and the Centurion Station being situated in West Street, has attracted high rise developments to this area. This will lead to an increase in the population which results in an increase in road traffic and density of people per hectare in this area. Plate 1 shows the Centurion CBD area, with the Centurion mall, the Gautrain station and commercial developments in this area. Plates 2 and 3 illustrate the densification that has already taken place in the Die Hoewes and Lyttelton residential areas over the past 40 years. CTMM actively supports and propels higher densities in the Centurion CBD area which has required the CGS to evaluate the sinkhole risk associated with this increase in development densities.

The large amount of information available in the Centurion CBD area, particularly in digital formats, meant that a first order sinkhole hazard analysis could be attempted.

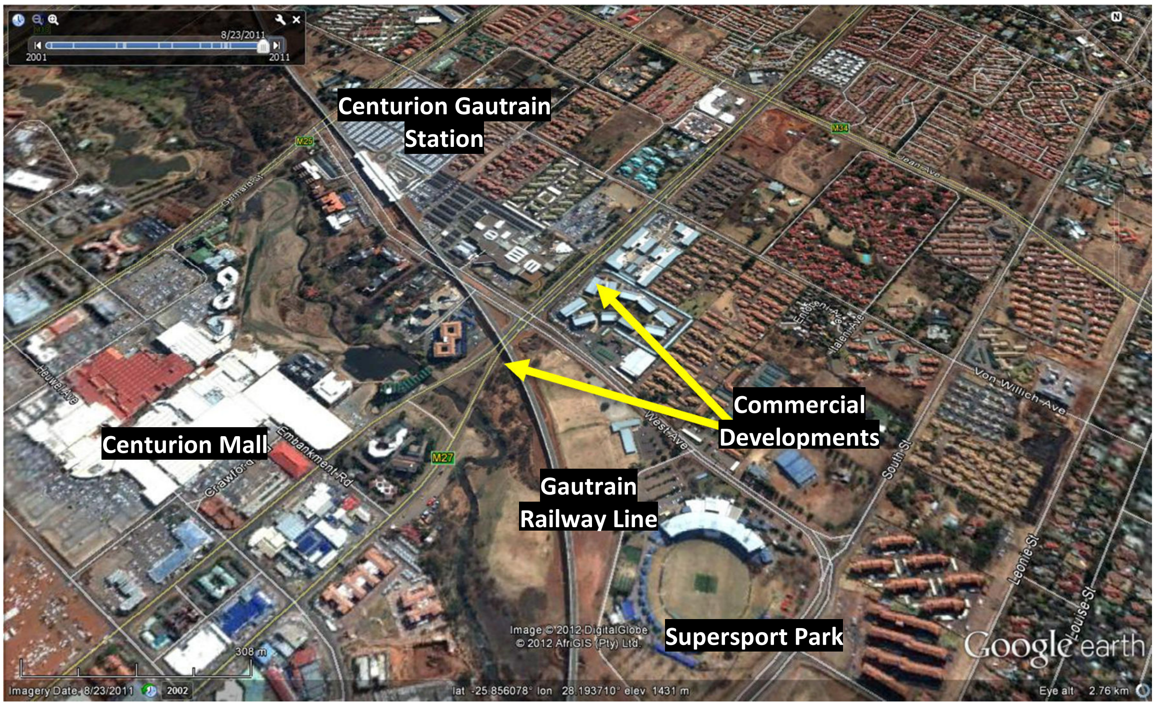


Plate 1. The Centurion CBD area (from Google Earth)

Plate 2. Lyttelton during the 1950's (from the Record Newspaper)

Plate 3. Lyttelton Manor Extensions during 2012 (from Google Earth)

The current method used in determining the hazard[1] for sinkhole formation in dolomitic areas is the *Method for dolomite land hazard and risk assessment in South Africa*, as described by Buttrick et. al (2001). The methodology and origin of this method will be explained later in Section 3.9 of this dissertation. Buttrick and van Schalkwyk (1998) indicated that this method was developed before the concept of appropriate development and compulsory precautionary measures were introduced and it is therefore assumed in their methodology that the land use is considered as being 'abused'. The Centurion CBD and surrounding areas, on the contrary, cannot be considered as abused land, since precautionary measures and specific foundation designs have been introduced over the majority of the area, and this is therefore considered as 'managed' land.

1.2. Problem Statement

The Centurion area has been known to be vulnerable to sinkhole formation. With the Centurion CBD and surrounding areas being rapidly densified, in terms of commercial and residential development, the Centurion CBD sinkhole occurrence will increase, leading to injury and damage. This could have an adverse effect on the confidence of this area. In order to enable CTMM to guide safe development in Centurion, areas where a high hazard of sinkhole formation exists need to be identified and appropriately managed. However, at present the CGS reviews

[1] *Hazard is defined as a potential source of danger (Oxford Dictionary).*

development proposals in the Centurion CBD area without having a broad overview of the geological conditions of the area.

This study will be used as a tool for staff of the CGS to make a quick assessment of the type of conditions that are present in the immediate vicinity of the particular site to be developed.

Sinkholes have led to the demolishing of houses, damage to infrastructure and vast amounts of Rands spent on repairing in the Centurion CBD and surrounding areas. Plate 4 shows one of the events that have occurred. This subsidence (S100) affected several units in this residential complex, and access for the residents living in this complex was affected, two units have subsequently had to be demolished.

Plate 4. A 15 m diameter subsidence in a residential complex (S100)

1.3. Study Objective and Aims

The main objectives of the study are as follows:

- To undertake a literature study on dolomite in the Centurion area.

- The classification of the dolomite in terms of low to high hazard (according to Buttrick et. al (2001)) and the occurrence of sinkholes. Provide a map where the hazard of sinkhole formation is indicated in the Centurion CBD and surrounding areas.

- Compare an 'abused' land use scenario, used in the Buttrick et. al (1995) classification system, against the more controlled, managed Centurion CBD and surrounding areas.

- Make recommendations regarding the suitability of land usage based on the hazard of sinkhole formation, as stipulated in the draft SANS 1936-1:2012.

1.4. Study Area

CTMM demarcated the Centurion CBD area, as John Vorster road in the south, Jean Avenue in the north, the N1 highway in the south-east and South Street in the east (Figure 1). Since development and densification is not only limited to the CBD area the immediate surrounding areas were also included in this study. The study area is thus bounded by Trichardt Road in the north, Botha Avenue in the east, the N1 highway in the south and the N14 highway in the west (Figure 1).

Various suburbs form part of the study area:
- The area south of John Vorster Drive towards the southern corner of the study area is known as Zwartkop;
- The area north-east of John Vorster Drive and the Hennops River is known as Centurion;
- The area north-east of the Hennops River up to North Street in the north, Clifton Street north-east and Leonie Street in the east is known as Die Hoewes or formerly as Lyttelton Agricultural Holdings (some areas are still known as the Lyttelton Agricultural Holdings);
- The area east of Leonie street up to the N1 Highway and bounded by Botha and Limpopo Streets east and north respectively, is known as Doringkloof;
- The area north of Limpopo Street, east of Clifton Street, and south of Trichardt Street up to the boundary of the study area is known as Lyttelton Manor.

In this dissertation the study area as delineated above, will collectively be referred to as the Centurion CBD area.

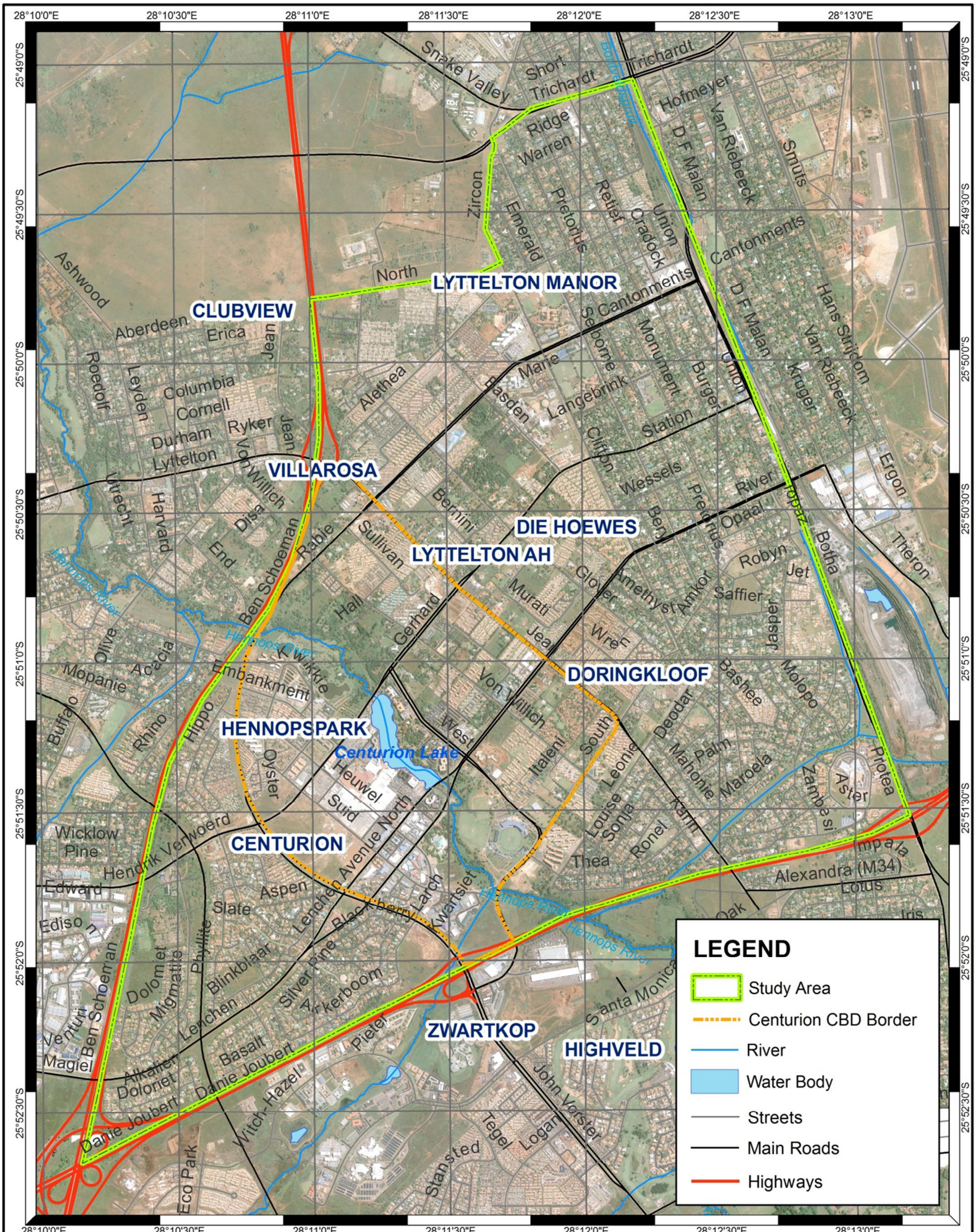


FIGURE 1: LOCALITY OF THE CENTURION CBD AND SURROUNDING AREAS

The Centurion CBD and surrounding areas covers a surface area of approximately 1 657 hectares. The area is relatively flat and is gently sloping towards the Hennops River, which cuts thought the middle of the Centurion CBD area. The surface elevation of the area varies between 1410 metres above mean sea level (mamsl) in the area of the Hennops River valley, to 1497 mamsl in the area of Basden Street (Lyttelton Agricultural Holdings) in the north as well as in the area of John Vorster Drive in the south.

The majority of the Centurion CBD and surrounding areas has been developed, with commercial developments dominating the area around the Centurion Lake and residential development present towards the outskirts, as revealed on the aerial photo in Figure 1.

1.5. Available Data

The following data are available within the Centurion CBD area:

- *Dolomite Stability Reports*: The Dolomite Stability Reports, falling within the delineated area, were extracted from the National Dolomite Databank. Their report boundaries and borehole positions had already been plotted on the CGS Geographic Information Systems (GIS) database.

  A total of 555 dolomite stability reports are situated within the Centurion CBD area (Figure 2) and a list of the available Dolomite Stability Reports is attached in Appendix A.

- *Percussion Borehole Logs*: Percussion boreholes are generally drilled as part of the dolomite stability investigations which forms the basis of the Dolomite Stability Reports. A total of 3587 percussion borehole (Figure 2) profiles are available from the Dolomite Stability Reports within the Centurion CBD area and its immediate surrounds. A list of all the boreholes in the Centurion CBD area is provided in Appendix B.

- *Gravity Survey*: The only available usable gravity survey is limited to the Lyttelton Agricultural Holdings i.e. the northern side of the Hennops River and was obtained from a report by Dr. B.H. Relly (Geological Report on the Stability of the Lyttelton Agricultural Holdings – A General Study of a Dolomite Area, 1976). The gravity survey contained in this dissertation is a Bouguer gravity map produced on a 45 m grid which as Dr. Relly indicated, is at 50% of the standard spacing (30 m) for township development projects. This Bouguer gravity information was converted into a Residual gravity layer by Africon (Pty) Ltd as part of the initial

Gautrain investigations, and was made available to the CGS. The map was digitally converted and added as a layer in the GIS (Plate 13).

Gravity surveys are usually conducted as part of the site investigations for each site. Approximately 500 separate gravity surveys were undertaken as part of the dolomite stability investigations available. Due to these gravity maps not being uniform (i.e. different scales, different geophysicists who conducted the study, some in Bouguer format, others in Residual format) and not covering the entire area, these were excluded in this study.

- *Sinkhole Data*[2]: The sinkhole data has been sourced from different sources. The CGS has captured a number of sinkholes in the area. A sinkhole database in the form of an Access database was created by the consultancy firm BKS for CTMM in the early 2000's. CTMM has also recorded a number of sinkholes in the area which was made available. A number of private consultants (engineering geologists) have also reported sinkhole events to the CGS. A record of the sinkhole events are presented in Appendix C.

- *Aerial Photos*: Aerial photos obtained from the Department of Housing, taken during 2004 at a scale of 1:5 000 were used as the background layer in GIS.

All the data is available in ArcGIS®.

2 It should be noted that the sinkhole information is very sensitive and this could not be made available to the general public.

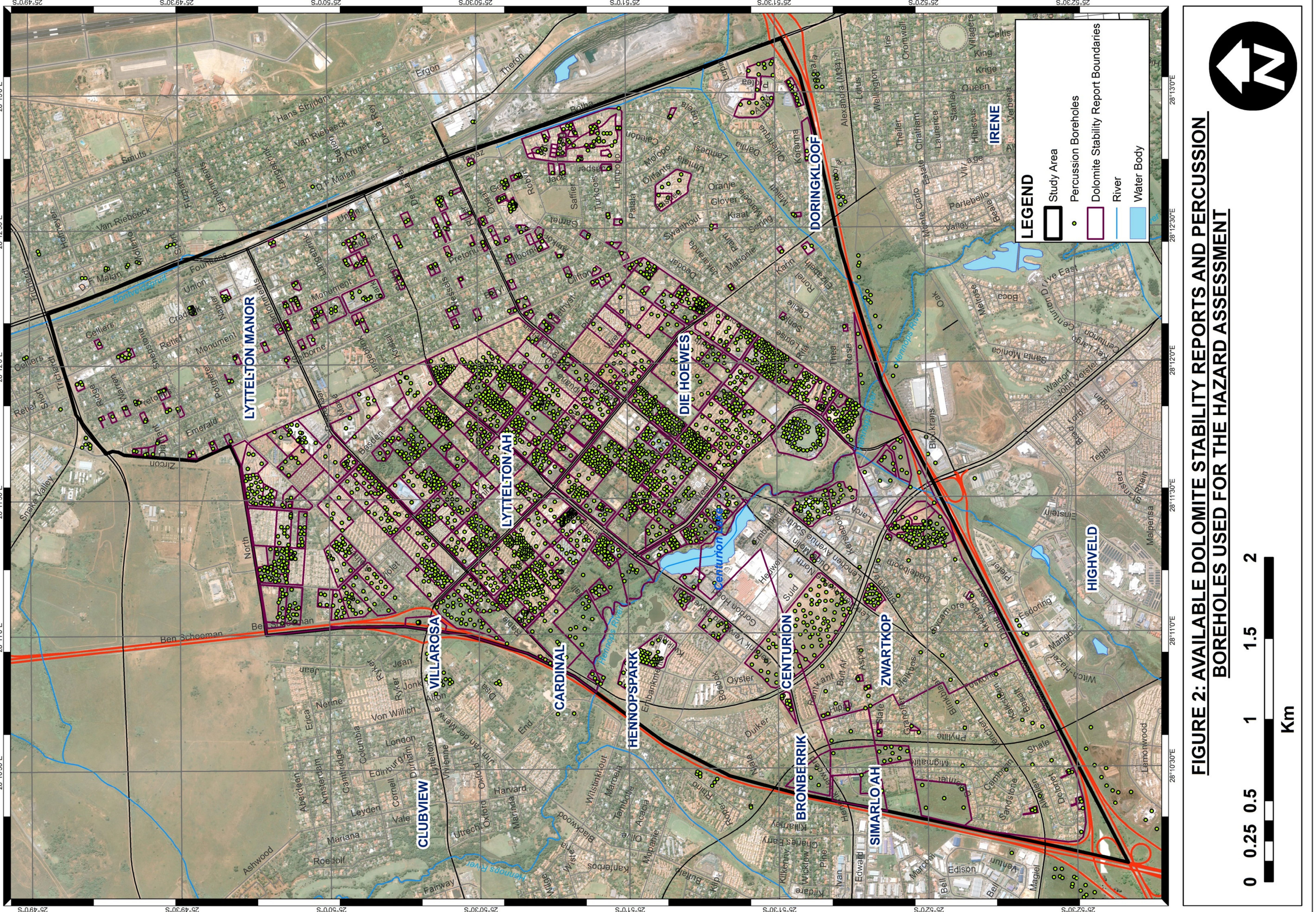


FIGURE 2: AVAILABLE DOLOMITE STABILITY REPORTS AND PERCUSSION BOREHOLES USED FOR THE HAZARD ASSESSMENT

2. GEOLOGY AND GEOHYDROLOGY

2.1. Regional Geology

The Centurion CBD and surrounds are situated in the Malmani Subgroup of the Transvaal Supergroup. The Malmani Subgroup is up to 2 000 m thick and is subdivided into five formations, based on chert content, stromatolite morphology, intercalated shales and erosion surfaces (Button, 1973; Eriksson and Truswell, 1974).

At the base is the Oaktree Formation which is transitional from siliciclastic sedimentation to platform carbonates and consists of 10 – 200 m of carbonaceous shales, stromatolitic dolomites and locally developed quartzites. The Monte Christo Formation, 300 – 500 m thick, overlies the Oaktree Formation and begins with an erosive breccia and continues with stromatolitic and oolitic platformal chert-rich dolomites. The Lyttelton Formation follows the Monte Christo with 100 – 200 m of shales, quartzites and stromatolitic dolomites, and is, in turn, overlain by the chert-rich dolomites of the Eccles Formation, up to 600 m thick, and which includes a series of erosion breccias. The Eccles is overlain by the Frisco Formation comprising mainly stromatolitic dolomites, becomes more shale-rich towards the top and is up to 400 m thick (Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J. 2006).

2.2. Geology of the Centurion CBD Area

The central and larger portion of the Centurion CBD area is underlain by chert and dolomite rocks of the Monte Christo Formation. The Lyttelton Formation is present along the eastern boundary of the area and the Oaktree Formation is present in a small area in the southern corner of the Centurion CBD area. Dolomite from the Lyttelton and Oaktree Formations are generally chert-poor whereas the Monte Christo Formation is chert-rich.

Syenite has intruded the area in the form of sills and dykes and a large syenite sill is present towards the southern boundary of the Centurion CBD area in Zwartkop, as indicated on Figure 3, showing the unpublished 1:50 000 2528CC Centurion Geological Sheet. A prominent north-south trending dyke is present along the eastern boundary of the Centurion CBD area as well as a smaller northwest-southeast trending dyke in the area of the Lyttelton Agricultural Holdings. Alluvial material is present in the center of the Centurion CBD area close to the Hennops

River. A small Karoo outlier (Vryheid Formation) is present in the northwestern boundary of the area. Figure 3 shows the geology map of the area.

2.3. Geohydrology

The Centurion CBD area is situated in the Irene catchment which comprises four sub-catchments or compartments which are hydraulically connected as evidenced by the direction of groundwater flow (Hobbs, 1988). The four sub-catchments are analogous to the Fountains West, Fountains East, Doornkloof West and Doornkloof East compartments described by Vegter (1986).

The majority of the Centurion CBD area is situated in the Fountains West sub-catchment or compartment (Figure 3). Hobbs indicates that an extremely weak groundwater gradient of some 0,2% is manifested from immediately north of the Hennops River in a north-north-easterly direction toward the Fountains West spring, and indicating a high transmissivity of the dolomite aquifer in this sub-catchment. According to a groundwater level contour map by Hobbs the groundwater level of the Fountains West Groundwater Compartment ranges from 1416 mamsl in the south to 1385 mamsl in the north of the Centurion CBD area. This constitutes a range of 48 m below ground surface in the south to 91 m below ground surface in the north.

Along the eastern boundary of the site, the Centurion CBD area is situated in the Fountains East sub-catchment or compartment. This compartment drains in a north-westerly direction to the East Fountain Spring in the north (Hobbs, 1988).

The weak groundwater gradient of some 0,004 again indicates a relatively high aquifer transmissivity. According to Hobbs, the groundwater level of the Fountains East Groundwater Compartment ranges from 1429 mamsl in the south to 1425 mamsl in the north of the Centurion CBD area, indicating a relatively flat groundwater level across this compartment. This level is 16 m below ground surface in the south, to 20 m below ground surface in the north of the Centurion CBD area.

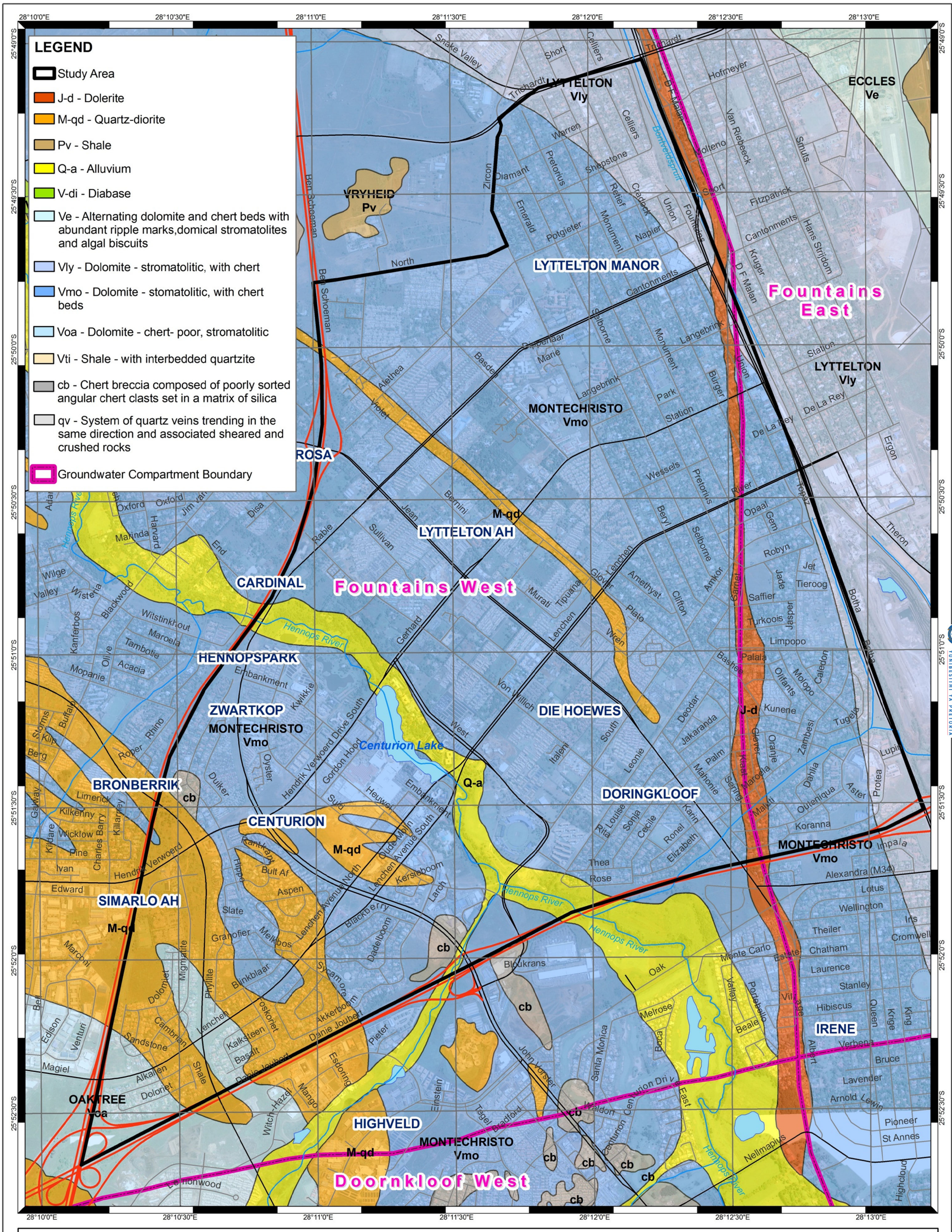


FIGURE 3: 1:50 000 GEOLOGY MAP SHOWING GROUNDWATER COMPARTMENT BOUNDARIES

3. A REVIEW OF CLASSIFICATION SYSTEMS USED FOR THE EVALUATION OF DOLOMITIC LAND

3.1. Background

Various classification systems have been proposed since the 1970's in an attempt to evaluate the stability of sites on dolomite in South Africa. The aim of these classification systems was to identify zones or areas of similar geological and geotechnical conditions and to assign a certain risk or hazard value to each zone accordingly. The advantage of using a classification system is that it provides a standard approach to the problem to be solved which ultimately allows for better communication between parties (Schöning and A'Bear, 1987).

Each of the classification systems has been well documented, and a summary of each are provided in the sections to follow, as prepared by Van Rooy (1996) and Buttrick (1992).

3.2. A Classification System by Stephan (1975)

Stephan (1975) proposed a classification system based on assigning a code number to each horizon in the dolomitic profile which can be related to its probable stability. The suggested code numbers are as follows:

Code	**Number**
No sample return above solid rock	5
Wad	4
Wad and little chert	3,5
Wad and chert	3
Chert and wad	2,5
Chert and little wad	2
No sample return in solid dolomite	3
Leached dolomite	2
Unweathered dolomite	1
Terra rosa	1,5
Cemented chert in terra rosa	1,5
Chert, weathered chert and chert breccia	1
Shale, sandstone, quartzite, intrusive	- 4
Weathered shale, weathered intrusive	0

A detailed description of each of the numbers and the conditions to which the numbers can be applied is documented by Stephan (1975).

Each code number is then multiplied by the thickness in metres of the particular layer in the profile. A depth correction is also applied, since the influence of a poor layer at 20 m is not the same as that of a poor layer at 5 m depth. Stephan also proposed that a 1 % reduction in the code number for each 5 m increment of depth.

The reduction factor should not be implemented in the case of stable materials and the following additional limitations should be taken into account:

a) The total thickness of these horizons must exceed 8 m (for horizons less than 8 m thick a code number of 0 is assigned).
b) The upper contact of these horizons must be at a depth of less than 30 m.

The summation of the calculated stability of the various horizons gives the total calculated stability of each profile. These calculated values can be divided into three classes:

Table 1. The outcome of the Classification System by Stephan (1975)

Value	Suitability for development
< 0	Area suitable.
0 – 40	Area suitable for development provided that water precautionary measures are applied.
> 40	Area unsuitable for development.

During the evaluation of this classification system Buttrick (1992) commented as follows:

- The system grossly simplifies the complex dolomite environment.
- The position and interaction of a layer with other layers in a certain geological setting are ignored.
- The system does not include any reference or make any allowance for the context in which the evaluation is being affected, either a dewatering or non-dewatering scenario.
- The use of the term wad and the positive influence on the stability of materials such as chert in terra rosa, weathered chert and unweathered dolomite are not acceptable in view of present terminology and experience.

3.3. X-Factor Classification System by Weaver (1979)

Weaver (1979) proposed that the stability of sites be classified using an empirical method based on information obtained from boreholes that are less than 30 m in depth. The method is based on a comparison between borehole information and the stability history in an area south of Pretoria in the Lyttelton Formation, Chuniespoort Group.

A stability factor, x, is calculated for each borehole. The x factor is the ratio of depth to wad in the profile over the total thickness of wad. Boreholes with no wad present are assigned an x factor value of infinity.

The x values of all the boreholes on the site are determined and contour lines are drawn for the x values between 1 and 4. The three zones are then interpreted as having the following stability evaluation:

Table 2. The stability evaluation of Weaver's X Factor Classification System

Suitability for development	X Factor
Highly Unsuitable	$x < 1$
Doubtful	$1 > x < 4$
Suitable	$x > 4$

During the evaluation of this classification system Buttrick (1992) commented as follows:

- This system was one of the first developed to evaluate sites on dolomite. Buttrick (1992) indicates that little was known of wad (residual dolomite) at that time and the material was viewed only having a negative influence on the engineering geological properties.
- Buttrick (1986) has concluded a detailed geochemical and geotechnical study of the weathering products of dolomite, i.e. the so called "wad and ferroan soils". He emphasized that the terms "wad and ferroan soils" were merely omnibus expressions describing a range of materials with widely divergent geotechnical characteristics, ranging from poor to very good. Buttrick (1987) indicated that gap graded materials such as chert rubble and fines (clay (wad), silt (wad) or terra rosa), might have a higher erosion potential. Buttrick (1992) indicates that with this classification system the gap graded materials are reviewed in a positive light which implies an enhancement in the stability.
- Buttrick (1992) indicates that the following factors were not taken into account with this classification system:

- Groundwater level
- Receptacle development
- Nature of other soil materials in the subsurface profile which may either enhance or detract from the stability characterization.

3.4. A Classification Approach Proposed by Venter (1981)

According to Venter (1981) the classification of dolomite sites should attempt to:

i) Subdivide the dolomite geology into groups of similar behavior in 3 dimensions.
ii) Create a basis for the understanding of the characteristics of each group.
iii) Provide quantitive data for the design of the foundations of buildings, either precautionary or rehabilitative.
iv) Provide a basis of communication.

A comparison of inducing and inhibiting factors with respect to instability events gives an indication of the suitability of the site for a certain use. Venter (1981) suggests that the degree of suitability of a site will vary according to different proposed usages. The inhibiting and inducing factors are defined as follows:

<u>Inhibiting factors:</u>

- The strength of the overburden material. The greater the strength of the overburden material, the greater is the ability of the material to bridge any voids in the residuum.
- The erosion resistance of the overburden material. The less erodible the material the less likely is the process of internal erosion to occur.
- The thickness of the overburden material. The thinner a layer the less significant it will be. If the overburden is very thin, the characteristics of the bedrock are of importance.

<u>Inducing factors:</u>

The following factors may increase the probability of ground movement:

- The bedrock gradient
- The pinnacled nature of the bedrock
- The degree of cavitation in the bedrock
- The degree of void development in the overburden.

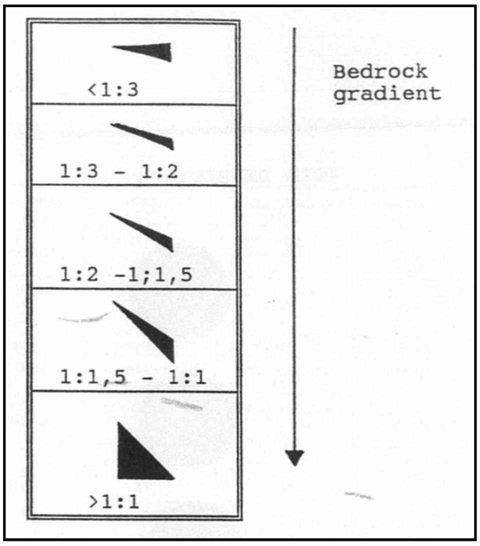
Tables 3 and 4 and Plates 5, 6 and 7 give an indication of what values these factors can assume.

Table 3. Factors influencing the strength of geological materials (After Venter, 1981)

Rock Material	Soil Material
1. Type of Material	1. Moisture content 2. Colour 3. Consistency 4. Structure 5. Soil type 6. Origin $\tau = c + \sigma \tan \varphi$
2. Degree of Weathering Completely weathered Highly weathered Moderately weathered Slightly weathered	
3. Jointing and rock mass strength Strong rock Average rock mass Weak rock mass Very weak rock mass	
4. Penetration rates Very strong Strong Average Weak Very weak	

Table 4. Factors influencing the resistance to erosion of geological materials (After Venter, 1981)

Rock Material	Soil Material
Degree of consolidation and cementing	Grading
Degree of weathering	Wad content High Medium Low
Jointing Very closely jointed Closely jointed Medium jointed Widely jointed Very widely jointed	Wad condition Dense Loose
Permeability	Permeability



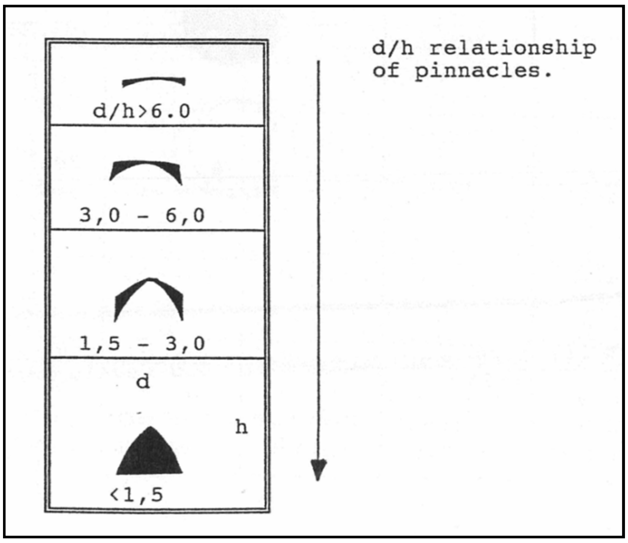


Plate 5 (left). Different magnitudes of bedrock gradient (After Venter, 1981)

Plate 6 (right). Different magnitudes of pinnacle development (After Venter, 1981)

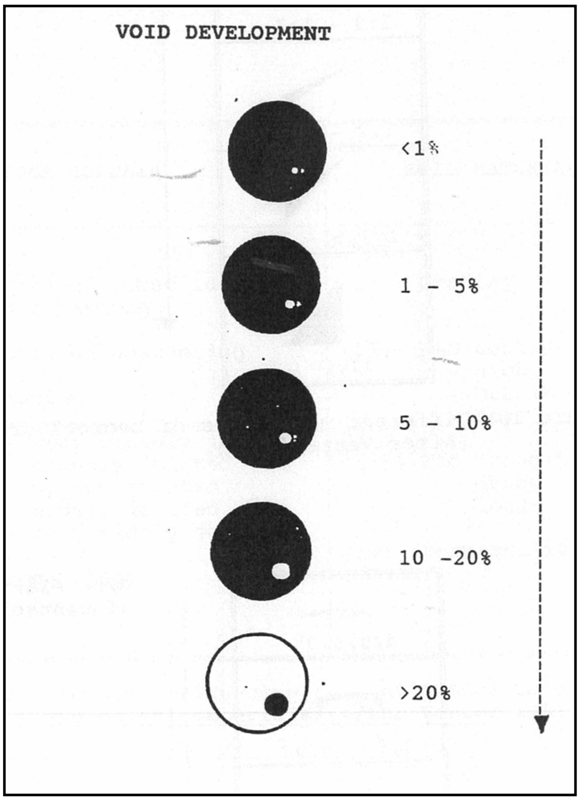


Plate 7. Different degrees of void development (After Venter, 1981)

The position of the groundwater table in the sub-surface profile is also important. It is apparent that the factors will have individual as well as interrelated, combined influence on potential instability events.

Venter (1981) points out that if a single factor were to change in either magnitude or intensity, it is possible that the character of the entire geological setting will change and consequently the nature of the instability event. Therefore it is necessary prior to classifying a dolomite terrain, to subdivide the area into zones of engineering geological homogeneity.

Each of the factors discussed above are incorporated in Table 5. Each factor is subdivided into five categories where each category is assigned a value depicting its relative importance in terms of the probability that there is a direct correlation between the factor and potential ground movement. Venter (1981) indicates that although the strength and potential erodibility of the overburden material are presently viewed as equal important, this may not necessarily be the case.

Venter (1981) also proposed the use of a value reflecting the ratio of the overburden and the void free residuum A to the thickness of the layer residuum B containing voids or wad. If the ratio is large, the relative importance of such factors as the bedrock gradient, the pinnacled nature of the bedrock etc., is of less importance, whereas with a smaller ratio, the significance of the influence of the bedrock variable increases.

The sum of all factors gives a "grand total". The significance of the total is expressed in terms of the expected number of sinkholes or subsidences that will potentially occur within a twenty year period within an area of one square kilometer (Table 5). Venter (1981) also proposes different development types for the various grades of risk and possible special founding or stabilization methods for high cost / high maintenance developments.

Table 5. Dolomite zonal risk classification (After Venter, 1981)

STRENGH VALUE A	VERY WEAK 7	WEAK 10	MOD. STRONG 12	STRONG 15	VERY STRONG 18
ERODIBILITY VALUE B	HIGHLY ERODIBLE 7	ERODIBLE 10	MODERATELY ERODIBLE 12	LOW ERODIBILITY 14	VERY LOW ERODIBILITY 16
THICKNESS X THICKNESS VALUE C THICKNESS FACTOR T	0 – 3 m 0.6 $\frac{3X}{X+Y+Z}$	3 – 12 m 0.7 $\frac{3X}{X+Y+Z}$	12 – 30 m 0.8 $\frac{3X}{X+Y+Z}$	30 – 60 m 0.9 $\frac{3X}{X+Y+Z}$	>60 m 1.0 $\frac{3X}{X+Y+Z}$
STRENGH VALUE D	VERY WEAK 7	WEAK 10	MOD. STRONG 12	STRONG 15	VERY STRONG 18
ERODIBILITY VALUE E	HIGHLY ERODIBLE 7	ERODIBLE 10	MODERATELY ERODIBLE 12	LOW ERODIBILITY 14	VERY LOW ERODIBILITY 16

THICKNESS Y **THICKNESS VALUE F** **THICKNESS FACTOR Z**	0 – 3 m 0.6 3Y / X + Y + Z	3 – 12 m 0.7 3Y / X + Y + Z	12 – 30 m 0.8 3Y / X + Y + Z	30 – 60 m 0.9 3Y / X + Y + Z	>60 m 1.0 3Y / X + Y + Z
STRENGH **VALUE G**	VERY WEAK 7	WEAK 10	MOD. STRONG 12	STRONG 15	VERY STRONG 18
ERODIBILITY **VALUE B**	HIGHLY ERODIBLE 7	ERODIBLE 10	MODERATELY ERODIBLE 12	LOW ERODIBILITY 14	VERY LOW ERODIBILITY 16
THICKNESS I **THICKNESS VALUE R** **THICKNESS FACTOR P**	0 – 3 m 0.6 3I / X + Y + Z	3 – 12 m 0.7 3I / X + Y + Z	12 – 30 m 0.8 3I / X + Y + Z	30 – 60 m 0.9 3I / X + Y + Z	>60 m 1.0 3I / X + Y + Z
BEDROCK GRADIENT **IF C + F > 0.8** **0.4 – 0.8** **0.4**	> 1:1 -3 -4 -5	1:5 - 1:1 -2 -3 -4	1:2 – 1:5 -1 -2 -3	1:2 – 1:3 0 -1 -2	< 1:3 0 0 0
d/h RATIO **IF C+F > 0.8** **0.4 – 0.8** **0.4**	-2 -3 -4	< 1:5 -2 -3 -4	1:5 – 3.0 -1 -2 -3	3.0 – 8.0 0 -1 -2	< 8.0 0 0 0
VOID DEVELOPMENT **RESIDUUM B** **IF C+F > 0.8** **0.4 – 0.8** **0.4**	> 20 % -4 -5 -6	10 – 20 % -3 -4 -5	5 – 10 % -2 -3 -4	1 – 5 % -1 -2 -3	< 1 % 0 -1 -2
BEDROCK VOID **DEVELOPMENT** **IF C+F > 0.8** **0.4 – 0.8** **0.4**	> 20 % -4 -5 -6	10 – 20 % -3 -4 -5	5 – 10 % -2 -3 -4	1 – 5 % -1 -2 -3	< 1 % 0 -1 -2
CIRCUMSTANCE FACTOR	12 - 30	31 - 50	51 - 70	71 - 90	91 – 100
GRAND TOTAL OF ASSIGNED VALUES	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
RISK CATEGORY	VERY HIGH	HIGH RISK	MEDIUM RISK	LOW RISK	VERY LOW
PERMISSABLE DEVELOPMENT	NO DEVELOPMENT	LOW COST	HIGH COST	HIGH COST	HIGH COST

During the evaluation of this classification system Buttrick (1992) commented as follows:

- The system reflects a detailed and thorough consideration of the many complex interrelated factors influencing the stability of a dolomite site and is one of the most comprehensive produced to date.
- Water management, position of the groundwater level and dewatering are not included in the weighting process.

- Buttrick (1992) indicates that to evaluate the resistance to erosion of materials it is necessary to establish the permeability and this assessment is either made directly, or based on laboratory data. In effect, therefore, the materials in the subsurface profile are being evaluated under the influence of head of water simulating what is to be expected when water ingress occurs.
- Void development must be predicted on a scale of <1% to >20% which is not possible by either a geophysical or any other method.
- The pinnacled nature of the bedrock is of particular relevance in areas of shallow bedrock, whereas the importance characteristic diminishes in areas where the bedrock is covered by a substantial blanketing layer.
- This classification system places great emphasis on the bedrock gradient which is particularly important in areas subjected to dewatering. Unfortunately, this system fails to embrace the process of water level drawdown. Based on a study conducted south of Pretoria, Schöning (1990), indicates that there is no preferential occurrence of sinkholes on any particular gravity anomaly.

During the write-up of this dissertation it was also noticed that the classification method by Venter (1981) indicates that on the high risk areas low cost housing are considered suitable. Nowadays, low cost housing are rather placed in low risk areas because the residents can't afford special foundation designs and all the other requirements with developing on high risk dolomite ground.

3.5. A Classification Method Proposed by De Beer (1981)

De Beer (1981) indicates that the evaluation of dolomite areas is affected by assessing certain "influencing factors" that may have had an effect on a site in the past, or that may still affect a site during its development. The "influencing factors" are as follows:

a) Natural influencing factors
b) Historical, occupational influencing factors,
c) Future occupational influencing factors.

De Beer (1981) indicates these factors should be regarded as a checklist of factors to be considered when evaluating dolomite areas.

A rating of 1 to 5 is applied to each of the individual factors within the three main groups of influencing factors, where 1 represents the most favorable condition and 5 the most adverse condition. The individual factors are rated equally compared with each other, but any one factor may emerge as an overriding factor. All the factor ratings are finally added and the total gives a rough guide as to the risk of damage (De Beer 1981).

The proposed subdivision of the influencing factors and the designated ratings are elaborated on below:

a) Natural influencing factors

i) Watertable

1 Static and shallow
3 Static and at bedrock level
5 Static and at considerable depth below bedrock

ii) Geology – Depth to bedrock

1 > 30 m
3 Around 15 m
5 Outcropping to less than 10 m

iii) Geology – Strength and permeability of surface material

1 Well developed pedocrete of Karoo shale blanket
3 (No definition given by De Beer (1981))
5 Wad and waddy dolomite within 1,5 m of ground surface

iv) Geology – Nature of Intervening residual materials

1 Mainly chert
3 Wad and chert
5 Mainly wad

b) Historical occupational influencing factors

i) Relative frequency of damage

1 No known sinkhole / settlement / subsidence occurrence within 10 km of the site. Newly developed area, less than 5 years old.
3 (No definition given by De Beer (1981))
5 Sinkhole / settlement / subsidence on site or within 50 m of site. Development in immediate vicinity of site for at least 20 years.

ii) History of drainage of site

1 Natural undisturbed gently sloping grassland, no previous development, no ploughing
3 Gently sloping topography, residential development, no buried storm water reticulation (e.g. Tembisa, Katlehong)
5 Industrial or residential development with septic tanks, French drains, buried storm water reticulation, well watered gardens (e.g. Valhalla)

c) Future occupational influencing factors

i) Proposed disturbance of ground surface and natural drainage

1 None
3 Removal of pedogenic blanket
5 Deep cuts exposing wad, pinnacles and voids

ii) Proposed structure

1 Railway line
2 Special residential with shallow foundations
3 Dairy, brewery factory etc. where quantities of washwater are used
4 Concrete Reservoir
5 Unlined dam

iii) Knowledge of geological conditions

1 Infra-red photography, gravity, test pits, trial holes, boreholes, shafts
3 Test pits, trial holes and boreholes
4 Test pits only
5 No investigation

The factor ratings are added and grouped into the following broad categories of risk of damage:

0 – 15	Low
16 – 30	Moderate
31 – 45	High

The site is then divided into zones or areas of varying degree of risk of damage.

Once such an evaluation of the site has been completed it has to be related to the Damage Acceptability of the structure which is the soil-structure interaction (De Beer 1981).

d) Damage Acceptability (Soil structure interaction)

1. *Minor cracking* – filling and repairing of cracks – operation unaffected, inconvenience only
2. *Damage to walls and finishes requiring extensive repairs* – operation unaffected but major inconvenience
3. *Major damage to structure* – temporary cessation of operations during repairs
4. *Major damage to structure or abandonment of parts of structure* – cessation of operations for long periods
5. *Damage to structure cannot be tolerated, e.g. hospital, nuclear power station etc.*

De Beer (1981) states that the property owner or developer has to be intimately involved in the decisions on damage acceptability of the proposed development related to the final evaluation of the site.

During the evaluation of this classification system Buttrick (1992) commented as follows:

- This detailed and thorough system is particularly aimed at provoking thought and ensuring that the evaluator is considering the key factors influencing the stability of a site.

- Watertable: De Beer (1981) views a static and shallow groundwater table as most favorable situation and the least favorable a watertable which is static and at considerable depth below bedrock.

  Buttrick (1992) indicates that the qualification 'Static' implies that the system does not allow for lowering of the waterlevel and that within the context of a dewatering scenario the shallow groundwater level could represent the most unfavorable situation.

  Buttrick (1992) further indicates that a static watertable at considerable depth below bedrock may present a very unfavorable stability situation if potentially erodible soil materials blanket the bedrock in a non-dewatering and dewatering scenario. In both scenarios, ingress water may cause damage to the subsurface profile.

- Geology – depth of bedrock: Buttrick (1992) indicates that the depth to bedrock is crucial for three reasons:
  - Depth to receptacles in bedrock
  - Depth to an incompressible medium (dewatering scenario)
  - Depth to the bedrock / soil interface where preferential erosion may occur along potential flow paths (non-dewatering scenario)

  Buttrick (1992) further indicates that the location of either receptacles or disseminated receptacles should perhaps be viewed as more important criterion than bedrock depth. Disseminated receptacles, particularly, may be located above bedrock level. Water level is important with respect to receptacle depth in both a dewatering and non-dewatering scenario and with respect to bedrock in the former.

- Geology – strength and permeability of surface material: Buttrick (1992) indicates that it must be noted that the well-developed pedocrete or Karoo shale may be favorable in a non-dewatering scenario but may not be adequate to create favorable conditions in a dewatering scenario.

So called wad, may if correctly constituted, enhance stability. Experience indicates that clay (wad) may in fact be less susceptible to subsurface erosion that some of the gap graded materials such as the combinations of chert rubble and fines (Buttrick, 1992).

- Geology – nature of intervening residual materials: De Beer (1981) indicates that he views intervening residual materials, mainly of chert, as the most favorable condition, 'wad and chert' as intermediate and 'mainly wad' as the most adverse condition.

  According to Buttrick (1992) experience indicates that gap graded materials possess a multitude of potential flow paths which may be exploited by percolating water resulting in subsurface erosion. Clay soil materials (e.g. wad and ferroan soils) may in fact enhance stability if characterized by a low permeability. The nature of the soil material must first be established (Buttrick 1992).

  Historical occupational influencing factors are also affected by a change in the dewatering scenario of the site.

- The recent past and present state of a site is not necessarily a key to the future stability behavior. The age of surrounding developments, comparison of similar subsurface conditions and man's influence and disturbance all plays a role in revealing its susceptibility to sinkhole and subsidence formation.

3.6. Wagener's (1982) Method of Classes

Wagener (1982) proposed that dolomite sites be classified according to the thickness of the overburden layer. This layer occurs between the soil surface and the average level of dolomite pinnacles and floaters. Evaluation of the thickness of the overburden gives an indication of potential settlement problems. Three types of settlement can be distinguished.

i) Normal settlement – a combination of immediate elastic settlement and consolidation settlement.

ii) Sudden subsidence settlement – the appearance of a sinkhole caused by the collapse of an arch, which is spanned over a cavity in the residuum.

iii) Gradual subsidence settlement or doline formation – the formation of a slow subsidence over a cavity or weak zone in the residuum, where an arch is not able to form.

Wagener (1982) indicates that a site may be divided into three categories on completion of the filed work and the evaluation.

- Class A: Pinnacle and boulder dolomite either at or near the surface. 0 < C < 3 m
- Class B: Pinnacle and boulder dolomite overlain by moderately thick soil cover. 3 m < C < 15 m
- Class C: Pinnacle and boulder dolomite overlain by thick soil cover. C > 15 m

C refers to the average thickness of overburden to the tops of the pinnacles and boulders.

This zonation of the site is executed on the basis of information obtained from remote sensing, gravity surveys, borehole data, test pits and laboratory tests.

Based on the selected category, it is considered possible to quantify the types of settlement and proposed appropriate solutions to withstand expected movements. Wagener (1982) suggests the following solutions in Table 6 in relation to the three classes.

Table 6. Appropriate foundation solutions according to Wagener's three classes (After Wagener, 1982)

Foundation Description		Site Categories
i)	Conventional foundations	Class A, B & C
ii)	Mattress of improved earth	Class A, B & C
iii)	Founding on pinnacles	Class A, B & C
iv)	Piling	Class A
v)	Shafts	Class B & C
vi)	Caissons	Class B & C
vii)	Special foundation methods a) Dynamic consolidation b) Reinforced earth	 Class B & C Class B & C
viii)	Special structures a) Reservoirs b) Slimes Dams	 Class A, B & C Class A, B & C

During the evaluation of this classification system Buttrick (1992) commented as follows:

- This system does not include the following factors:
  - groundwater level /s

  - possible movements of the water level or the activities of other mobilizing agencies
  - the nature of the materials blanketing the dolomite bedrock
  - receptacle development

- The system is based on the premise that the selection of an appropriate construction method will preclude stability problems and is an excellent guide to the selection of appropriate construction methods once the stability conditions on the site have been evaluated.

- The foundation design of a structure is not the only purpose of conducting a stability investigation. Townships consist of many infrastructural elements, such as roads, walkways, parks etc. and people may be at risk in the open areas around the buildings. The evaluation of the stability of an entire site allows the selection of appropriate township / development design structure and foundation design and water precautionary measures.

3.7. Van Rooy's (1984) MF-Classification System

Van Rooy (1984) developed a classification system based on the data obtained from standard investigation techniques used during dolomite stability site investigations in the early eighties. A so-called Multiple Factor or MF-Classification System was developed. The system encompasses the following factors:

- Drainage history
- Gravity contour feature
- Depth to wad
- Thickness of wad
- Characteristics of the wad
- Type of material above the first appearance of wad
- Type of material below the base of wad
- Damage: Historical record
- Future development

Van Rooy (1984) proposes the use of the following classification parameters:

a) <u>Classification utilizing surface information:</u>
A site must first be subdivided into similar geological zones due to the great lateral and vertical variation of subsurface conditions in karst areas. This variation makes it difficult to obtain subsurface information through drilling of all the possible conditions on the site. This subdivision is done by using geological maps, air photographs and stratigraphic information.

The following features are delineated: Outcrop areas, chert-gravel zones, areas of similar vegetation, old sinkhole zones, subsidence areas, scattered outcrop areas, different formations and intrusives.

b) Classification utilizing thermal infrared linescan

The following risk characteristics are assigned to tonal variations, on the thermal infrared linescan imagery:

Zone (Tone)	Risk
Black	Very High
Dark Grey	High
Grey	Medium
Light Grey	Low
White Grey	Very low

Terrain data, development density, vegetation, topography and geology influence the imagery. Van Rooy (1984) contends that all these areas of poor drainage may be regarded as high risk areas. Thermal infrared linescan imagery can prove of great value in delineating areas of poor drainage.

c) Classification utilizing gravity information

Features on the gravity contour map permit the identification of four basic zones:

- Gravity "high" anomalies
- Gravity "low" anomalies
- Steep gradient zones
- Gentle gradient zones

Generally this subdivision of the gravity permits the interpretation of the bedrock topography on the site. Confirmation of conditions within these zones by the selective placement of boreholes ultimately limits the amount of drilling required.

d) Classification utilizing borehole data

Borehole information is used to subdivide the following factors into five classes of differing conditions:

- Depth to wad
- Total thickness of wad
- Characteristics of the wad
- Type of soil material overlying the first occurrence of wad
- Type of soil material below the base of the wad

A value of 0,25 to 4 is assigned to each condition ranging from poor to very good. Each factor's value is addressed based on the borehole information (Table 7). These values are then multiplied.

Table 7. Weighting values for boreholes with erodible soil (After Van Rooy, 1984)

Assigned Value	Depth to Wad	Total Thickness of Wad	Properties of Wad	Material Above First Occurrence of Wad	Material Below Last Occurrence of Wad
4	D > 15	A ≤ 1	High penetration resistance Chert with 15% wad	High strength material e.g. dolomite	Unweathered rock
2	12 < D ≤ 15	1 < A ≤ 2	Chert with 30% wad Wad with high penetration resistance	Competent material e.g. leached dolomite with 30% red soil	Leached dolomite Weathered chert
0,75	8 < D ≤ 12	2 < A ≤ 3	Wad with 30% chert	Moderate strong e.g. red soil with 30% chert	Jointed dolomite Chert with red soil
0,5	3 < D ≤ 8	3 < A ≤ 5	Wad with low penetration resistance	Low strength material red soil, shale sand	Red soil with chert
0,25	D ≤ 3	A > 5	Cavity Wad with no penetration resistance	Material with poor strength silt/clay	Cavities in dolomite Pinnacled dolomite

The classification of borehole information is subdivided into two broad categories namely boreholes containing wad and those not. By evaluating the above mentioned factors for each borehole a stability value is calculated.

The following factors must be borne in mind when values are assigned to the various factors:

- Material description in the profile must firstly be grouped into zones of the same characteristics e.g. colour variations in either chert breccia or shale are not distinguished.

- The total thickness of wad is obtained by adding the depth values for all the wad layers if more than one layer of wad occurs in the profile. The properties of the poorest layer are utilized in the assessment of the stability value calculation.
- The depth to wad is taken as the depth to the first layer of wad in the profile.
- The total depth of a borehole also plays a role. A standard depth of 30 m is assumed for this classification system based on the practice of drilling most of the site investigation boreholes on dolomite to only 30 metres. The influence of material deeper than 30 metres is not taken into account.
- An average value is calculated if the material above or below the wad layer have different properties. This average value then serves as the factor for the material above the wad and material under the wad.

Table 7 and 8 represents the proposed values for the subdivision of boreholes with wad and boreholes which do not contain wad respectively.

Table 8. Weighting values for boreholes without highly erodible soil (After Van Rooy, 1984)

Material Type		Value		
		Entire Profile	>10 M	< 10 M
Dolomite:	Unweathered	20	8	4
	Leached	16	5	2
	With chert	16	5	2
Chert:	Unweathered	20	8	4
	Weathered	15	4	2
	With silty clay	0.13	4	2
	With shale	20	8	4
Shale:	Unweathered	20	8	4
	Weathered	15	4	2
	With chert	20	8	4
Igneous Rock:	Unweathered	20	8	4
	Weathered	8	4	2
	Residual clay	0.12	0.25	0.5
Clayey silt (red soil):		0.12	0.5	0.75
	With chert	0.13	0.5	1
Sand		4	2	1
Silt		0.12	0.5	1
Clay		0.12	0.5	1
In general:	Very high strength	16	8	4
	High strength	0.6	4	2
	Medium strength	0.13	0.5	0.75
	Low strength	0.12	0.25	0.5

The borehole stability values are subdivided into intervals relating to designated risk grades with respect to sinkhole formation, as indicated in Table 9.

Table 9. Borehole stability value intervals with corresponding risk classes for sinkhole development (After Van Rooy, 1984)

Borehole Stability Value	Risk
0.0 – 0.0024	Very high
0.0025 – 0.124	High
0.125 – 0.5624	Medium
0.5624 – 15	Low
16 - 256	Very low

e) Classification utilizing damage to structures

Damage to structures existing either on the site or under investigation or on adjacent sites can be utilized to identify poor zones where instability events can be expected. Obviously a distinction must be drawn between damage due to poor construction methods and unstable foundation conditions. Only the latter is considered here (Table 10). Factors such as poor drainage around the building, leaking water bearing services and the utilization of the building, may also play a role.

Table 10. Classification of risk using damage to structures (After Van Rooy, 1984)

Crack Width K (Mm)	Degree of Damage	Risk
k > 10	Severe damage	Very high
5 < k < 10	Moderate damage	High
2.5 < k < 5	Visible damage	Medium
0 < k < 2.5	Little damage	Low
K = 0	No damage	Very low

f) Final stability zoning

All the stability and risk values are depicted on a map of the site according to which the site is subdivided into very high, high, medium, low and very low risk zones.

In summary, the final risk zoning is constituted as follows:

i) Sub-division of the site by means of surface information, drainage history and gravity contour features.

ii) Confirmation of geology, qualification of the variation and risk grade of each zone using borehole information.

iii) The further adaption of the grade of risk by reviewing damage records and property utilization.

In the final risk classification the number of boreholes and the applicability of the factor (e.g., was a gravity survey done?) will determine the proportional contribution made be each parameter.

During the evaluation of this classification system Buttrick (1992) commented as follows:

- This system appears to be designed for application in the context of a non-dewatering scenario. The only agency considered to be operative in the creation of instability events is ingress water. No reference is made to the process of dewatering or other relevant disturbing agencies, water level fluctuation, gravity and ground vibrations.
- The dark zones on the thermal infrared imagery may also depict a moist clay (e.g. residual clay on an intrusive) which may serve as an aquitard in the upper profile giving rise to a cool spot due to dark signature of the moist clay. This aquitard would enhance the stability, in fact warranting a low risk characterization (Buttrick, 1992).
- Gravity usually indicates the bedrock topography on a site and is important in evaluating the stability of an area where dewatering might take place. This system does not take the influence of watertable drawdown into account as it was developed on a site south of Pretoria. The bedrock gradient is not very important in the case of a non-dewatering scenario (Schöning, 1990).
- Van Rooy (1984) has followed the practice of other authors, such as Weaver (1979) in the classification of borehole information, where only a negative connotation to "wad" is attached.
- The classification utilizing damage to structures must be applied with discretion. A lack of damage does not necessarily imply that the site is stable.

3.8. Evaluation of potential instability in Karoo outliers (Jones, 1986)

In the case of Karoo outliers, the inter-related and interdependent influences of lithology, geological structure and hydrology must be taken into account. Jones (1986) proposes that the potential instability in Karoo outliers may be evaluated by:

a) Ranking the physical or engineering characteristics of individual lithological units in a geological profile according to their potential for instability.

b) *Expressing the instability potential of a specific geological profile by weighting the engineering or physical characteristics or each lithological unit it contains, according to its apparent thickness.*

c) *Predicting the impact which subsurface water elevation may have on the geological succession.*

d) *Taking the dolomitic bedrock configuration and the presence of any cavities into account.*

e) *Instability potential of lithological units, where this can be regarded as a function of the compressibility, erodibility and inverse of tensile strength or cohesion for either a rock or subsoil.*

The compressibility of unconsolidated subsoils may be quantified in terms of the compression index (C_c) and the co-efficient of consolidation (C_v). In the case of chert gravels and weathered Karoo sedimentary rocks, the above-mentioned laboratory tests are not applicable. Wrench (1984) has shown that relationships exist between Young's modulus, plate bearing capacity and consistency and that these relationships provide an initial estimate of compressibility and bearing capacity in gravels. As far as intact rocks are concerned, Hobbs (in Jones 1984) also suggested that Young's modulus may be applied to determine potential instability. In the case of rock masses the effect of joints and fractures must be taken into account. Coon and Merrit (1978) advocate the use of fracture frequency to quantify rock quality in terms of a mass factor "j".

The erodibility of residual soils and soft rocks is a more difficult parameter to quantify. Any attempt to evaluate potential erodibility should take into account grading (percentage passing 0,075 mm) and permeability as influencing factors.

As far as the tensile strength of residual materials or soft rocks is concerned, the cohesion value "c" is considered a meaningful measure.

To quantify the instability potential it is suggested that the parameters of compressibility, erodibility and inverse of tensile strength be give numerical index values. Low values would indicate low compressibility, low erodibility and high tensile strength or cohesion characteristics whereas high index values would indicate the inverse. The instability ranking of a specific subsoil or stratum 'ind/L' could be derived from the formula:

$$ind/L = f\ (a,b,c)$$

Where 'a', 'b' and 'c' represent the instability index values given to compressibility, erodibility and tensile strength/weakness respectively.

Without explicit information, the contribution of 'a', 'b', and 'c' in the above formula cannot be related. It is essential, therefore, that if valid ranking index values are to be obtained, detailed analysis should be made of each physical characteristic for every individual material in a large number of instability occurrences.

f) *Instability potential of a specific geological profile:*

Jones (1984) proposed that the instability potential of a specific geological profile, 'Rf' may be compiled by weighting the instability index value (ind/L) of each individual material in the succession according to its thickness or apparent thickness. The equation for such an evaluation would therefore be:

$$Rf = \sum_{j=1}^{j=0} \left[\{(tl \text{ x ind/L}) + (t_2 \text{ x ind/L}_2) + (t_3 \text{ x ind/L}_3)....\} / T]\right]$$

In the above equation 'ind/L' and 't' represents the instability ranking index value of an individual material and its thickness respectively, whereas 'T' represents the total thickness of all the materials in a specific geological succession.

g) *Evaluation of risk at a specific site:*

This 'Rf' value only apply to a specific locality (e.g. a borehole) since it does not take other influencing factors such as lithological sequence, subsurface water and the dolomitic bedrock topography into account (Jones 1984).

i) *Lithological sequence:*
The 'Rf' values should be adjusted where necessary by qualified earth scientist and engineers to take the influence of the lithological order prevalent in the geological succession into account.

ii) *Subsurface water:*
The movement of subsurface water has probably the most important influence on promoting instability in a geological profile. Jones (1984) argues that in the compilation of an instability risk hazard evaluation for a site, a hydrological factor rated with numerical values to indicate its contribution to instability, must be applied to the 'Rf' value of each individual profile in the area.

iii) *Configuration of the dolomitic bedrock:*
The configuration of the dolomitic bedrock considerably influences the potential instability of a Karoo outlier. A palaeo-karst subsurface

configuration with closely spaced steep-sided pinnacle, enhances potential sinkhole development providing the infilling materials possess high erodibility and poor tensile strength (Jennings, Brink, Louw and Gowan, 1965). Conversely, a gently undulating dolomitic bedrock profile, in which the span between the shallow sloped abutments is too great to permit the formation of an arch will produce conditions favouring either differential surface settlement or doline development. Jones (1984) also supports the method proposed by Venter (1981) whereby the parameters of abutment slope-gradient, height and width are applied.

iv) *Cavities and voids:*

Jones (1984) advocates that the same approach be followed for voids occurring in either the residual subsoils or Karoo sedimentary rocks as proposed by Venter (1981) for the presence of cavities in dolomitic bedrock.

The compilation of a potentially instability risk evaluation “RH” at any specific point or site can therefore, be derived by the following formula:

$$RH = f\ (Rf, Rs, Rh, Rd, Rv)$$

In the formula, Rf represents the instability potential of a given geological profile as already discussed, whereas Rs, Rh, Rd and Rv refer to the influences of the lithological sequence, subsurface water movement, the nature of the dolomitic bedrock configuration and the frequency of voids / cavities respectively; each being given numerical values which increase with rising instability potential.

During the evaluation of this classification system Buttrick (1992) commented as follows:

- The system is well developed but only applies to a very specific geological setting.
- Many of the factors considered may be too difficult to determine, e.g., receptacles. No technique exists to determine either the extent of void development, depth of occurrence or spatial dimensions.

3.9. Buttrick’s (1992) Method of Scenario Supposition

Buttrick proposed a single framework of reference for the evaluation of the stability of dolomite land. Many different site investigation methods have been applied and several methods of site classification or characterization have been developed in an effort to accurately predict the risk of ground-surface damage in any given area

(Buttrick, 1992). In response to the identified need for a standardized, functional methodology, Buttrick (1992) formulated a framework of reference for the evaluation of stability.

The 'method of scenario supposition' was developed to characterize the potential stability of dolomitic land. The stability characterization of a site requires hypothesizing the probable impact of man's activities on the dolomitic karst environment during the lifetime of a development. The potential stability of a virgin tract of land must be reviewed in the context of either a dewatering or non-dewatering scenario. The basic supposition in this evaluation process is the selection of the potentially applicable scenario, which provides the framework within which the evaluation procedure may be applied (Buttrick, 1992).

The individual boreholes representing subsurface conditions on the site can only be evaluated and characterized if abstractly subject to the activity of an assumed mobilizing agency within the context of the selected scenario.

3.9.1. Characterization of the Risk of Sinkhole Formation

Buttrick (1992) identified the following factors for the characterization of the risk of sinkhole formation:

a) *Receptacles*: Either the receptacles or disseminated receptacles occurring within the bedrock or within the overburden and can receive mobilized materials. These receptacles may occur as small disseminated and interconnected openings in the overburden or as substantial openings, referred to as cavities, particularly in the bedrock.

b) *Mobilizing agency*: Mobilizing agencies include ingress water, ground vibrations, water level drawdown and any activity or process which includes mobilization of the material in the blanketing layer.

c) *Blanketing Layer*: Overburden refers to any loose, unconsolidated material which rests upon solid rock (Whitten and Brooks, 1972). The overburden is thus the dolomite residuum and other materials found overlying the dolomite bedrock and occurring between the ground surface and the dolomite interface. The term 'blanketing layer' is, however, suggested to denote that component of the overburden which overlies the potential receptacles (Plate 8). The nature of the blanketing layer is crucial to the advancement, retardation or prevention of the process of sinkhole or subsidence formation.

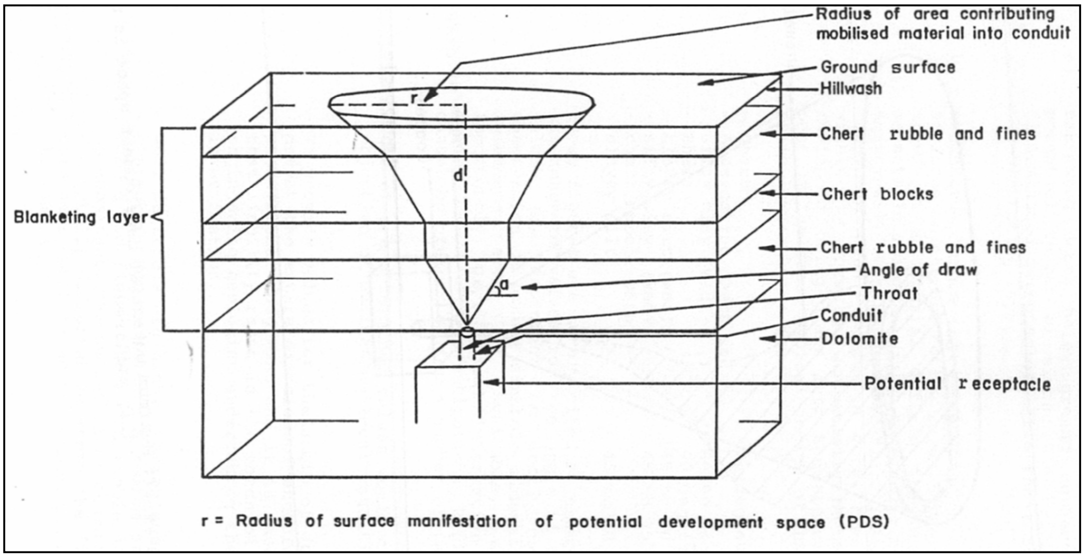


Plate 8. Maximum potential development space (After Buttrick, 1992)

d) *Maximum potential development space*: The 'maximum potential sinkhole development space' is a simplified estimation of the maximum size sinkhole that can be expected to develop in a particular profile, providing that the available space is fully exploited by a mobilizing agency (Plate 9). The potential development space (pds) is associated with either a receptacle or disseminated receptacles and depends on the following factors:

i) Estimated depth below ground surface to the potential throat of either the receptacle or disseminated receptacles (i.e. the thickness of the blanketing layer).

ii) Estimated 'angle of draw' in the various horizons in the blanketing layer. The 'angle of draw' in a material describes a cone and defines the angle of a metastable slope to which a particular mobilizing agency will become operative in that material. The material in the cone within the cone can potentially be mobilized by moved or drawn into the conduit at the base of the cone. Typical angles of draw are defined as follows:

- Chert	90 °
- Alternating chert and silty clay (wad)	80 – 90 °
- Shale	90 °
- Clayey silt (wad)	45 – 60 °
- Silty clay (wad)	45 – 75 °
- Chert rubble with clayey silt	45 – 90 °

Buttrick (1992) indicates that these figures are merely cited as examples of the range of values for the angle of draw. The values are dependent on local conditions, observation of actual sinkhole sidewalls in the immediate area, if available, and more importantly, geotechnical information gathered during the field investigation.

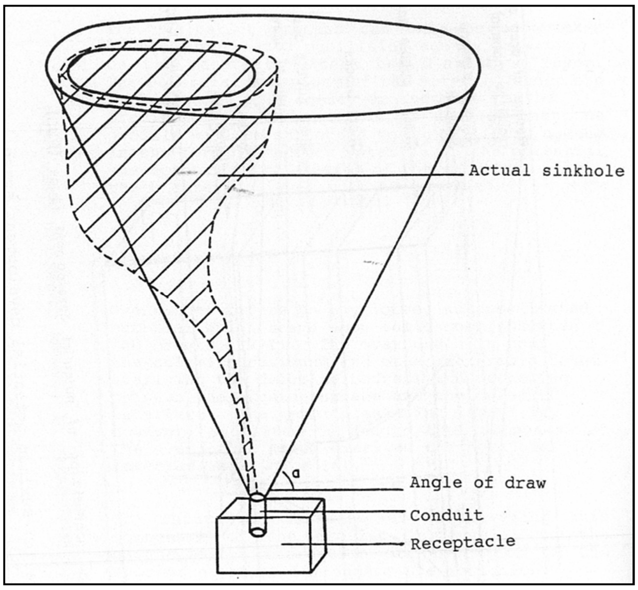


Plate 9. Maximum potential development space is not fully utilized (After Buttrick, 1992)

iii) Thickness of the various horizons constituting the blanketing layer. Plate 8 displays this concept schematically. The depth to the potential receptacle is obtained from borehole information and the radius of the potential development space on surface is obtained by a simplified diagrammic construction. The ‘angle of draw’ of the various materials and the depth to the receptacle is used to project and estimate the radius.

Realization of the full sinkhole may occur in stages, including an initial catastrophic even when it ‘daylights’, followed by the growth of the feature owing to slip failures and raveling along the side walls. This process will continue until a metastable state is achieved. The sinkhole could potentially grow until it fully utilizes the limits defined by the potential development space (Plate 10).

Thus, for each receptacle, there is a ‘potential development space’ that may be fully realized or exploited, creating the maximum size sinkhole, provided that:

- The receptacle is large enough to accommodate all mobilized material from within the ‘development space’
- The materials constituting the blanketing layer can be mobilized, and

- An adequate and sustained mobilizing agency is present to mobilize all the material.

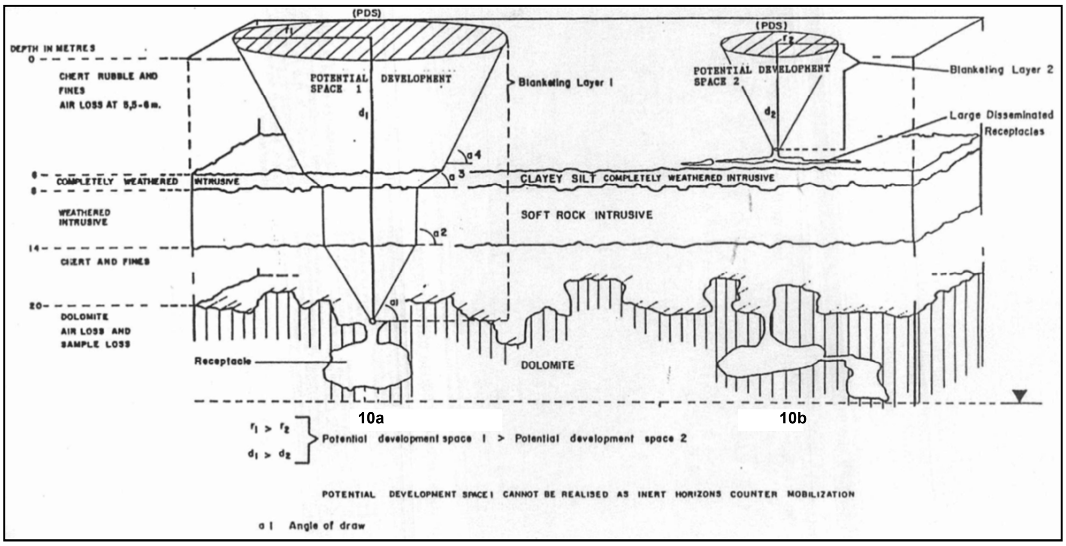


Plate 10. The influence of horizons with a low mobilization potential on the maximum Potential Development Space (PDS) (After Buttrick, 1992)

In reality, the receptacle may be too small to accommodate the mobilized material and hence the maximum potential development space may not be fully utilized (Plate 9). In such an instance, where a profile is characterized by receptacles of an inadequate volume, the maximum size sinkhole will be smaller than the potential development space. Buttrick (1992) indicates that as there is no efficient technique available at present to ascertain the volume of receptacles, it must be assumed that receptacles of adequate volume are present. It must be emphasized that the potential development space represents the maximum space available in the profile for a sinkhole. Table 11 contains broad categories of ‘potential development space’ and hence the associated scale of potential maximum size sinkholes.

Table 11. Suggested scale of sinkhole sizes (Buttrick 1992)

Maximum potential development space	Maximum diameter of surface manifestation (dimension: metres)	Suggested terminology
Small potential development space	<2	Small sinkhole
Medium potential development space	2 - 5	Medium-size sinkhole
Large potential development space	5 – 10	Large sinkhole
Very large potential development space	> 10	Very large sinkhole

e) *Mobilization potential of materials in the blanketing layer*: Under the influence of a mobilizing agency, it is the materials within the blanketing layer that determine the potential susceptibility of the development space to exploitation and mobilization. This susceptibility should be expressed in terms of the risk of mobilization. Buttrick (1992) indicates that the materials may reflect a low, medium or high risk of mobilization under the influence of a particular mobilization agency.

The different mobilization risk categories are characterized as follows:

- Low risk of mobilization: The profile displays no voids. No air loss or sample loss is recorded during drilling operations. Either a very shallow water table or a substantial horizon of materials with a low potential susceptibility to mobilization may be present within the blanketing layer (e.g. continuous intrusive features or shale material).

- Medium risk of mobilization: This type of profile is characterized by an absence of a substantial 'protective' horizon and a blanketing layer of materials potentially susceptible to mobilization by extraneous mobilization agencies. The water table is below the blanketing layer.

- High risk of mobilization: The blanketing layer reflects a great susceptibility to mobilization. A void may be present within the potential development space indicating that the process of sinkhole formation has already been affected. Boreholes may register large cavities, sample loss, air loss, etc. The water table is below the blanketing layer. In a dewatering situation, the lowering of a shallow groundwater level would obviously increase the risk of mobilization.

  Plate 10(a) indicates a profile with a deep groundwater level situated within the bedrock. The blanketing layer and hence the potential 'development space' are fully exposed to the potential activities of extraneous mobilizing agencies. This plate also depicts a significant layer of intrusive material with a low mobilization potential. This horizon acts as either an aquitard or an aquiclude that prevents mobilization and movement of materials into receptacle. The material within the 'development space' is thus protected from the mobilizing agency.

Plate 10(b) reveals the presence of potential disseminated receptacles above the intrusive horizon displaying the low mobilization potential. A smaller potential development space is thus available for exploitation by a mobilizing agency.

3.9.2. Characterization of the Risk of Doline[3] Formation

Subsidence as used by Buttrick (1992) refers to a shallow enclosed depression that may have formed as a result of various mechanisms. The factors for the characterization of the risk of subsidence formation are listed below. These factors can be readily identified during the stability investigation.

Buttrick (1992) identified the following factors for the characterization of the risk of subsidence formation:

a) *Receptacles*: Inadequate receptacle size may also result in the premature termination of the process of sinkhole development, resulting in a subsidence.

b) *Nature of the blanketing layer*: The following properties of the blanketing layer must be considered:
   - Thickness of the soil material (depth to bedrock)
   - Depth to the original water table
   - Nature of the soil material above the water table (i.e. type of soil and geotechnical characteristics)
   - Nature of the soil material below the water table (i.e. type of soil and geotechnical characteristics)

c) *Mobilization potential*: The influence of the mobilization agency on the profile material is determined by the following:
   - Thickness of the overburden
   - Depth of the original water table
   - Thickness of the soil material above the water table
   - Thickness of the soil material below the water table
   - Nature of the soil material above the water table
   - Nature of the soil material below the water table

---

[3] *The term doline has subsequently been replaced by 'subsidence' in the latest South African dolomite literature.*

The susceptibility of the soil material to mobilization i.e., consolidation settlement under the influence of the mobilizing agency (water table drawdown) may be characterized as follows (Buttrick et. al., 1995):

- Low risk of subsidence formation: In this type of profile, the water table can be above the bedrock and at shallow depth (ingress water), in the bedrock (water table drawdown) or in soil material with geotechnical characteristics reflecting a low susceptibility to consolidation settlement, i.e. material with a high density, low void ratio and low compression index (e.g. Karoo shale).

- Medium risk of subsidence formation: This type of profile is characterized by an absence of a substantial 'protective' horizon and has a blanketing layer of materials potentially susceptible to mobilization by ingress water. The water table is within the bedrock or at depth within the blanketing layer. Voids and disseminated voids may be present above the bedrock, indicating the susceptibility to subsidence formation.

- High risk of subsidence formation: The blanketing layer reflects a great susceptibility to mobilization. The water table is above the bedrock in soil material with a low dry density, high void ratio and high compression index. Residual dolomite soils, namely wad and ferroan soils, have a high potential for dramatic ground settlement.

3.9.3. Implementation of the Method of Scenario Supposition

Geophysical surveys and/or relevant remote sensing techniques and field information (geological mapping) are used to subdivide a site into potential (karst) morphological zones (Steps 1 and 2, Table 12).

Boreholes are then drilled to characterize these zones. The normal procedure would be to characterize the profile of each borehole, using the method of scenario supposition (Step 4, Table 12).

The characterizations of the individual boreholes within a potential zone are then pooled (Step 5, Table 12). If several boreholes confirm a particular characterization, that zone will be defined accordingly. If there are marked deviations, the zoning must be modified by the creation of separate zones, always erring in the favour of a conservative assessment.

Table 12. Application of the method of scenario supposition (Buttrick, 1992)

Step 1	Field reconnaissance and desk study of site	
Step 2	Preliminary zoning utilizing tools such as air photo interpretation and geophysics	
Step 3	Preliminary boreholes to characterize 'preliminary' zonation	
Step 4	Characterization process (scenario supposition). *Individual borehole profiles are reviewed within the context of the selected scenarios*	
	Evaluation factors	
	Sinkhole formation	*Doline formation*
	Mobilization agency / agencies Receptacle development Potential development space (i.e. potential sinkhole size) Nature of blanketing layer/s Mobilization potential of blanketing layer/s	Mobilization agency Nature of blanketing layer/s Mobilization potential Lateral extent
Step 5	Pooling of individual borehole characterization and amending of preliminary zoning, taking historical information into account	
Step 6	Finalized risk zonation characterized in terms of certain risk of certain-sized features forming	
Step 7	Selection of appropriate development types and precautionary measures	
Step 8	Implementation of appropriate development design and precautionary measures	
Step 9	Vigilance and maintenance	

3.9.4. Risk Characterization and Recommended Type of Urban Development

An engineering geological stability investigation of an area proposed for development must characterize it in terms of (i) the risk of certain size sinkholes developing and (ii) the risk of doline formation.

Buttrick (1995) defined the denoted hazard[4] to be a reflection of the 'inherent' geotechnical characteristics of the subsurface profile when subject to a postulated scenario or scenarios that reflect the most unfavourable conditions in terms of dewatering and other mobilizing agencies that may be anticipated at that location.

The hazard[5] characterization can be determined only if the profile is assumed to be 'abused'. If the land has a 'high hazard of large sinkholes forming', it retains that characterization irrespective of the recommended or actual development type. What does change with different types of development is the probability of consequence

[4] The term hazard replaced the initial term 'risk' used by Buttrick (1995)
[5] The term hazard replaced the initial term 'risk' used by Buttrick (1995)

from an event. In order to reduce the probability of the consequence of an event, it is necessary for the development selected for any area to be appropriate in relation to the risk (Buttrick, 1995).

The characterization of the site provides pertinent information for design purposes. Urban development normally results in a disturbance of the metastable conditions prevalent in the dolomitic environment. The particular type of development selected in relation to the risk characterization is critical to the safe and successful long-term viability of a project (Buttrick, 1995).

Table 13 indicates the number of ground movement events anticipated to be generated in low, medium and high risk areas if inappropriate development were to take place.

Table 13. Anticipated Ground-movement events per hectare over a 20-year period (After Buttrick, 1995)

Risk Characterization	Ground-Movement events Per Ha In a 20-Year Period
Low	0,0 events / ha
Medium	0,07 events / ha
High	0,7 events / ha

Buttrick (1992) proposed the use of a zoning system relating the risk characterization of an area and certain suitable or appropriate types of development. Table 14 denotes these suggested types of development, as later adjusted by Buttrick et al (2001), related to the risk characterization. Development design is based on the most conservative assessment for an area, that is on the risk of the most catastrophic event occurring.

Table 14. Characterization: Inherent Risk of subsidence and a specified-size sinkhole forming (After Buttrick et al., 2001)

Inherent Hazard Class	Small sinkhole	Medium sinkhole	Large sinkhole	Very large sinkhole	Risk of doline formation	Recommended type of development in order to maintain acceptable Development Risk
Sinkhole diameter (m)	**< 2**	**2 – 5**	**5 – 15**	**> 15**	**-**	
Class 1	Low	Low	Low	Low	Low # NDS or DS	Residential, light industrial and commercial development provided that appropriate water precautionary measures are applied. Other factors affecting economic viability such as excavatability, problem soils, etc. must be evaluated.
Class 2	Medium	Low	Low	Low	Medium #NDS	Residential development with remedial water precautionary measures. No site and service schemes. May consider for commercial or light industrial development
Class 3	Medium	Medium	Low	Low	Medium #NDS	Selected residential development with exceptionally stringent precautionary measures and design criteria. No site and service schemes. May consider for commercial or light (dry) industrial development with appropriate precautionary measures.
Class 4	Medium	Medium	Medium	Low	Medium #NDS	Selected residential development with exceptionally stringent precautionary measures and design criteria may be considered on such land where investigation for individual structures has indicated that conditions are suitable. No site and service schemes. May utilize for commercial or light (dry) industrial development with appropriate stringent precautionary measures.
Class 5	High	Low	Low	Low	High #NDS	These areas are usually not recommended for residential development but under certain circumstances selected residential development (including lower-density residential development, multi-storied complexes, etc.), may be considered, commercial and light industrial development. The risk of sinkhole and doline formation is adjudged to be such that precautionary measures, in addition to those pertaining to the prevention of concentrated ingress of water into the ground are required to permit the construction of housing units.
Class 6	High	High	Low	Low	High #NDS	These areas are usually not recommended for residential development but under certain circumstances high rise structures or gentleman's estates (stands 4 000m2 with 500m2 proven suitable for placing a house) may be considered, commercial or light industrial development. Expensive foundation designs may be necessary. Sealing of surfaces, earth mattresses, water in sleeves or in ducts, etc.
Class 7	High	High	High	Low	High #NDS	No residential development. Special types of commercial or light industrial (dry) development only (e.g. bus or trucking depots, coal yards, parking areas). All surfaces sealed. Suitable for parkland.
Class 8	High	High	High	High	Low-High *NDS or DS	No development, nature reserves or parkland.

* Number of anticipated events per hectare over a period of 20 ears with poor design and management

Non-Dewatering Scenario and Dewatering Scenario

The basic philosophy of this zoning system is therefore that with increasing probability of more catastrophic events occurring, the density of development should decrease. If development is really required on the more hazardous land, design and construction costs would have to increase to improve safety. This table does not deal with all the possible combinations of risks and events but does indicate development type as related to a trend of 'increasing risk of increasingly catastrophic events' (Buttrick, 1995).

Buttrick et. al (2001) explains that the Inherent Risk for sinkhole formation is a reflection of the geotechnical characteristics of the materials in the blanketing layer and depends mainly on the mobilizing potential of the overlying materials to utilization and mobilization under the influence of a mobilizing agency. Buttrick et al. (2001) delineated between low, medium and high Inherent Risk for sinkhole formation based on the susceptibility of the subsurface profile with particular interest to the blanketing layer to mobilization. This table is presented below in Table 15.

Table 15. Guidelines for assessing the risk for mobilization of the blanketing layer (Inherent Risk for sinkholes) (Buttrick et al., 2001)

Inherent Risk	Typical Site Condition
Low	The profile displays no voids. No air loss or sample loss is recorded during drilling operations. Either a very shallow water table or a substantial horizon of materials with a low potential of susceptibility to mobilization may be present within the blanketing layer (e.g. continuous intrusive features or shale material). Depth to potential receptacle is typically great and the nature of the blanketing layer is not conductive to mobilization.
Medium	This type of profile is characterized by an absence of substantial 'protective' horizon and has a blanketing layer of *materials potentially susceptible to mobilization* by extraneous mobilization agents. The water table is below the blanketing layer.
High	The blanketing layer of the high-risk profile reflects a great susceptibility to mobilization. A void may be present and is interpreted to be very likely, within the potential development space, indicating that the process of sinkhole formation has already started. Boreholes may register large cavities, sample loss, air loss, etc. Convincing evidence exists of cavernous subsurface conditions which will act as receptacles. The water table is below the blanketing layer. In dewatering situation, the lowering of a shallow groundwater level would obviously increase the risk of mobilization.

4. METHODOLOGY

4.1. Data Preparation

The Dolomite Stability Report boundaries and percussion borehole positions were captured in GIS as part of the Dolomite Section database activities. The GIS software used by the CGS is Esri ArcMap® Version 9.3.

All the percussion boreholes drilled during dolomite stability site investigations in Centurion were analysed in order to capture groundwater and bedrock depth and later determine the hazard of sinkhole formation at each borehole point. The actual borehole logs (3587 boreholes) are not presented in this dissertation as a summary is provided in Appendix B.

4.2. Classifying the area in terms of the hazard of sinkhole formation

4.2.1. Background

The Buttrick (1992) Scenario Supposition Method was adopted by the CGS as the most acceptable method for evaluation of dolomite sites, in 1994 (pers. Comm., G. Heath 2012). This method has been adjusted by Buttrick et al. in 1995 and 2001 where some factors were refined.

Some of the terms as used in the Scenario Supposition Method were changed in the draft SANS 1936-1:2012 document. The eight classes of the Scenario Supposition Method were known as Inherent Risk Classes, but have subsequently been changed to become Inherent Hazard Classes.

Some definitions from the draft SANS 1936-1:2012 document are:

- *Competent person:* person who is qualified by virtue of his experience, qualifications, training and in-depth contextual knowledge of development on dolomite land to
  a. plan and conduct geotechnical site investigations for the development of dolomite land, evaluate factual data, develop a geological model, establish interpretative data and formulate an opinion relating to the outcomes of such investigations;
  b. develop and inspect for compliance the necessary precautionary measures required on dolomite land to enable safe developments to take place;
  c. develop dolomite risk management strategies; or

d. investigate the cause of an event and participate in the development of the remedial measures required.

Hazard[6]: source of potential harm

Inherent hazard: potential for an event (sinkhole or subsidence) to develop in a particular ground profile on dolomite land

Inherent Hazard Class: classification system whereby a site is characterized in terms of eight standard inherent hazard classes, denoting the likelihood of an event (sinkhole or subsidence) occurring, as well as its predicted size (diameter)

Risk[7]: potential for realization of some unwanted consequence arising from a hazard

Sinkhole: feature that occurs suddenly and manifests itself as a hole in the ground

Subsidence[8]: shallow, enclosed depression

The draft SANS 1936-1:2012 document does not specify how to derive at the eight hazard classes, and provides the opportunity to the 'competent person' to use any method to derive thereat, as long as it can be verified.

4.2.2. Implementation of the Inherent Hazard Zoning System

Since there are no numerical limits to the Scenario Supposition method classification system, draft guidelines for allocation of each hazard class, based on CGS institutional memory and experience has been developed. This approach is mainly based on the dolomite bedrock depth and the mobilization potential of the overlying horizons. The size of sinkhole that could develop is again a function of the depth of dolomite bedrock, i.e. the thinner the overburden the smaller size sinkhole is expected and the thicker the overburden, the larger the size sinkhole expected.

An Inherent Hazard Class is assigned to each borehole, based on the characteristics of the material encountered in that borehole. Table 16 provides these basic guidelines for classifying boreholes in a non-dewatering scenario specific to the Centurion CBD.

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[6] *Hazard is a function of magnitude (of the events), area, and frequency.*
[7] *Risk is a function of the probability of failure and the consequences of failure.*
[8] *Most South African literature previously used the term "doline" when referring to subsidence as defined above. The use of the term "subsidence" is in line with international literature and practice.*

Table 16. Guidelines for determining the Inherent Hazard Class in a non-dewatering scenario, as applied in the Centurion CBD and surrounds

Inherent Hazard Class	Characteristics (Non-Dewatering Scenario)
IHC 1	- Overburden must consist of a competent, non-dolomitic cover (e.g. shale or syenite) of at least 30 m in thickness, overlying dolomite or chert residuum. - No voids (cavities) or low density material (wad) must be present.
IHC 2	- Overburden must consist of a competent, non-dolomitic cover (e.g. shale or syenite) of at least 20 m in thickness, overlying dolomite or chert residuum. - No voids (cavities) or low density material (wad) must be present. OR - A very shallow, static groundwater level exist, i.e. less than 5 m from surface, which forms a solid base
IHC 3	- Dolomite bedrock is situated between a depth of 6 m and 15 m below surface. - No voids (cavities) must be present. - If low density material (wad) is present, no more than 2 m should have recorded penetration rates of less than 15 seconds.
IHC 4	- Dolomite bedrock is situated deeper than 15 m in depth. - No voids (cavities) must be present. - If low density material is present, no more than 2 m should have recorded penetration rates of less than 15 seconds.
IHC 5	- Dolomite bedrock is shallower or situated at 5 m in depth. - Dolomite bedrock is discontinuous i.e. pinnacles and grykes are believed to exist, the latter acting as conduits to the voids below. - It is assumed that the grykes are narrow (i.e. < 1 m) and is present in the bedrock of depths exceeding 5 m. - No voids (cavities) are present in the dolomite bedrock.
IHC 6	- Dolomite bedrock is situated between 6 m and a maximum of 20 m in depth. - Voids and/or low density material (wad) is present. The low density material has recorded penetration rates of less than 15 seconds and is more than 2 m in thickness.
IHC 7	- Dolomite bedrock is situated between 20 m and a maximum of 35 m in depth. - Voids and/or low density material (wad) are present. The low density material has recorded penetration rates of less than 15 seconds and is more than 2 m in thickness.
IHC 8	- Dolomite bedrock is situated deeper than 35 m in depth. - Voids and/or low density material (wad) is present. The low density material has recorded penetration rates of less than 15 seconds and is more than 5 m in thickness.

In a non-dewatering scenario, the base of the erosion level (i.e. the depth to where erosion could occur) is either the head of dolomite bedrock or a static dolomitic groundwater level. Therefore, if the groundwater level is situated at 7 m below surface, and the dolomite bedrock is situated at 18 m below surface, the Inherent

Hazard Rating would be IHC 3, since the groundwater level forms the base of the erosion level and not the dolomite bedrock.

This method does not take the angle of draw, as proposed by Buttrick (1992) into account. It is merely based on the assumption that a larger size sinkhole will develop in deeper dolomite bedrock environments. Since this method is not entirely following the Method of Scenario Supposition, it is proposed as the '*Modified Method of Scenario Supposition*'.

For a dewatering scenario, the following guidelines are suggested, based on experience at the CGS:

Table 17. Suggested guidelines for determining the Inherent Hazard Class in a dewatering scenario, applicable to the Centurion CBD and surrounds

Inherent Hazard Class	Characteristics (Dewatering Scenario)
IHC 1	- Groundwater level is within dolomite bedrock
IHC 2	N/A
IHC 3 & 4	- Groundwater level is situated above dolomite bedrock - No low density material (wad) is present underneath the groundwater level - Should the groundwater level be lowered, no material below should be able to compress (e.g. chert should be present above dolomite bedrock)
IHC 5	N/A
IHC 6	- Groundwater level is situated above dolomite bedrock - If the groundwater level is lowered, the material below will compress which result in subsidence or sinkhole formation - The compressible material below the groundwater level(wad) should not be more than 5 m in thickness - The depth of the groundwater level should be between 5 m and 20 m
IHC 7	- Groundwater level is situated above dolomite bedrock - If the groundwater level is lowered, the material below will compress which result in subsidence or sinkhole formation - The compressible material below the groundwater level(wad) should not be more than 10 m in thickness - The depth of the groundwater level is generally between 20 m and 35 m
IHC 8	- Groundwater level is situated above dolomite bedrock - If the groundwater level is lowered, the material below will compress which result in subsidence or sinkhole formation - The compressible material below the groundwater level(wad) is more than 10 m in thickness - The depth of the groundwater level is generally greater than 35 m

Since dewatering has not had an influence on stability in Centurion, the boreholes were not classified in terms of dewatering classification, and therefore only a non-dewatering classification was applied. Table 17 was included for information purposes to illustrate that the *'Modified Method of Scenario Supposition'* can be applied in a dewatering scenario.

The table attached in Appendix B indicates the details including the Inherent Hazard Class, of all the boreholes in the Centurion CBD area.

4.3. Creating a Hazard Classification Map

The Inherent Hazard Class of each borehole produced above, was then transferred to the attribute table of the Percussion borehole shapefile[9] in ArcMap®, the GIS software, Plate 11. The attribute table of the shapefile indicates the spatial position of the boreholes and information such as the borehole number, depth of the dolomite bedrock, length of the borehole, etc. were captured in the attribute table.

The Spatial Analyst® extension of ArcMap® was used to create the Hazard Classification Map. In order to create a grid surface in ArcGIS®, the Spatial Analyst® extension makes use of one of several interpolation tools. Interpolation is the process of estimating an unknown value using known values. In the context of the Spatial Analyst® interpolation tools, interpolation is used to determine a value for an empty cell using the nearby sample points, called a z-value. It is based on the principle of spatial autocorrelation which measures the degree of relationship or dependence between near and distant objects.

The method used in the creation of the Inherent Hazard Map is the Natural Neighbor method. The Natural Neighbor interpolator uses the weighted average of surrounding or neighbouring data points. The basic equation used in Natural Neighbor, implements the assumption that things that are close to one another are more alike than those that are further apart.

The input parameter in the Natural Neighbor method is the borehole shapefile. A Z-value is requested, which is the attribute column in the shapefile that contains the values on the Inherent Hazard Class. A cell size can be specified for the output raster, the smaller the value the higher resolution would be the output raster be.

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[9] *A shapefile is a popular geospatial vector data format for GIS software. A shapefile is a digital vector storage format for storing geometric location and associated attribute information. This format lacks the capacity to store topological information. Shapefiles are simple because they store primitive geometrical data types of points, lines, and polygons. These primitives are of limited use without any attributes to specify what they represent. Therefore, a table of records will store properties/attributes for each primitive shape in the shapefile. (Definition from Wikipedia)*

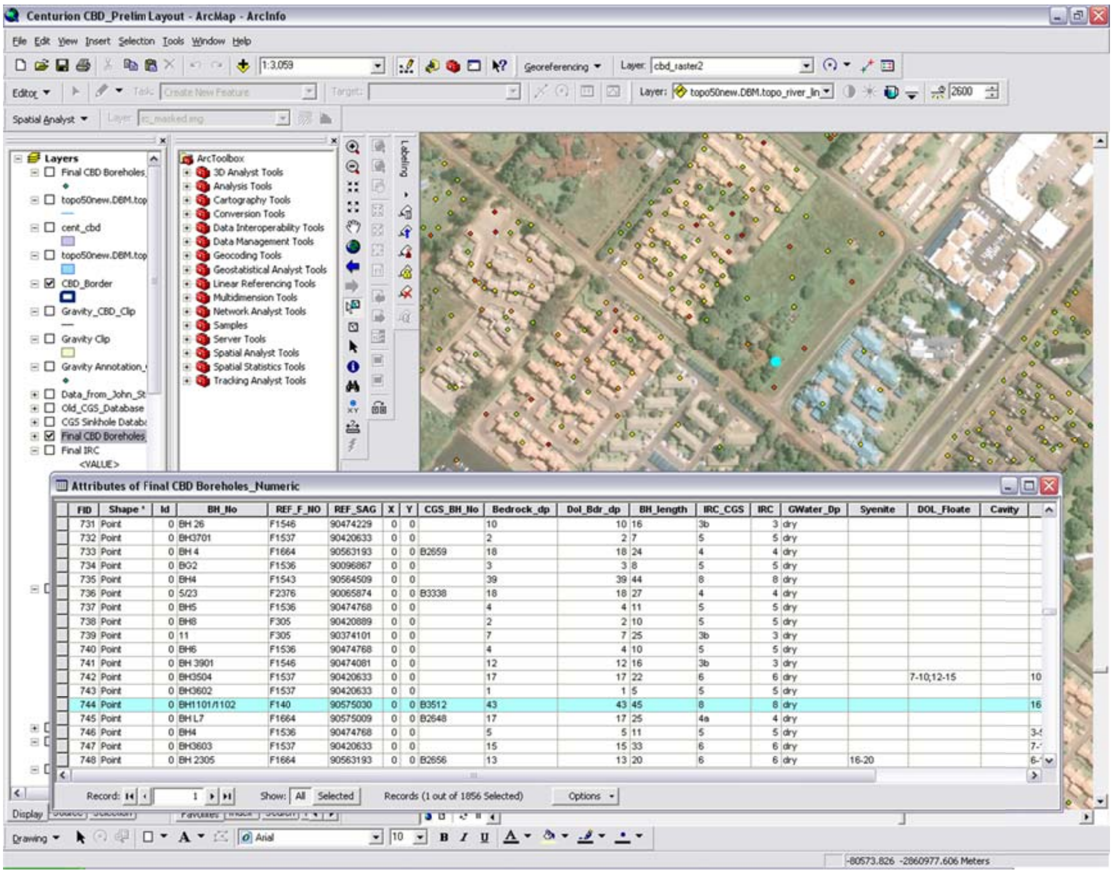


Plate 11. The attribute table of the borehole shapefile

5. DATA INTERPRETATION

5.1. Percussion Boreholes

A total of 3437 boreholes are situated within the Centurion CBD and surround areas which covers a surface area of approximately 1657 hectares. This constitute 2,07 boreholes per hectare. A total of 3587 percussion boreholes were used to assess the dolomite stability conditions. Some boreholes just outside the periphery of the demarcated Centurion CBD and surrounds were also included to ensure coverage to the boundary of the Centurion CBD area.

It is obvious that the borehole data is not evenly distributed. Fewer borehole points are present within the area south of the Hennops River (414 boreholes, 0,88 borehole per hectare) compared to north of the Hennops River (3024 boreholes, 2,54 boreholes per hectare) in the Lyttelton Agricultural Holdings, Die Hoewes and the Lyttelton Manor residential area. The boreholes are very densely spaced in the area of the Lyttelton Agricultural Holdings and Die Hoewes. Figure 2 indicates all the boreholes used in the assessment of the Centurion CBD area.

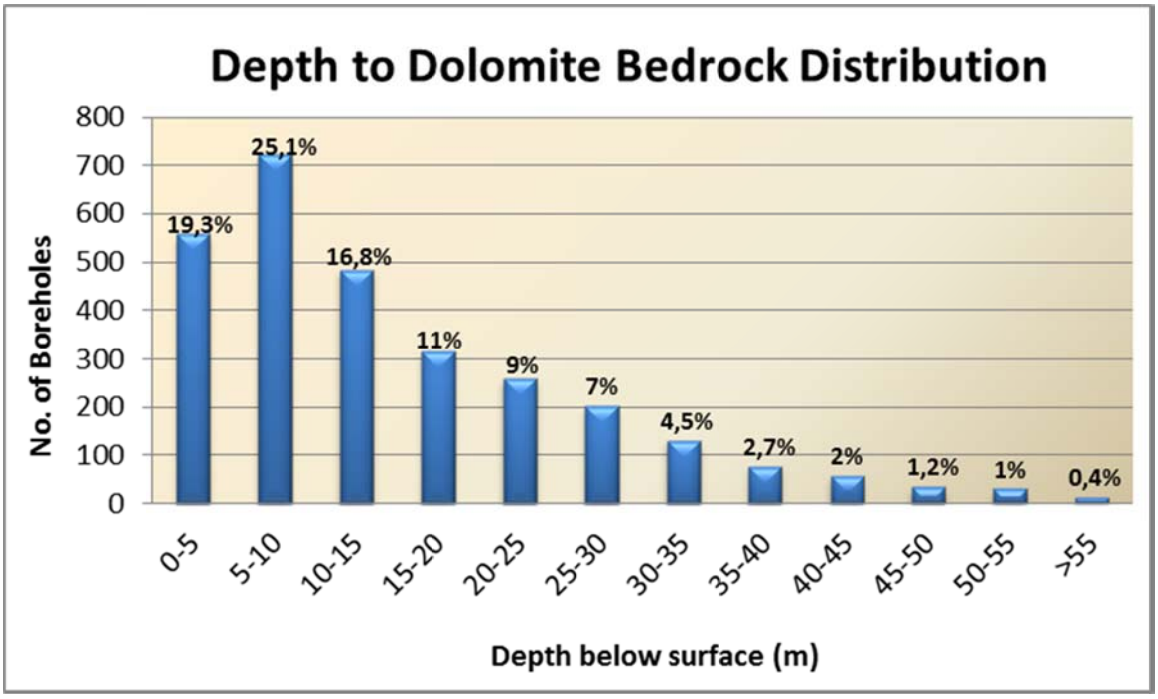
5.1.1. Dolomite Bedrock Depth

The depth to dolomite bedrock[10] is very irregular with a minimum bedrock depth of 0 m and a maximum of 66 m. Note however that some of the boreholes (21%) were terminated either before solid dolomite bedrock was encountered or within syenite rock. These boreholes were not included in the bedrock statistics (2880 boreholes in and around the Centurion CBD and surrounds area were used for the analysis). The average bedrock depth for the area is 15 m below ground surface. Plate 12, taken in the Lyttelton Quarry situated immediately north of the Centurion CBD area shows the irregularity of the dolomite bedrock where numerous pinnacles are exposed (note the size of the excavator in relation to the dolomite pinnacles).

Plate 12. The variability of dolomite bedrock in the Lyttelton Quarry (I. Venter, 1981)

Graph 1 indicates the distribution of the depth below ground surface at which dolomite bedrock was intersected. The majority of the boreholes, 772 (25,1%) intersected bedrock between 5 m and 10 m. A total of 1763 (61,2%) boreholes intersected dolomite bedrock at a depth of less than 15 m below ground surface.

[10] The dolomite bedrock depth is referred to as the top of dolomite rock head where dolomite rock is referred to as hard, competent rock with a drilling penetration rate of over 3 minutes.



Graph 1. Depth to dolomite bedrock distribution

A map was created in Spatial Analyst® showing the Dolomite Bedrock Depth (Figure 4).

From the Dolomite Bedrock Depth map, the following are noted in the area north of the Hennops River:

- Borehole points are densely spaced over most of this area although some small areas are not covered by any boreholes.
- Shallow dolomite bedrock is present in Lyttelton Manor, extending south-westerly towards Doringkloof. Patches of 0 – 5 m, large areas of 5 – 10 m is present, which correlates well with the type of conditions shown in Plate 12, which is in the Lyttelton Quarry across the road.
- The Lyttelton Agricultural Holdings and Die Hoewes generally represent areas of shallower dolomite bedrock with occasional deeper valleys being present.
- Deeper dolomite bedrock is present in the area of Bernini Street (Lyttelton Agricultural Holdings) and in the area surrounded by Wren and Plato Streets (Die Hoewes).
- Towards the Hennops River the area surrounding Supersport Park and the southern parts of Doringkloof represents deeper dolomite bedrock.
- A large area representing deeper dolomite bedrock is present in the area between the Lyttelton Agricultural Holdings and Lyttelton Manor, running almost parallel to Clifton Street.

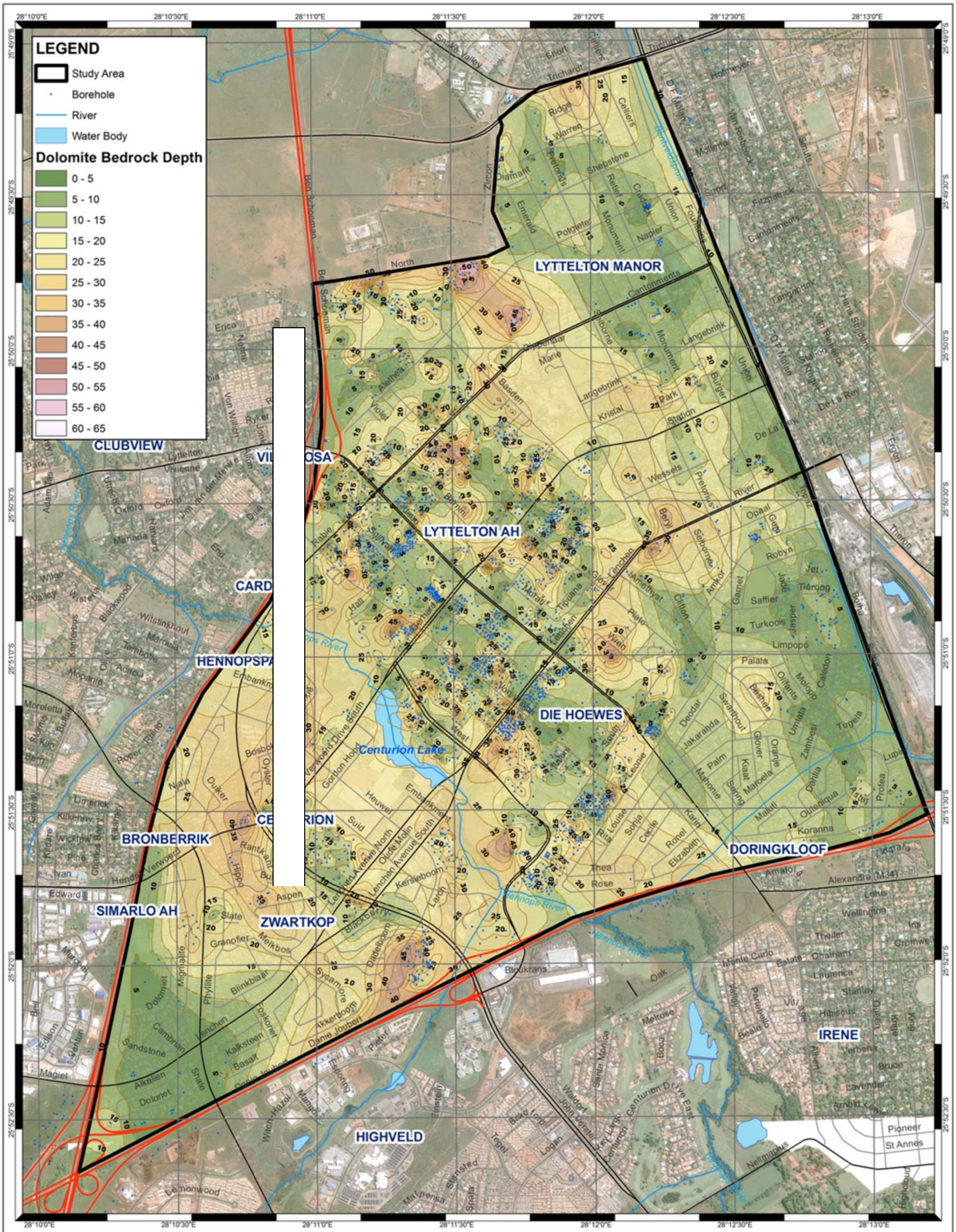


FIGURE 4: DOLOMITE BEDROCK DEPTH BELOW SURFACE

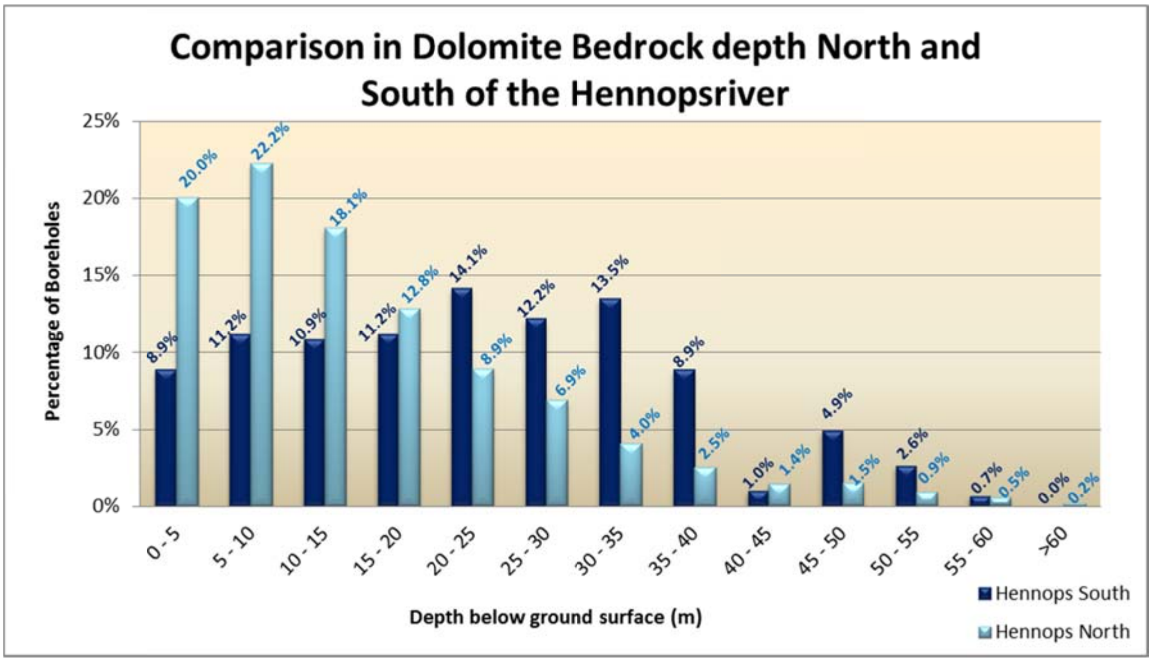
- The average depth to dolomite bedrock for the area north of the Hennops River (Lyttelton Agricultural Holdings, Die Hoewes and Doringkloof) is 14,5 m below ground surface (from 2445 boreholes).

From the Dolomite Bedrock Depth map, the following are noted in the area south of the Hennops River:

- The borehole points are sparsely spaced and large areas are not covered by any boreholes.
- The depth to bedrock map in this area therefore does not give a realistic view of the actual conditions present, but since it is the only data available one can assume that the general depth to bedrock is deeper in the area south of the Hennops River than in the northern part.
- Dolomite bedrock is mostly situated between 20 m and 35 m below ground surface.
- Shallow dolomite bedrock is present in the southern most corner of the Centurion CBD area, towards the intersection between the Ben Schoeman and Danie Joubert Freeways, which correlates well with the Oaktree Formation.
- Areas of deeper dolomite bedrock are present in the area of Kwikkie Street (Hennopspark) and Dadelboom Street (Zwartkop).
- The average depth to dolomite bedrock in the area south of the Hennops River is 22,5 m below ground surface (from 304 boreholes).

Graph 2 indicates the difference in dolomite bedrock depth distribution for the areas north (Lyttelton Agricultural Holdings) and south of the Hennops River.

From this graph it is evident that the dolomite bedrock depth in the area north of the Hennops River is generally shallow with 60,4% of the boreholes encountering dolomite bedrock at a depth of less than 15 m below surface. In the area south of the Hennops River, the bedrock is generally at an intermediate depth with 39,8% of the boreholes encountering dolomite bedrock at depths between 20 m and 35 m below surface.



Graph 2. Comparison of the depth to dolomite bedrock between the northern and southern areas of the Hennops River

5.1.2. Dolomite Bedrock Elevation

A dolomite bedrock elevation map was created using Spatial Analyst® and is presented in Figure 5. The following are noted from this map:

- The dolomite bedrock generally follows the surface elevation, where a valley is present in the area of the Hennops River with higher slopes on either side of the river.
- In the area south of the Hennops River the average dolomite bedrock elevation is 1420 mamsl with the highest point situated at 1490 mamsl (situated between South and John Vorster Streets, Centurion) and the lowest point at 1364 mamsl (Area of Kwikkie Street, Hennopspark).
- In the area north of the Hennops River the average dolomite bedrock elevation is 1436 mamsl with the highest point situated at 1491 mamsl (Corner of Station and Clifton Streets, Lyttelton Agricultural Holdings) and the lowest point at 1366 mamsl (Area of Supersport Park).

It is assumed that the dolomite bedrock elevation will not reflect the actual bedrock topography, as indicated in Figure 5, due to the wide spacing of boreholes and the large scale at which the map was created. For a bedrock elevation map to show the actual undulating dolomite bedrock surface, boreholes needs to be drilled at a very close spacing and a site specific map should be created. An example of a 'test' area within the Centurion CBD area is shown below in Plate 13. From this plate it is evident that pinnacles (marked P on plate) are present with some associated deeper valleys (large area in turquoise colour on plate).

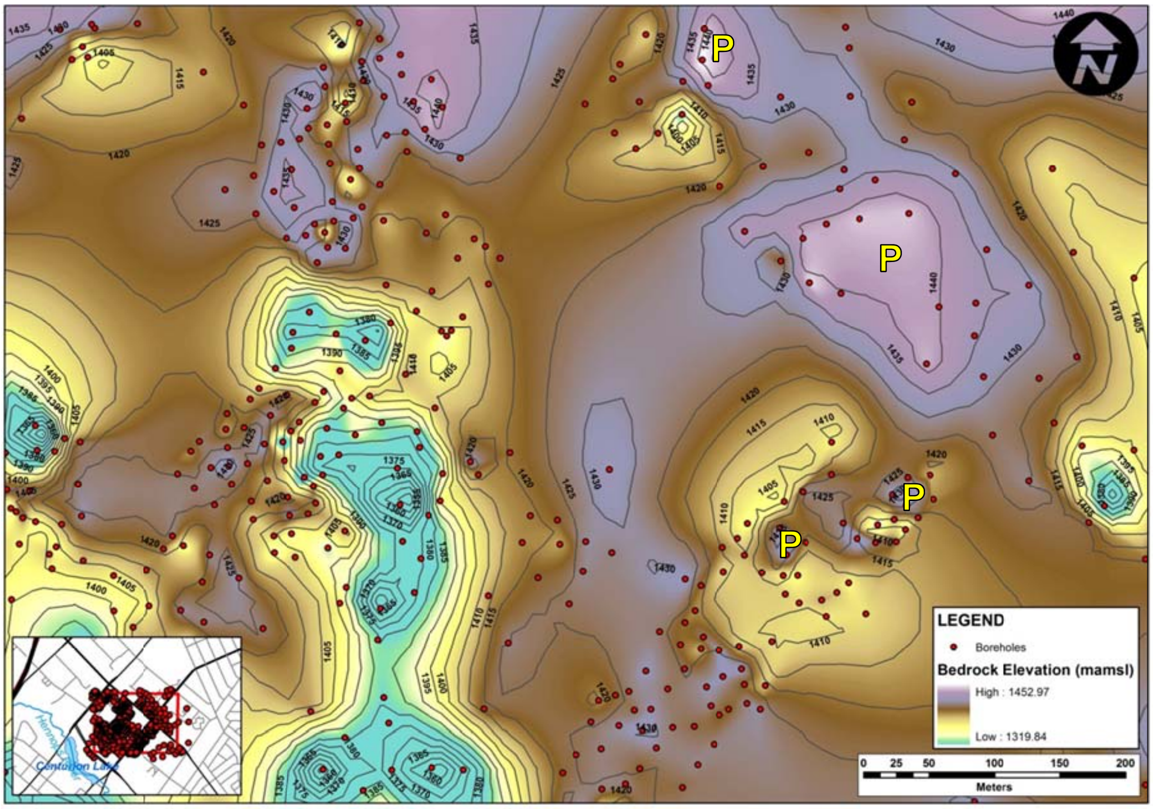


Plate 13. Example of a bedrock elevation map on a small area within the Centurion CBD area

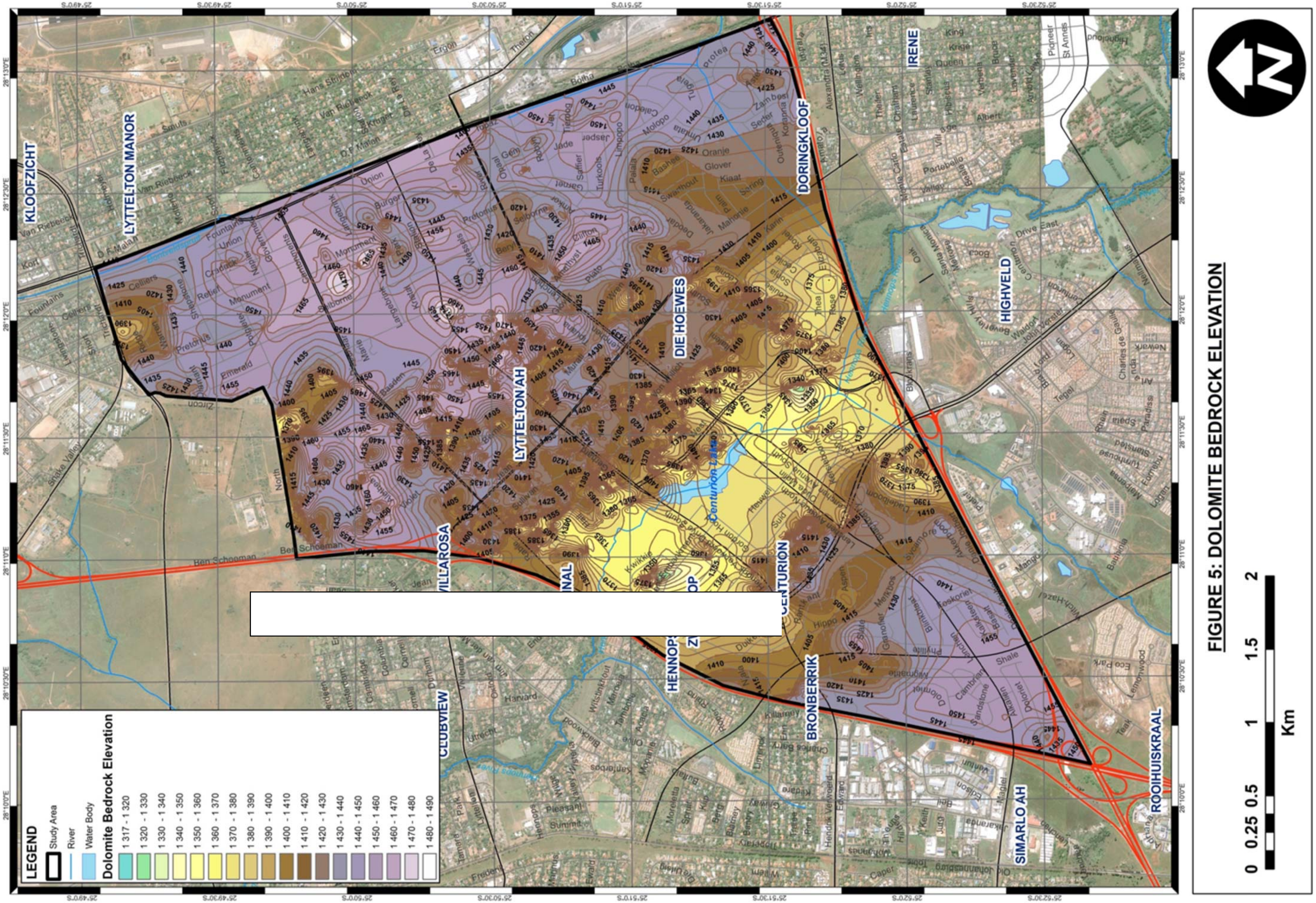


FIGURE 5: DOLOMITE BEDROCK ELEVATION

5.2. Gravity Data

The residual gravity lines, from the Relly investigation (1976) are indicated on Plate 14. Relly has described the pattern of gravity contours to be extremely complicated reflecting complexities in the distribution of subsurface mass and in particular reflecting great variations in the depth of the dolomite sub-surface.

Gravity is used as a tool to indicate areas of low and high density material. A gravity high usually implies an area where high density material is present, i.e. dolomite bedrock is shallow and similarly a gravity low implies an area of lower density material such as a void or thick wad or even dense bedrock but at depth.

In this study the gravity was not used as part of assessing the dolomitic conditions, due to the limited area for which gravity is available.

The residual gravity generally indicates an area of gravity lows and steep gradients, especially in the north-eastern and the eastern corners. A broad gravity low, extending northwest-southeast is present along the western boundary (towards the Hennops River) of the gravity survey area, followed by an area of a broad gravity high in the centre of the gravity survey area, also stretching northwest-southeast in the area of Wren Street in the south to North street in the north. The north-eastern boundary of the gravity survey is mainly characterized by some gravity low areas.

Some of the gravity low areas do correspond to areas of deeper dolomite bedrock, which include:

- The large gravity low feature trending north-south running from Rabie to Von Willich Street (marked 1);
- The smaller gravity low feature immediately east of the intersection between Lenchen and West streets (2);
- Between Rabie and Alethea Streets (3) in the north; and
- The area at the corner of Clifton and Gerhard streets (4).

The only gravity high that corresponds well to an area of shallow bedrock is present at the corner of South and Von Willich Streets (5), and to a lesser extent does the gravity high immediately west of Rabie street (6) correspond with the bedrock depth.

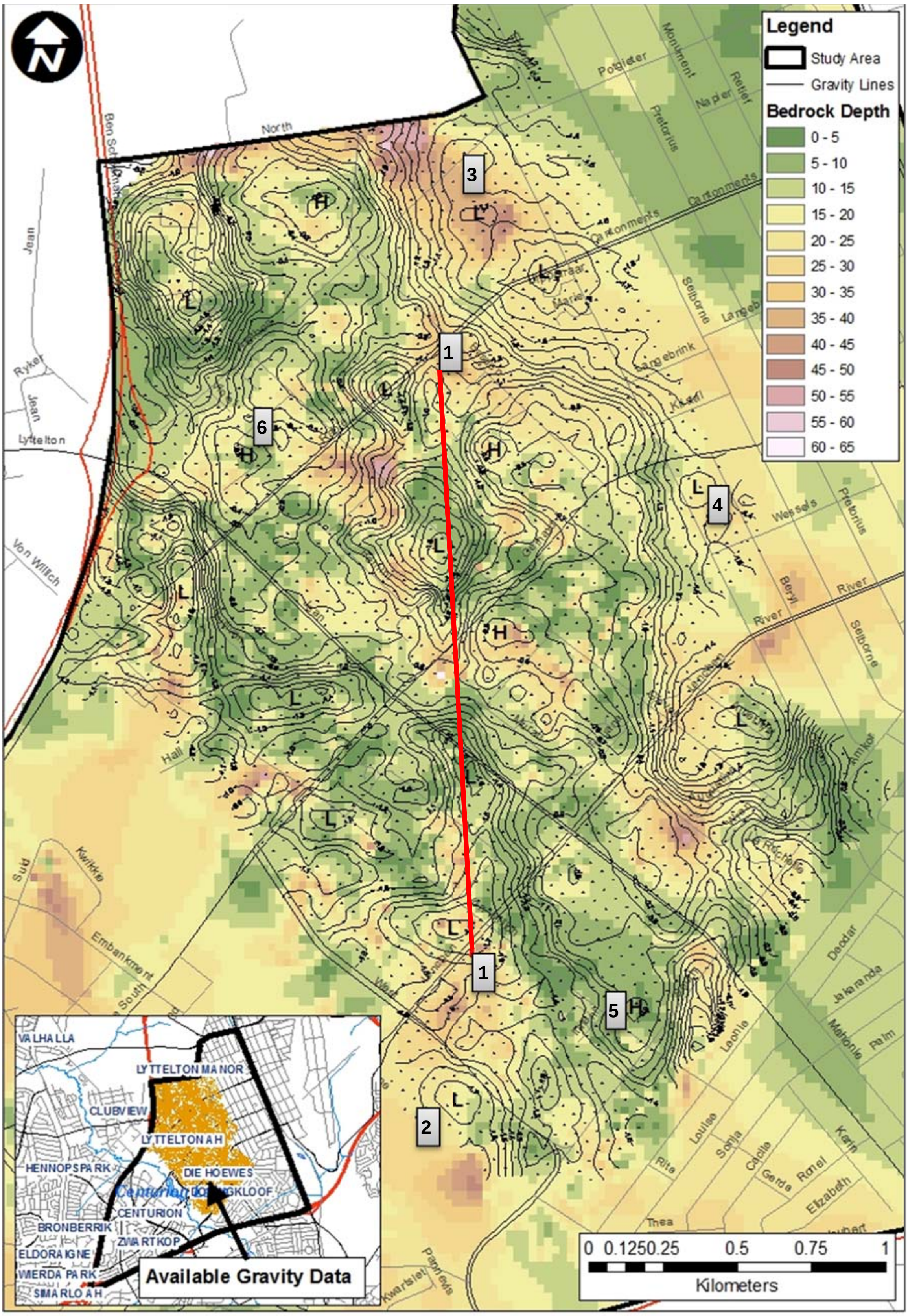


Plate 14. Available gravity data overlain on the dolomite bedrock depth (From Africon (Pty) Ltd)

The gravity does not correlate well with the dolomite bedrock map and this could be because the gravity points are widely spaced (45 m), and the borehole points are not equally spaced.

5.3. Sinkhole Database

A total of 119 sinkholes have been recorded in the Centurion CBD area since the early 1970's to date, the positions of which are indicated on Figure 6. The sinkhole record, held by the CGS is still under review and a large number of the sinkholes do not have a complete record. The sinkhole record is presented in Appendix C. It should be noted that the sinkhole database is confidential and not readily accessible to the public. Therefore, limited information is presented in this dissertation on the exact positioning of sinkhole occurrences.

5.3.1. Nature of Sinkhole Occurrences in the Centurion CBD and surrounding areas

The following were derived from the sinkhole database:

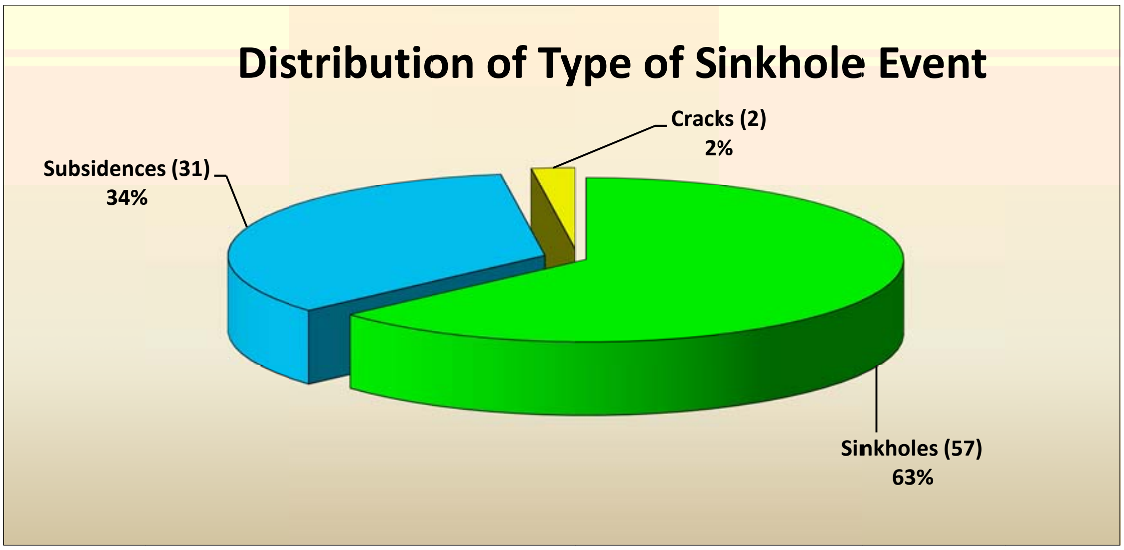
- The largest reported sinkhole is S41, with dimensions of 32 m x 23 m. This sinkhole is situated in Lyttelton and occurred as a result of a broken water pipe.
- The deepest reported sinkhole is S49 that is 10 m deep. This sinkhole occurred as a result of a leaking sewerage pipe.
- Only 1 sinkhole (S45) has occurred through syenite, situated close to the John Vorster and Jean Avenue intersection (No detailed information is available regarding this sinkhole event).
- A total of 110 sinkholes (92%) occurred in the Monte Christo Formation whereas only 8 sinkholes (7%) occurred in the Lyttelton Formation. No sinkholes occurred in the Oaktree Formation. See Table 18 below for the number of sinkhole events that have occurred in each of the geological successions or formations in the Centurion CBD area (from the available unpublished 2528 CC Centurion geology map).
- Only 1 sinkhole (S45) has occurred south of the Hennops River.
- The oldest known sinkhole (S15) occurred on 24 March 1971 and the most recent sinkhole (S109) occurred on 23 September 2011.
- 90 (75,6%) of the database have information regarding the type of the event that occurred. From this available information, 57 (63,3%) of the events were

recorded as sinkholes; 31 (34,4%) were recorded as subsidences[11]; 2 (2,2%) were recorded as cracks. (29 events (24,37%) did not have available information). Graph 3 indicates the distribution of type of sinkhole events.

- The average sinkhole depth is 3,24 m (data from 47 sinkholes).
- The average sinkhole size is 5,1 m (data from 53 sinkholes).
- 3 lives have been lost as a result of a sinkhole (S19) in the Centurion CBD area. It should be noted that these lives were lost during the rehabilitation of the sinkhole, and not as a result of the event itself.
- 7 Houses or units had to be demolished as a result of sinkholes (S39, S42, S97 & S100) in the area.

Table 18. Number of sinkholes that have occurred in each geological succession

Geological Succession / Formation	Area (ha)	No. of Sinkholes Occurred
Lyttelton Formation	91,82	8
Monte Christo Formation	1246,61	103
Oaktree Formation	44,80	0
Chert Breccia	9,77	0
Dolerite	35,10	1
Quartz – Diorite (Syenite intrusions)	171,34	5
Alluvium	58,31	2



Graph 3. Distribution of type of sinkhole events

[11] *A subsidence is referred to as a shallow earth depression which forms as a result of the compression at depth of low-density dolomite residuum. It is not a catastrophic event and is shallow in nature.*

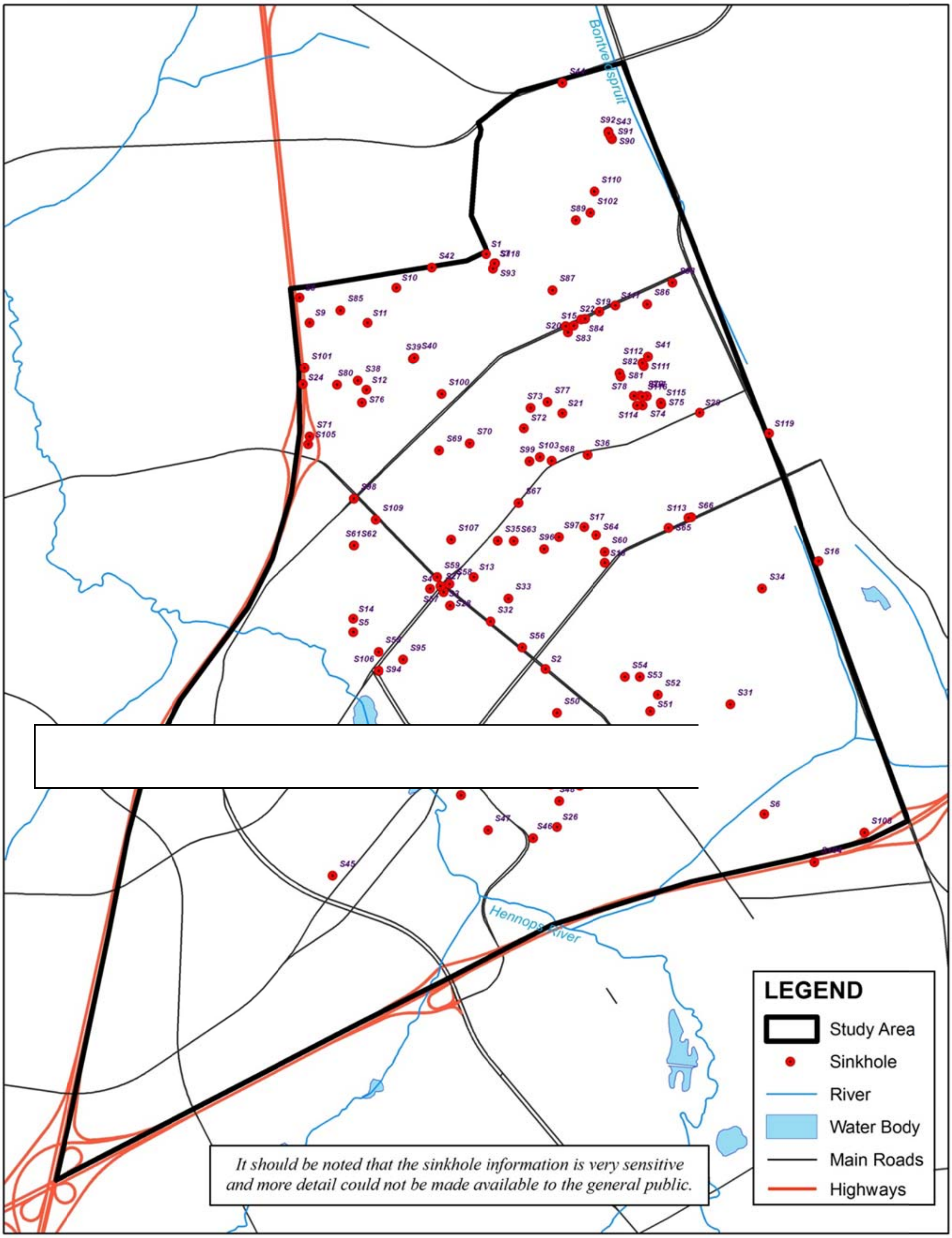


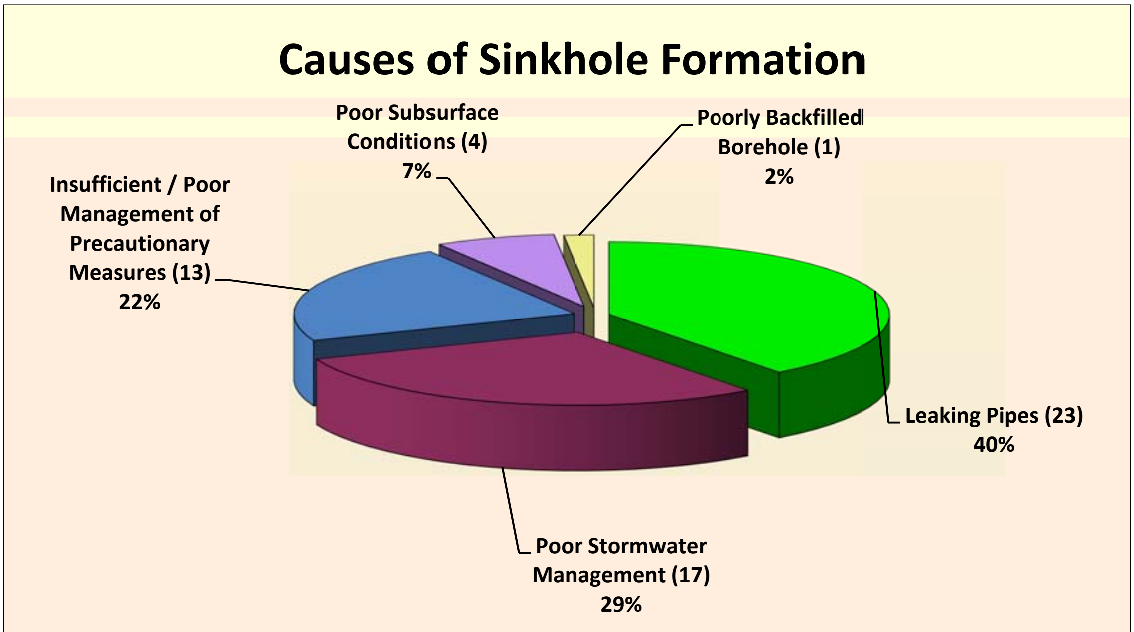
FIGURE 6: SINKHOLE MAP OF CENTURION CBD AREA

5.3.2. Quality of the Sinkhole Database

The CGS is still in a process to verify all the sinkhole data points with approximately 90% already verified. It should be noted that there could be sinkholes that have not been recorded and more sinkholes could have occurred in the area. Note there is no legal obligation for persons or authorities to record the occurrence of sinkholes, nor to report them to the CGS. It is therefore quite possible that information regarding many events has been lost.

Only 58 of the sinkholes (49%) in the database have information regarding the possible cause of the sinkhole development. According to this information 23 sinkholes or subsidences (40%) formed as a result of leaking water bearing services, 17 events (29%) occurred as a result of poor surface / storm water management and 13 events (22%) occurred as a result of inadequate or poor precautionary measures (e.g. downpipes draining into soil next to foundations, ponding water). Only one sinkhole (2%) occurred as a result of a poorly backfilled borehole whereas a total of 4 sinkholes or subsidences (7%) occurred as a result of poor subsurface conditions. Using this limited information (49% of the database) it is evident that 93% of the events in the Centurion CBD area occurred as a result of man's disturbance of the natural ground conditions, confirming what Buttrick et al (2001) indicated.

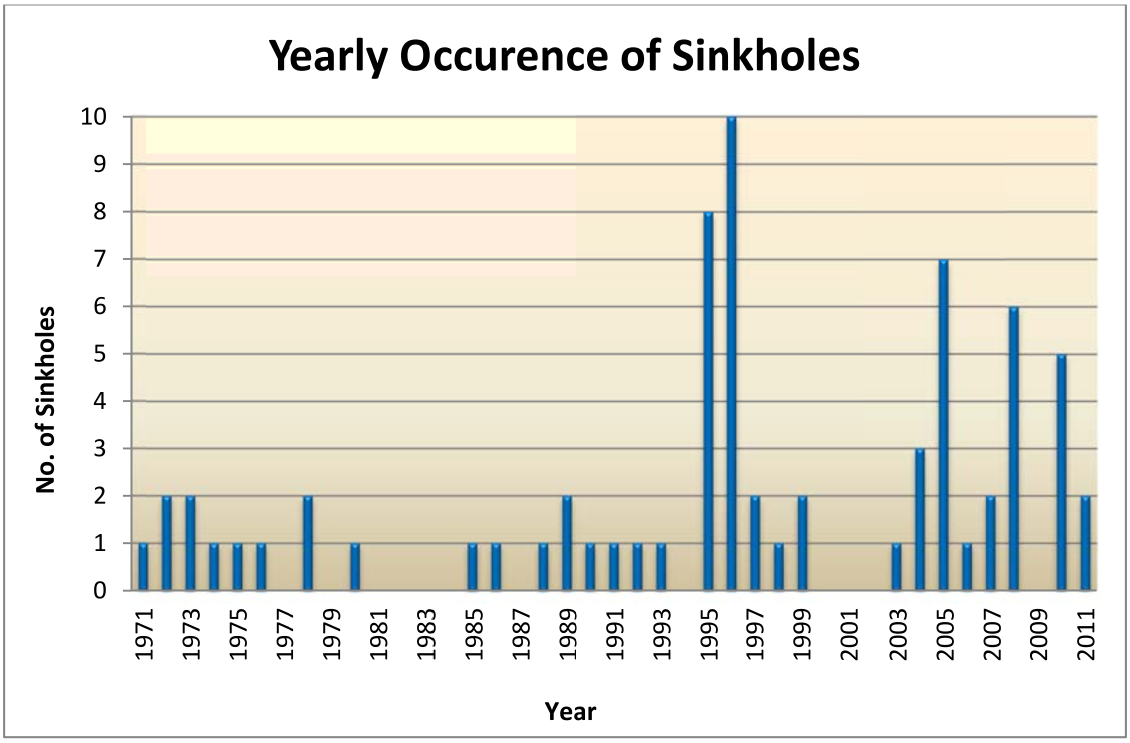
Graph 4 below shows the distribution of the cause of sinkhole occurrence in the Centurion CBD area. Unfortunately, 51% of the database did not have any information regarding the cause of the sinkhole occurrence.



Graph 4. Distribution of cause of sinkhole events

Graph 5 shows the yearly occurrence of sinkholes in the Centurion CBD area. Not all the sinkhole data points have information regarding the date of occurrence, with only 70 sinkholes (58%) having this information. The year where the most sinkholes were recorded is 1996 when 10 sinkholes occurred. This can be ascribed to high rainfall, especially during 1995 and 1996.

For some years (1977, 1979, 1981-1984, 1987, 1994, 2000-2003 and 2009) no sinkholes have been recorded, or none have occurred. It is assumed that all the data has not been recorded, especially in the 1970's and 1980's and 2000 to 2003.



Graph 5. Yearly occurrence of sinkholes in the Centurion CBD area

Only 53 sinkholes (45%) in the database have information regarding the size i.e. the diameter of the sinkhole. The sinkhole size distribution is discussed in Section 5.4 of this dissertation.

5.3.3. Consequence of Sinkhole Occurrence

The consequence of sinkholes occurring has led to the demolishing of houses (7) and other structures which have resulted in a loss of money for property owners in dolomite areas. CTMM attempts to apply more stringent precautionary measures and make the public more aware of the sinkhole problem. In recent years, developments with improved foundation systems have been implemented in order to prevent damage due to these catastrophic events. The Gautrain route in particular, traversing over the centre of the Centurion CBD area has had to implement foundation systems costing millions of Rands to ensure the safety of the train line.

Below are some pictures showing sinkholes that have occurred in the Centurion CBD and surrounding areas.

Plates 15 and 16 indicate a subsidence (15 m in diameter) that occurred next to the N14 Highway, approximately 100 m north of the Jean Avenue off-ramp (S101). It occurred as a result of surface water run-off from the highway into the adjacent open field. Traffic congestion resulted for a prolonged period during the remediation of this sinkhole.

Plate 15. Sinkhole east of the N14 Highway (S101)

N14 sak in en maak verkeer erge kopseer

Pad herlei weens reusagtige sinkgat

Motoriste op die Ben Schoeman-hoofweg in 'n suidelike rigting ry verby die afgesperde sinkgat. Motoriste kan tans slegs die vinnige baan gebruik en verkeer het gisteroggend opgehoop tussen die Eeufeesstraat- en die Jeanlaan-afrit.

Plate 16. The N14 Highway sinkhole in the newspapers (Beeld, 7 February 2006)

Plate 17 shows cracks in a unit and a broken garden wall in a residential complex in Die Hoewes (S97). Although the damage does not seem very severe, three units have been demolished after a thorough investigation which revealed that poor subsurface conditions are present, and since the foundation systems appear inadequate, substantial repairs are required. The cause of this settlement appears to be poor storm water drainage, where storm water accumulated at the back of the unit against the boundary wall.

Plate 17. A settlement in a residential complex, Die Hoewes (S97)

Plates 18 and 19 below show the sinkholes that have occurred on the embankment of the N1 highway, approximately 300 m south of the Botha Avenue. Plate 17 was taken during September 2010 and Plate 18 during December 2010. The two plates clearly show how these sinkholes have enlarged during this period of three months as a result of continual inflow of rain water.

Plates 18 & 19[12]. Sinkholes that occurred on the embankment of the N1 Highway (S104)

[12] *Plate 19 – Courtesy of Ms. A Sudu from the City of Tshwane Metropolitan Municipality*

A large sinkhole (12 m in diameter, 5 m deep) developed in Jean Avenue (S109) during September 2011 as a result of a leaking municipal water service pipe (Plate 20).

Plate 20. A Sinkhole that developed in Jean Avenue (S109)

A large area (approximately 25 m x 15 m) was excavated in order to repair this sinkhole by means of the reverse filter method, which essentially means backfilling the sinkhole by placing coarser grained materials (such as boulders) at depth and finer grained materials nearer to the surface (Plate 21). According to the Tshwane Metropolitan Municipality this sinkhole cost about 6,3 million Rand to repair (pers. Comm., A. Sudu 2013).

This sinkhole was also reported in the local newspaper, The Pretoria News (26-09-2011), see Plate 22. According to the newspaper article water also ponded on the surface before the sinkhole occurred.

Plate 21. Remediation of the sinkhole Jean Avenue (S109)

A sinkhole at the entrance to Jean Village. The earth caved in on Friday afternoon. PICTURE: YOLANDE DU PREEZ

Sinkhole in Lyttelton causes a hole lot of trouble

YOLANDE DU PREEZ

LYTTELTON residents watched in shock as the entrance to several businesses in Jean Village crumbled, leaving a large sinkhole.

Gavin McGannon, a Lyttelton resident, said he had been told by witnesses that there was a large pool of water on the surface of the road moments before it caved in on Friday.

First little pieces of earth started falling in, but eventually pieces of the tarred road at the entrance to the Moose Pub and Grill, The Big Six Sports Pub and several other businesses just caved in, he said.

A smaller sinkhole appeared in Jean Avenue itself, one of the busiest roads in the area.

Louise Brits, spokeswoman for the Tshwane Metro Police, said the sinkhole appeared at about 3pm on Friday near the intersection with Rabie Street.

Brits said only one lane of Jean Avenue was open in the vicinity of the sinkhole and barriers and detour signs had been put up.

"Despite our efforts it appears at least two motorists hit the barriers on Saturday night," she said.

Engineers are assessing the problem and have removed some of the soil to determine how deep the hole is and what needs to be done to repair it. Brits could not put a time frame on repairs to the road.

Jacques Visagie, owner of The Big Six Sports Pub, said he was not there when the incident happened, but when he arrived later, dozens of spectators were at the scene, taking photographs.

The sinkhole had cost him business at the weekend.

"Sundays are my busiest days and the place was empty today," he said.

Parts of Centurion are built on dolomite and sinkholes appear from time to time, like the subsidence problems that caused the closure of one of the entrances to the Lyttelton police station.

Engineers took extra precautions on the Gautrain's route through the area, making provision for the dolomitic conditions.

Plate 22. Jean Avenue sinkhole in the Pretoria News Newspaper (26 September 2011)

5.4. Sinkhole Size Distribution

Buttrick and van Schalkwyk (1995) proposed a scale of sinkhole sizes based on the potential development space of a sinkhole, as indicated in Table 11. This table was slightly amended by Buttrick et al. (2001) and has widely been used to refer to a specific sinkhole size. Table 19 below shows the scale sinkhole sizes as proposed by Buttrick et. al. (2001).

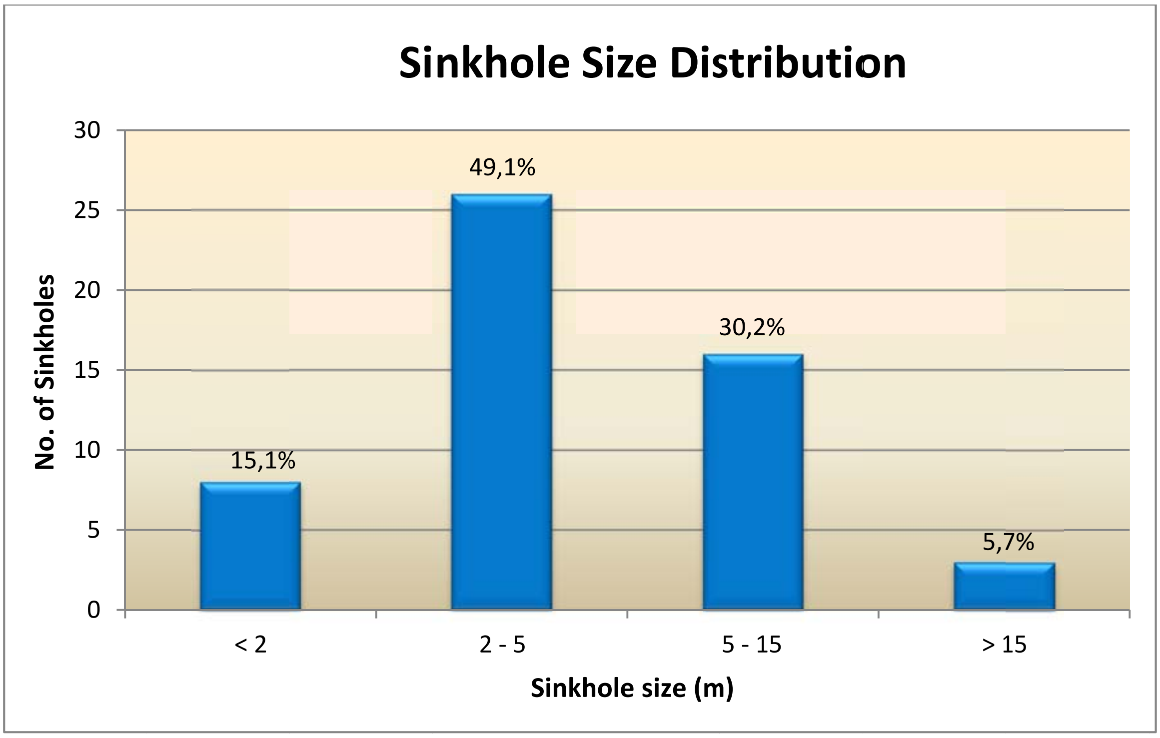
Table 19. Suggested scale of sinkhole sizes (Buttrick et. al, 2001)

Maximum potential development space	Maximum diameter of surface manifestation (dimension: metres)	Suggested terminology
Small potential development space	<2	Small sinkhole
Medium potential development space	2 - 5	Medium-size sinkhole
Large potential development space	5 – 15	Large sinkhole
Very large potential development space	> 15	Very large sinkhole

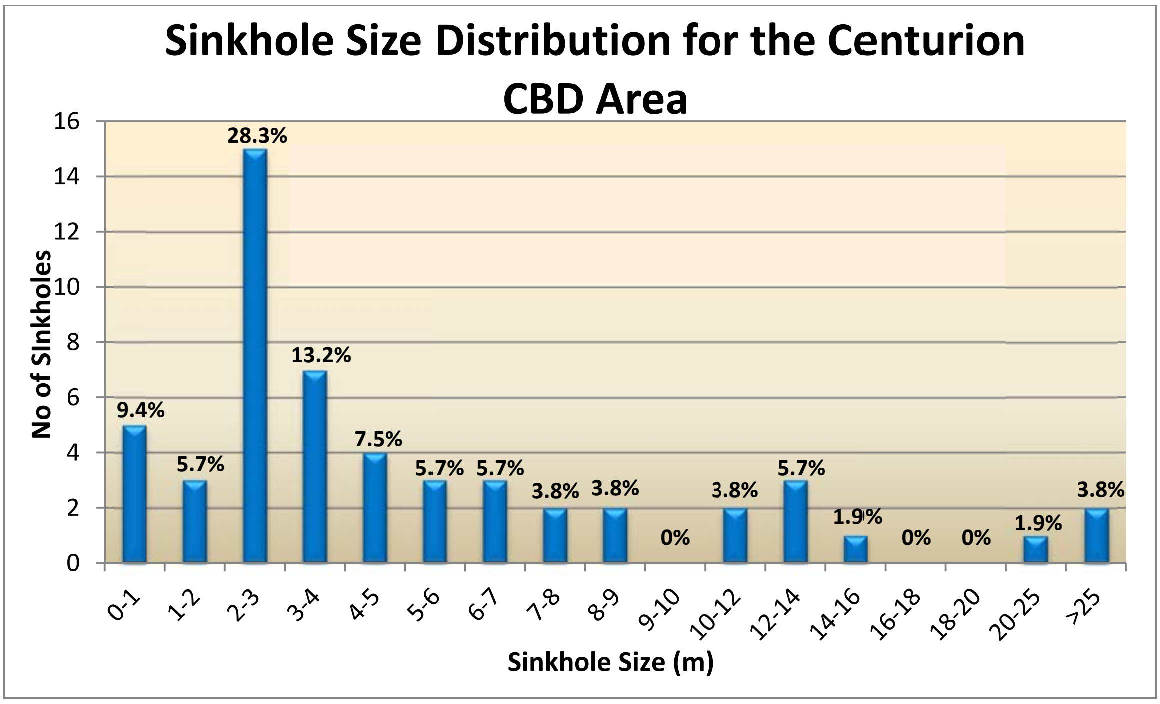
From the available information in the database, Graph 6 shows the size distribution of the sinkholes in the Centurion CBD area, based on the sizes indicated in Table 19. Just less than half of the sinkholes (49,1%) in the area are between 2 m and 5 m in diameter (i.e. medium size sinkholes), followed by large-sized sinkholes being almost a third of the available sinkhole sizes (30,2%). Small sinkholes constitute 15,1 % of the events with only 5,7 % of sinkholes being more than 15 m in diameter, i.e. very large sinkholes.

Graph 7 indicates the sinkhole size distribution using the available sinkhole database of the Centurion CBD. Surprisingly, almost 10% (9,4%) of the sinkholes which occurred were smaller than 1 m in diameter. Almost a third (28,3%) of the sinkholes in the Centurion CBD area are sized between 2 m and 3 m, followed by 13,2% of sinkholes sized between 3 m and 4 m. Only 17% of all sinkholes were larger than 10 m in diameter, whereas 83% of the sinkholes are sized 9 m or less in diameter. This graph confirms that medium sized sinkholes (2 m - 5 m) dominate in the Centurion CBD area.

It should be noted that these graphs only presents the available information (45% of records), using limited information.



Graph 6. The sinkhole size distribution, based on the suggested scale of sinkhole sizes (Buttrick et. al, 2001)



Graph 7. The sinkhole size distribution of the Centurion CBD and surrounding area

5.5. Size of sinkhole occurring compared against depth of dolomite bedrock

One of the most important factors of the proposed '*Modified Method of Scenario Supposition'* is the depth to dolomite bedrock, as it is assumed that the depth to dolomite bedrock has a direct influence on the size of sinkhole that could develop. Table 20 below shows the suggested depth of dolomite bedrock and hence the size of sinkhole that is expected.

Table 20. Suggested depth of dolomite bedrock scale influencing size of sinkhole expected

Depth of dolomite bedrock below surface (metres)	Expected sinkhole size (metres) (Based on the Suggested scale of sinkhole sizes (Buttrick et. al, 2001))
0 – 5	< 2
5 – 20	2 - 5
20 – 35	5 – 15
> 35	>15

Using the proposed sinkhole sizes, as indicated in Table 20 above, the actual data from the Centurion CBD, using only known sinkhole diameters are indicated in Table 21 below.

Table 21. Comparison between dolomite bedrock depth and sinkhole size within the Centurion CBD area

1	2	3	4	5
Depth of dolomite bedrock below surface (metres)	**% of boreholes intersecting dolomite bedrock at depth intervals in Column 1**	**Expected sinkhole size (metres)**	**% of sinkholes at specific size interval in Column 3**	**% variance**
0 – 5	19,3 %	**< 2**	15,1 %	4,2 %
5 – 20	52,9 %	**2 - 5**	49,1 %	3,8 %
20 – 35	20,5 %	**5 – 15**	30,2 %	9,7 %
> 35	7,3 %	**>15**	5,7 %	1,6 %
Column 2: Data obtained from Graph 1 *Column 4: Recorded sinkhole diameters in the Centurion CBD, as indicated in Graph 6*				

In general, the sinkhole size distribution corresponds well with the dolomite bedrock distribution, as indicated in Table 21. The largest variance (9,7%) occurs with large size sinkholes (5 m – 15 m) where not a good correlation exists with the boreholes intersecting dolomite bedrock between 20 m and 35 m. For small size sinkholes (> 2 m), fewer sinkholes occurred than the occurrence of shallow dolomite (> 5 m). The best correlation is for the very large size sinkholes (> 15 m) where a difference of only 1,6% is recorded.

The relative good correlation for all sinkhole sizes except the large size sinkholes as indicated in Table 21, support the fact that the depth of the dolomite bedrock does have an influenced in the size of sinkhole that could develop.

This needs however to be verified with actual data from investigations conducted next to sinkholes that have developed in the past. This was not addressed during this study.

6. HAZARD CLASSIFICATION MAP

A total of 3333 boreholes (93%) were used to compile an Inherent Hazard Class zonation map (Figure 7). Prior to 2004, a 30 m blanketing layer was considered adequate and so it became the norm to drill up to a depth of 30 m even if dolomite bedrock was not encountered (pers. Comm., SP Kok 2012). Some boreholes in the Centurion CBD area were also terminated at very shallow depths, i.e. 10 m. As a result, 7 % of the boreholes could not be used to determine the Inherent Hazard Class. After each of the boreholes was assigned an Inherent Hazard Class, a zonation map was compiled. This map has been compiled using the Spatial Analyst® extension of ArcGIS 9.3®, as explained in Section 4.3 of the dissertation. This method interpolates between data points and if no data exists, nearby data is used to determine the hazard of sinkhole formation in the area.

The hazard map (Figure 7) generally indicates a medium to high hazard for the formation of sinkholes in the Centurion CBD and surround areas with pockets of low hazard areas. The largest area of high hazard conditions, Inherent Hazard Class (IHC) 6 to IHC 8 is present in the area immediately north and east of the Hennops River and Centurion Lake. The largest area of low hazard conditions is present in the area of Zwartkop (south of the Hennops River). The low hazard class areas (IHC 1 and IHC 2) are generally areas where syenite was encountered in the boreholes, and therefore represent syenite dykes or sills of a substantial thickness.

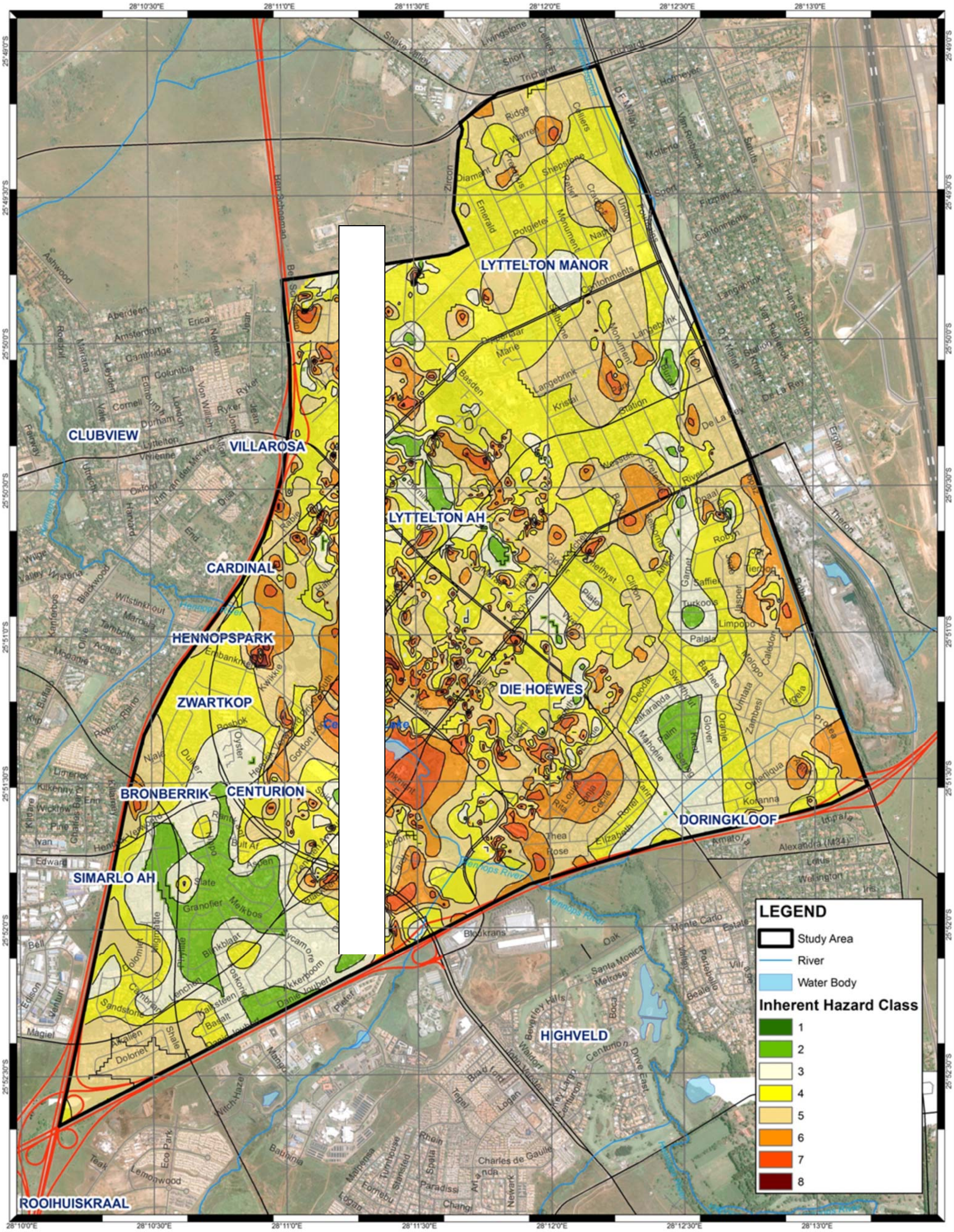


FIGURE 7: INHERENT HAZARD CLASS MAP OF CENTURION CBD AND SURROUNDING AREAS ACCORDING TO TABLE 16 GUIDELINES

From the sinkhole hazard map, the following are noted in the area north of the Hennops River:

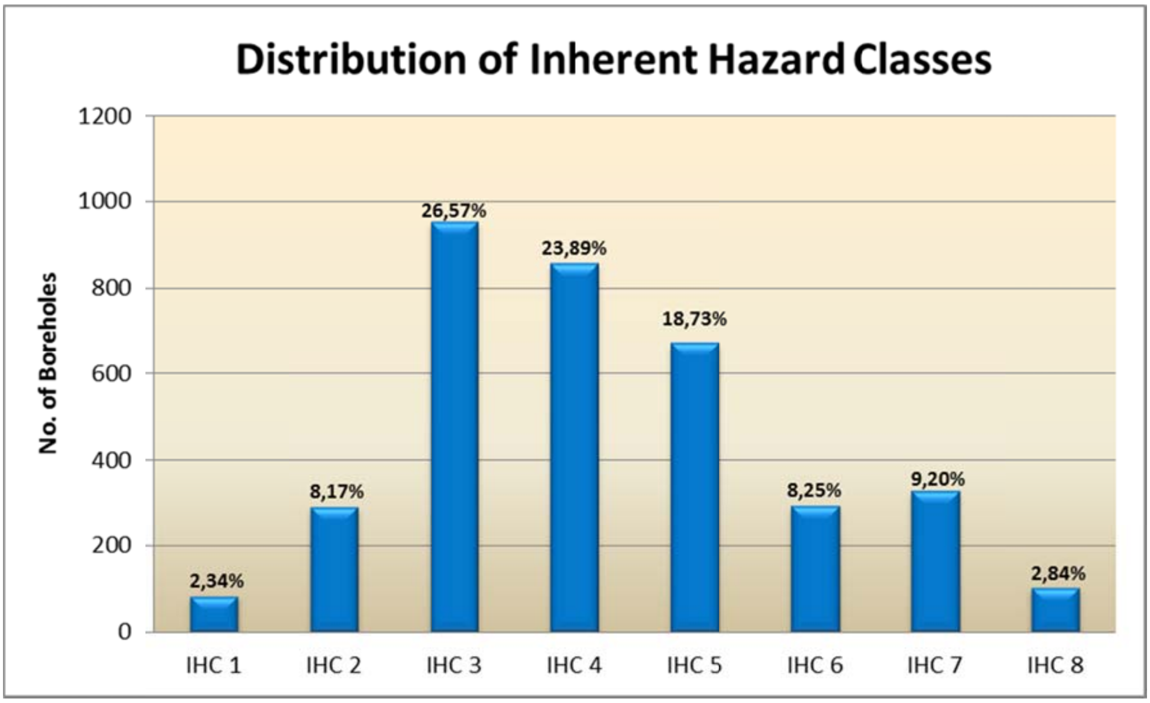
- More data points are available, which explains the variability in this area over smaller distances, i.e. the hazard of sinkhole formation changes over short distances from low to high hazard conditions, and this is especially present in the areas of the Lyttelton Agricultural Holdings and Die Hoewes.
- Towards the north-eastern boundary of the Centurion CBD area low to medium hazard conditions prevail where no IHC 8 conditions are present, though this could be due to a paucity of data or a change in dolomite formation.
- Small patches of low hazard conditions are present in patches across the site with the largest area north of the Hennops River being present in the area of Doringkloof.

From the sinkhole hazard map, the following are noted in the area south of the Hennops River:

- Less data points are available, therefore larger areas represent similar hazard conditions.
- This area generally represents low and medium hazard conditions (IHC 1 to IHC 4) with some areas where IHC 5 and 6 conditions are present.
- Towards the southernmost corner of the Centurion CBD area, towards the intersection between the Ben Schoeman and Danie Joubert Freeways, IHC 5 (i.e. shallow dolomite conditions, high hazard for small size sinkhole) prevail, which correlates well with the Oaktree Formation which is present in this area.
- Only small isolated patches of IHC 7 conditions are present in this area.

Graph 8 and Table 22 indicate the distribution of the hazard classes in the Centurion CBD area. Most of the boreholes (953) were classified as IHC 3 followed by IHC 4 (857) and IHC 5 (672). This corresponds well with the dolomite bedrock distribution that indicates that the most boreholes encountered dolomite bedrock between 5 m and 10 m which is in general classified as IHC 3 or IHC 5.

Table 22 indicates the percentage of each IHC in the Centurion CBD area. The Inherent Hazard Classes are grouped together to indicate Low (IHC 1 and IHC 2), Medium (IHC 3 and IHC 4) and High (IHC 5 to IHC 8) hazardous conditions. Half of the area is classified as having a medium hazard, with 50,46 % of the boreholes representing IHC 3 and IHC 4 conditions, whereas 39,03 % of the area is classified as having a high hazard. Only 10.51 % of all the boreholes indicated a low hazard for sinkhole formation.



Graph 8. The distribution of Inherent Hazard Classes of each borehole in the Centurion CBD and surrounds

Using this distribution of the boreholes, one can make the assumption that the Centurion CBD area generally represents a medium to a high hazard for the formation of sinkholes.

Table 22. Percentages of each Inherent Hazard Class in the Centurion CBD area

IHC	Total No of Boreholes	Boreholes as Percentage		
1	84	2.34%	**LOW**	10.51%
2	293	8.17%		
3	953	26.57%	**MEDIUM**	50.46 %
4	857	23.89%		
5	672	18.73%	**HIGH**	39.03 %
6	296	8.25%		
7	330	9.20%		
8	102	2.84%		

Figure 8 indicates the Hazard Classification map in terms of the low, medium and high classification. The map confirms the results of the boreholes and shows predominantly medium hazard conditions across the Centurion CBD area. High hazard conditions prevail in the areas surrounding the Centurion Lake and are also present along the south eastern boundary of the Centurion CBD area along Botha

Avenue. Smaller areas of high hazard conditions are present and scattered across the centre of the Centurion CBD area. Only small areas of low hazard are present, mainly in Zwartkop and Doringkloof.

This map has been used to calculate the coverage of each of the Inherent Hazard Classes, and the surface areas of each of the Inherent Hazard Classes and the respective percentage thereof is given below in Table 23:

Table 23. Coverage of each hazard class in the Centurion CBD area

Inherent Hazard Class	Surface Area (Hectares)	Percentage Cover in Centurion CBD Area
Low	73	4,4 %
Medium	1111	67 %
High	473	28,6 %

It is evident that two thirds of the Centurion CBD area represents a medium Inherent Hazard for sinkhole formation. Almost a third of the area can be considered as having a high Inherent Hazard for the formation of sinkholes with only a small portion of the area (4,4%) representing low hazard conditions.

6.1. Comparison between the CBD Hazard Map and Sinkhole Occurrence

The 119 sinkholes that occurred in the Centurion CBD area were plotted on Figure 8 to compare the occurrence of sinkholes against the low, medium and high hazard areas. Table 24 below shows the number of sinkholes in each of the hazard areas.

Table 24. No of sinkholes that have occurred in each of the hazard areas

Inherent Hazard Class	No of Sinkholes	Sinkholes as Percentage
Low	0	0 %
Medium	83	69,7 %
High	36	30,3 %

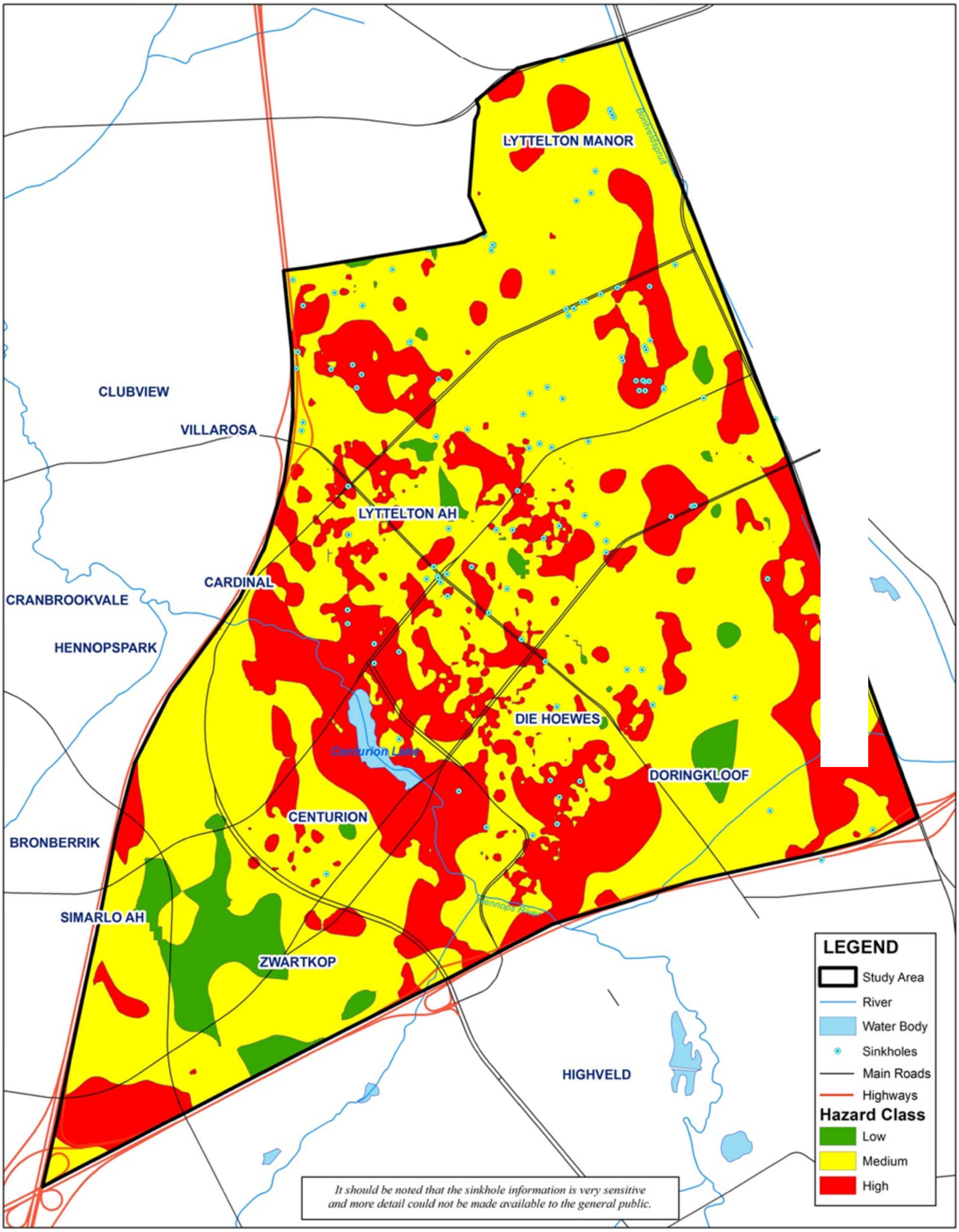


FIGURE 8: SIMPLIFIED INHERENT HAZARD MAP WITH SINKHOLE OCCURENCES

0 0.25 0.5 1 1.5 2
Km

The comparison between the Hazard map and the previous occurrence of sinkholes does not correlate well. The map does show that no sinkholes occurred in the areas classified as having a low hazard for sinkhole formation, which suggest that the delineation of low hazard areas was accurate and that the classification system define these areas well. Surprisingly, a vast majority (69,7%) of the sinkholes in the Centurion CBD area occurred in areas classified as having a medium hazard for the formation of sinkholes. This could suggest that medium hazard areas are equally vulnerable to sinkhole formation as high hazard areas or that the hazard map does not provide a good indication of the actual hazard conditions. But it must also be borne in mind that two thirds of the Centurion CBD area is considered to have a medium susceptibility for the formation of sinkholes.

6.2. Recommended Development Types

Using the Hazard Classification map, recommendations can also be made to what type of development would be suitable in the Centurion CBD area. The CGS aligns itself with the draft SANS 1936-1:2012 document which indicates permissible land usage that are suitable for the eight Inherent Hazard Classes. Tables 1 and 2 from the draft SANS 1936-1:2012 document is attached in Appendix D of the dissertation. Table 2 from draft SANS 1936-1:2012 specify that the proposed land use is permissible when a Dolomite Area Designation of D2 or D3 is indicated, conditional to the precautionary measures as stipulated in the draft SANS 1936-3:2012. Land uses where a Dolomite Area Designation of D4 is indicated for certain Inherent Hazard Classes, is considered not suitable for development and site specific precautionary measures is required. The definitions of the Dolomite Area Designations of D1 to D4 are indicated in Table 1 of the draft SANS 1936-1:2012, as attached in Appendix D. Table 25 below shows a summary of type of development allowed on each Inherent Hazard Class.

In general, the permissible land uses can be summarized as follows:

- Most Residential development types are allowed on IHC 1 to IHC 5. Some restrictions are placed on IHC 2 to IHC 5.
- Most Commercial development types up to three storeys are allowed on IHC 1 to IHC 6.
- Parking areas and garages are allowed on IHC 1 to IHC 6.
- Roads, railway lines, bulk pipelines, runways and pump stations are allowed up to IHC 6.

Table 25. Permissible land usage as indicated in the draft SANS 1936-1:2012 document

IHC	Infrastructure Type Allowed (D1 to D3)	Infrastructure Type Not Allowed (D4)
1	C1, C2, C3, C4, C5, C6, C7, C8, RH2, RH3,RL1, RL2, RN1, RN2, RN3, IN1, IN2, IN3, IN4, IN5	RH1
2	C1, C2, C3, C4, C5, C6, C7, C8, RH2, RH3, RL1, RL2, RN1, RN2, RN3, IN1, IN2, IN3, IN5	RH1, IN4
3	C1, C2, C3, C5, C6, C7, C8, RH3, RL2, RN2, RN3, IN1, IN2, IN3, IN5	C4, RH1, RH2, RL1, RN1, IN4
4	C1, C2, C3, C5, C6, C7, C8, RH3, RL2, RN2, RN3, IN1, IN2, IN3, IN5	C4, RH1, RH2, RL1, RN1, IN4
5	C1, C2, C3, C5, C6, C7, C8, RH3, RL2, RN3, IN1, IN2, IN5	C4, RH1, RH2, RL1, RN1, RN2, IN3, IN4
6	C2, C3, C6, C7, C8, IN1, IN5	C1, C4, C5, RH1, RH2, RH3, RL1, RL2, RN1, RN2, RN3, IN2, IN3, IN4
7	C6	C1, C2, C3, C4, C5, C7, C8, RH1, RH2, RH3, RL1, RL2, RN1, RN2, RN3, IN1, IN2, IN3, IN4, IN5
8	None	C1, C2, C3, C4, C5, C6, C7, C8, RH1, RH2, RH3, RL1, RL2, RN1, RN2, RN3, IN1, IN2, IN3, IN4, IN5
Note that only the designation are provided in this table and the full description of each type is available in the complete table in Appendix C		

For the purpose of this study Residential and Commercial Land use types are generally present in the Centurion CBD area and are foreseen for the near future. Figures 9(1) and (2) indicates which areas will be suitable for these types of development.

From Figure 9 (1) it is clear that:

- No areas were classified as IHC 1, and therefore no areas in the Centurion CBD area can be developed as such. Small areas are present for the development types proposed for Inherent Hazard Classes 1 and 2 as indicated on Figures 9(1) - 2.
- Large areas are suitable for residential type developments as shown on Figure 9(1) - 3, especially in the Zwartkop, Doringkloof and Lyttelton Manor

suburbs. IHC 4 land is suitable for almost all types of residential development except those of higher densities such as high rise developments, RL1 and RN1.

- Although large areas on Figure 9(1) - 4 is shown as suitable for development, this is mostly for commercial type developments, as several restrictions are placed on IHC 5 land in terms of residential development. IHC 5 land is not suitable for high density type residential developments, and the only residential type developments allowed are RH3, RL2 and RN3.
- All types of commercial developments, except C4 type developments are suitable on Inherent Risk Classes 1 to 5 (Figure 9(1) - 4).
- Figure 9(1) - 4 shows that the area surrounded by the Centurion Lake would be more suitable for commercial type developments, and residential type development would be more suitable towards the outer boundary of the Centurion CBD area.

From Figure 9 (2) it is clear that:

- Most areas in the Centurion CBD area are suitable for Commercial or Industrial type developments.
- No residential type developments are allowed on IHC 6 and higher (Figures 9(2) - 1 and 2). The large areas considered suitable for development in Figures 9(B) - 1 and 2 are mostly for commercial type developments.
- Small scattered areas were classified as IHC 8 (indicated as red on Figure 9(2)-2, where no development would be suitable.

Development is not considered suitable in IHC 8 land and therefore no map was created for IHC 8 land. The reason behind the fact that IHC 8 land is considered not suitable for any type of development is that each hazard class corresponds to a size of sinkhole that can develop, i.e. in IRC 7 areas a sinkhole of up to 15 m in diameter is expected. In IRC 8 areas a sinkhole of up to 40 m in diameter is expected and no foundation system currently exists to ensure safe designs in such areas.

The conclusion can be made that should the Centurion CBD area evolve into a CBD area such as Sandton City, the majority of the CBD (area surrounded by the Centurion Lake) would be suitable for most types of developments, hence high rise commercial type developments is suitable up to IRC 6 land. Residential type developments would be more suitable toward the outskirts of the CBD area, in the areas of Die Hoewes, Lyttelton Manor, Doringkloof and Zwartkop. All areas though require special precautionary measures and special foundation measures to ensure that sinkhole formation does not occur, and if so, that it does not cause any large scale destruction or loss of life.

The draft SANS 1936-1:2012 does make provision for development on the areas assigned a Dolomite Area Designation D4 (i.e. areas previously considered not suitable for development), but site-specific precautionary measures such as special foundation designs and water precautionary measures are required. All these ‘D4’ developments are subject to external review by a suitably qualified geo-professional, as stipulated in the draft SANS 1936-1:2012. The conditions for development of ‘D4’ land are stipulated in Section 4.3.4 in the draft SANS 1936-1:2012 (Attached in Appendix D). A total of 2 developments have been supported by the CGS in the Centurion CBD, which followed the ‘D4’ process.

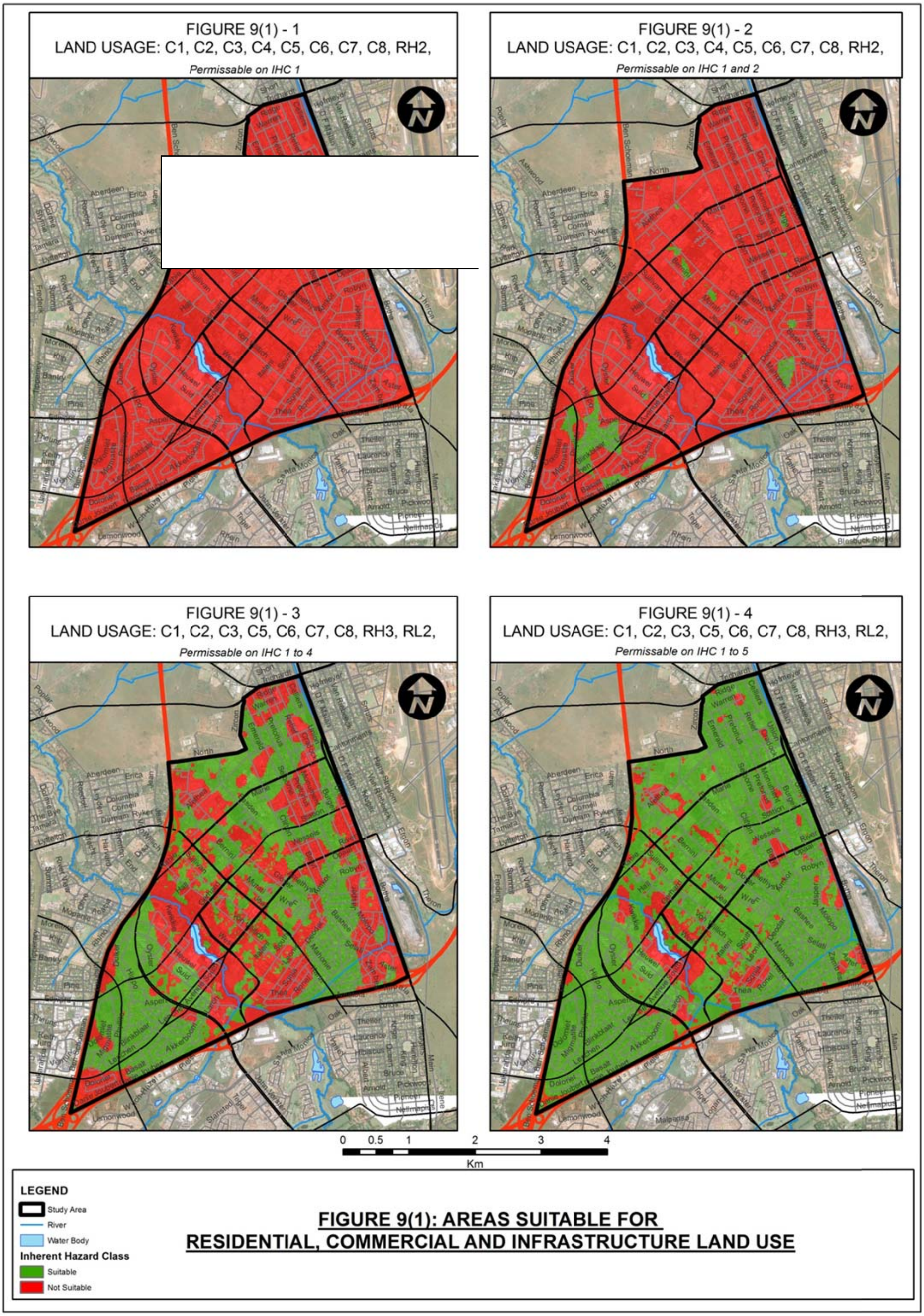


FIGURE 9(1): AREAS SUITABLE FOR RESIDENTIAL, COMMERCIAL AND INFRASTRUCTURE LAND USE

FIGURE 9(2) - 1
LAND USAGE: C2, C3, C6, C7, C8, IN1, IN5
Permissable on IHC 1 to 6

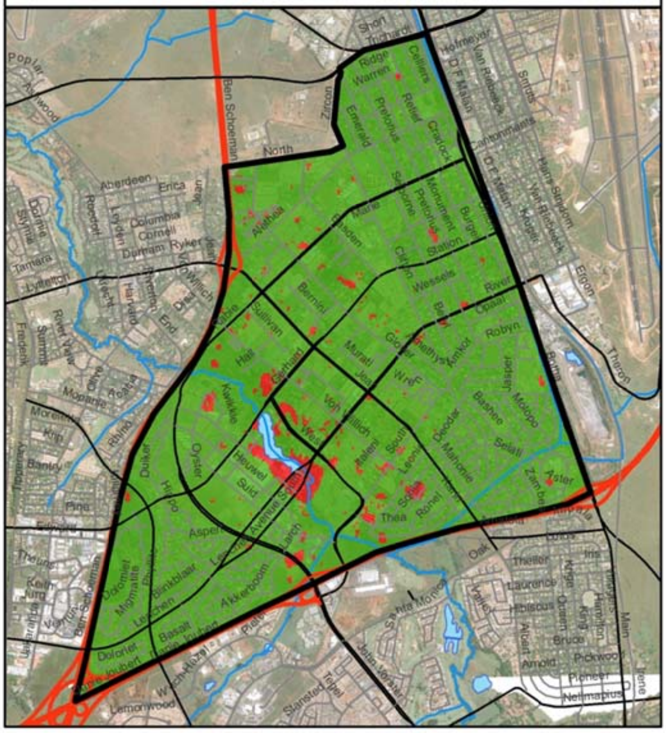
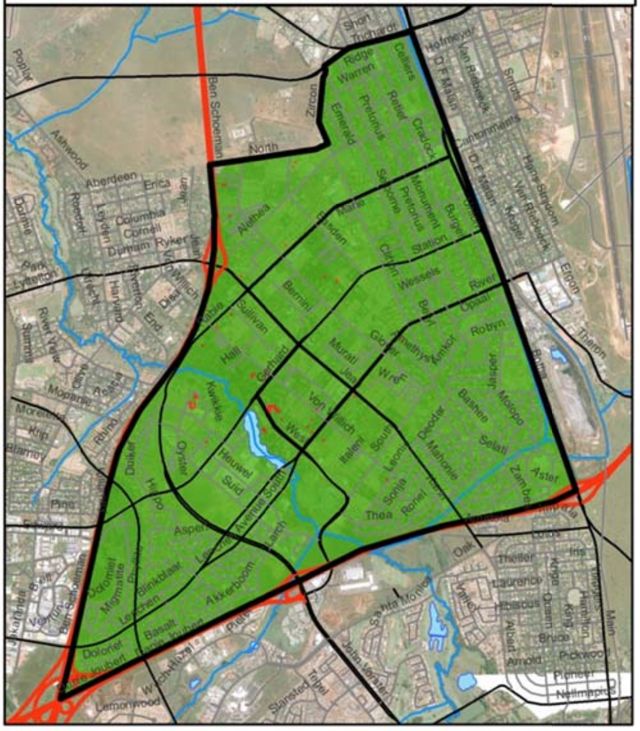


FIGURE 9(2) - 2
LAND USAGE: C6
Permissable on IHC 1 to 7



0 0.5 1 2 3 4
Km

LEGEND

- Study Area
- River
- Water Body

Inherent Hazard Class

- Suitable
- Not Suitable

FIGURE 9(2): AREAS SUITABLE FOR RESIDENTIAL, COMMERCIAL AND INFRASTRUCTURE LAND USE

7. DETERMINATION OF THE HAZARD OF SINKHOLE FORMATION USING VARIOUS METHODS

7.1. Sinkhole Database

Buttrick and van Schalkwyk (1995) indicated that the number of ground-movement events could be predicted based on statistics of inappropriate and poor service design and management over a 20 year period (Table 13). These results were based on data from a limited study area within Pretoria.

The Centurion CBD area is considered to have adequate design parameters and risk management plans in place for most of the area. Therefore, this area is considered not be an 'abused' land use situation which was used in the Buttrick et al. (1995) study, but more controlled and well managed in terms of water bearing services, foundation design and use of land.

In this study, the conventional method proposed by Buttrick et al. (1995) will be used as well as a back analysis method, where the existing sinkhole record is compared with Buttrick and van Schalkwyk's (1995) predicted sinkhole occurrence. Unfortunately, as much of the data does not have dates of occurrence, the outcome is indicative only.

7.1.1. Method Proposed By Buttrick et al. (1995)

By using Table 13, as proposed by Buttrick and van Schalkwyk (1995) the expected number of sinkholes can be predicted in the Centurion CBD area for the low, medium and high hazard classes.

The areas of each of the hazard classes in the Centurion CBD area are as follows (Table 26):

Table 26. Area of the different hazard classes in the Centurion CBD area

Hazard Class	Area (ha)
Low	73
Medium	1111
High	473

Therefore, the actual expected number of sinkholes in each of the hazard classes should be as follows (ha x value in Table 13):

Low Hazard	-	0 sinkholes
Medium Hazard	-	78 sinkholes
High Hazard	-	331 sinkholes
Total	-	409 sinkholes

Therefore, this method indicates that a total of 409 sinkholes could have been expected over the last 20 years in the Centurion CBD area. This figure indicates that the expected number of sinkholes predicted per hectare, as proposed by Buttrick and van Schalkwyk (1995), is almost four times more than what was actually recorded. This predicted number of sinkholes, especially for the high hazard areas does therefore not reflect actual conditions encountered in the Centurion CBD area.

According to Table 24 the actual number of sinkholes that have occurred in each of the hazard classes are:

Low Hazard	-	0 sinkholes
Medium Hazard	-	83 sinkholes
High Hazard	-	36 sinkholes

There is a relative good correlation between the predicted number of sinkholes against the actual number of sinkholes for the medium hazard areas, 78 predicted vs. the 83 occurred (it should be noted that the predicted number of sinkholes is for a 20 year period, whereas the actual number of sinkholes occurred, occurred over a time period of at least 40 years). In the medium hazard areas, 7 sinkholes have occurred prior to 1990 and 2 post 2010 (those of known the dates). Therefore, 78 were predicted for a 20 year period, against 74 occurrences in 20 years.

There seems to be no correlation between the predicted and actual number of occurrences for the high hazard areas.

It should be noted that since the sinkholes are not evenly distributed across the Centurion CBD area, a 20 hectare test site was not used in order to 'evaluate' the values provided in Table 13. If a 20 hectare site is selected in the Centurion CBD area, it could either have no sinkholes or have several sinkholes, depending on the positioning of the test site and for this reason; this method has not been tested in such a way.

7.1.2. Back Analysis Method

A total of 119 sinkholes have occurred in the entire Centurion CBD area, covering a surface area of 1657 hectares, i.e. 1 sinkhole in every 13,9 hectares or 0,07 events / ha. This occurred over a period of almost 40 years. Only 70 (58%) sinkholes that occurred in the Centurion CBD area have known dates of occurrence. If the time period is ignored, the number of actual events indicates that the Centurion CBD area can be viewed as having a medium hazard for the formation of sinkholes, as per Table 13 (Medium hazard = 0,07 events per hectare).

If a 20 year period is considered, from 1990 to 2010, only 52 sinkholes have occurred in the Centurion CBD area, i.e. 1 sinkhole every 31,86 hectares or 0,03 events / ha. Compared to the Buttrick et al. (1995) table, this indicates that the Centurion CBD area is classified as having a low to medium hazard of sinkhole development.

If it is assumed that the entire database represents a period of 40 years, and 119 sinkholes have occurred during this period a total of 0,04 events per hectare have occurred during a 20 year period (0,07 events per 40 years, i.e. 0,04 events per 20 year period). This confirms that the Centurion CBD area could be classified as having a low to medium hazard in terms of sinkhole development.

To make a rational back analysis of the Buttrick et al (1995) predicted sinkhole occurrence, the sinkhole record needs to be comprehensive. The back analysis method indicates that the Centurion CBD area can generally be classified as having a low hazard for the formation of sinkholes, using two different methods.

The results of the back analysis method do not correlate well with the predicted sinkhole occurrence from Buttrick et al (1995) in the Centurion CBD area. The Centurion CBD area is assumed to have a medium to high hazard for the formation of sinkholes from past experience, but the back analysis method indicates a low to medium hazard of sinkhole formation. The following factors could have an influence on the outcome of the results of the back analysis method:

- The area considered in the current study is too large and does not represent a pragmatic outcome, since sinkholes are not evenly distributed and land uses vary, compared to the area used by Buttrick et al (1995) where only certain portions of military land was used;
- The sinkhole record is not accurate and not all the data has been collected in the Centurion CBD area, compared to the area used by Buttrick et al (1995) where a more reliable sinkhole database was used;

- The Centurion CBD area is situated in an area where dolomite risk management is taking place, i.e. storm water reticulation and improved water bearing services are present compared to the 'abused' area which Buttrick et al (1995) considered.

7.1.3. Using the Hazard Class Areas to Calculate the Actual Number of Sinkholes per Hectare

If the actual number of sinkholes is used to calculate the hazard of sinkhole formation in the Centurion CBD area for each hazard class (areas as per Table 26), it would be as follows:

Low Hazard (0 sinkholes)	-	0 sinkholes per hectare
Medium Hazard (83 sinkholes)	-	0,074 sinkholes per hectare
High Hazard (36 sinkholes)	-	0,076 sinkholes per hectare

Once again, it should be noted that this is not for a 20 year period, as the data does not have all the dates of occurrence. It is known that 9 sinkholes occurred outside the 20 year time period of 1990 to 2010 in the medium hazard areas. Only two sinkholes occurred prior to 1990 in the high hazard areas. Therefore, if the actual number of sinkholes (assuming all other sinkholes without dates occurred in the 20 year period) is used, the actual occurrence of sinkholes in the Centurion CBD area is as follows:

Low Hazard (0 sinkholes)	-	0 sinkholes per hectare
Medium Hazard (74 sinkholes)	-	0,067 sinkholes per hectare
High Hazard (34 sinkholes)	-	0,076 sinkholes per hectare

Based on the above calculations, there does not seem to be a substantial difference in the hazard of sinkhole formation in a 'managed area' between medium and high hazard areas. Another influencing factor could be that the high hazard areas are generally not developed, whereas the medium hazard areas are densely developed. Even though municipal water bearing services are installed across the entire Centurion CBD area traversing low, medium and high hazard areas, less water connection points are generally present on the high hazard areas, since less development has taken place on these areas.

7.2. Other factors that have an influence on the outcome of the prediction of the hazard of sinkhole formation

From the above methods it is clear that no "exact" method exists from the Scenario Supposition Method on the classification of land in terms of the hazard of sinkhole formation. Other factors that were noted in the occurrence of sinkholes in the Centurion CBD area are the following:

7.2.1. Geological Succession

As indicated in Table 27, each geological formation has a different hazard for sinkhole formation. This table was derived from the information in Table 18. As expected, the number of events in the dolerite dykes, diorite / syenite intrusions and in the alluvial areas are much lower than those of the Lyttelton and Monte Christo Formations. No sinkholes have occurred on the Oaktree Formation in this area, but this Formation only represents a very small portion of the Centurion CBD area.

Table 27. Number of events per hectare for each geological succession

Geological Succession / Formation	Events per hectare
Lyttelton Formation	0,09
Monte Christo Formation	0,08
Oaktree Formation	0
Chert Breccia	0
Dolerite	0,03
Quartz – Diorite (Syenite intrusions)	0,03
Alluvium	0,03

The areas immediately underlain by 'non dolomitic' materials[13] (i.e. Alluvium, syenite / dolerite) correspond well with Table 13, and can be classified as areas representing a low to medium hazard for the formation of sinkholes. The Lyttelton Formation shows a slightly higher hazard for the formation of sinkholes than the Monte Christo Formation. These two dolomitic formations represent a medium hazard to the formation of sinkholes, as per Table 13.

This method corresponds well with the numbers provided by Buttrick et al (1995) in Table 13, but as shown on Figure 8, these formations cannot be considered to have a single hazard rating, as areas of low to high are present in each of these

[13] The entire area is underlain by dolomite at depth, and the geology map indicates the geological materials that are encountered at ground surface.

formations. Therefore, although this method seems to provide a more realistic view, dolomite hazard conditions are not uniform for each geological formation and this can only be used as an initial indicative method.

7.2.2. Areas North and South of the Hennops River

As indicated in Section 5.3.1, only one sinkhole have occurred in the area south of the Hennops River, i.e. 1 event per 468 hectares or 0,002 sinkholes per hectare. Therefore this area could be considered as having a very low probability for the formation of sinkholes.

The area north of the Hennops River cover a surface area of 1189 hectares and a total of 118 sinkholes have occurred in this area. Therefore, this area constitutes 1 event for every 10,07 hectares or 0,1 sinkholes per hectare. The area north of the Hennops River can therefore be considered as having a medium to high hazard for the formation of sinkholes.

7.2.3. Water Bearing Services

The largest cause of sinkhole formation is leaking water bearing services. From Graph 4 it is noted that 40% of sinkholes in the Centurion CBD area occurred as a result of leaking services. The following elements could have an influence in the occurrence of sinkholes:

- *The type and age of water bearing services in different townships*. For example, Lyttelton Manor was proclaimed as a township in 1908 (Schöning Msc Notes, 1996) compared to the Doringkloof township which was proclaimed in 1970 (Schöning Msc Notes, 1996). Different types of services were installed as time passed. The current norm in new townships (mostly outside the Centurion CBD) is to install High Density Polyethylene (HDPE) pipes whereas clay pipes were most commonly installed in older townships. Schöning, 1996 indicated that that most sinkholes and dolines occurred in areas which have been in use prior to 1950.
- *Volume and time period of leaking*. If water drips from a pipe over a long period of time, it would generally causes a subsidence or a sinkhole would occur over a prolonged period; whereas if a large diameter pipe burst and vast volumes of water is released, a sinkhole would occur over a short period of time. An example in Centurion CBD of such a sinkhole is S106, which occurred after a main municipal water pipe burst and the sinkhole formed within a couple of hours (pers. Comm., A Sudu, 2010).

- *Higher occurrence of sinkholes in municipal servitude areas.* Although this was not studied in detail in this dissertation, the general trend in the Centurion CBD area is that sinkholes occur along roads, in the servitude area of the water bearing pipes. An example of such a sinkhole is the Jean Avenue sinkhole (S109) discussed in Section 5.3.3 of this dissertation. When studying Figure 6 in detail, it is observed that there seems to be a general trend that some sinkholes occur linearly, i.e. along roads, for example, Sinkholes S2 to S98 in Jean Avenue.

It should be noted that the effect of water bearing services (type, age, location etc.) on sinkhole formation and occurrence is only briefly discussed in this dissertation and more detailed studies could define a more realistic outcome.

7.2.4. Basic Assumptions

Various methods show variable probabilities for the formation of sinkholes in the Centurion CBD area. There seem to be a good correlation between the number of events for the entire Centurion CBD area per hectare if no time period is associated with the data, but this does not give a realistic view (using the back analysis method). There is also a relatively good correlation in the hazard of sinkhole formation per geological succession, as the ‘non-dolomitic’ areas shows a low hazard and the dolomitic formations show a medium to high hazard. The area south of the Hennops River has a very low hazard for sinkhole formation compared to that of the north of the Hennops River. The reason behind this is not clear.

Different areas within the Centurion CBD area will have different hazard ratings for sinkhole formation. Therefore, it is quite difficult to propose a single rating for areas of low, medium and high hazard, as different factors have an influence. Not all the factors have been considered here, as many more factors such as positioning of water pipes, age of pipes, density of occupancy and type of development (land use) have not been considered.

8. CONCLUSIONS

1. 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.

2. The Gautrain train route now traverses across the Centurion CBD area, and the Centurion Station being situated in West Street, has attracted high rise developments to this area. This will lead to an increase in the population which results in an increase in road traffic and density of people per hectare in this area. CTMM actively supports and propels higher densities in the Centurion CBD area which has required the CGS to evaluate the sinkhole risk associated with this increase in development densities.

3. Information for the Centurion CBD area has become available through the dolomite stability reports that are submitted to the CGS for peer review. The availability of substantial data in digital format allowed the analysis and subsequent classification of the Centurion CBD area into the Inherent Hazard Classes, which delineate areas from low to high hazard of sinkhole formation on dolomitic land.

4. The Centurion CBD area is underlain by dolomite and chert of the Malmani Subgroup of the Transvaal Supergroup. The Monte Christo Formation covers the largest area of the Centurion CBD area whereas small areas are underlain by the Oaktree Formation in the south and the Lyttelton Formation in the north. Syenite dykes and sills have intruded the dolomite rock.

5. The Centurion CBD area is situated in two Dolomite Groundwater Compartments. The major portion is situated in the Fountains West Groundwater Compartment where the groundwater level is situated relatively deep (ranging from 48 m to 91 m below ground surface) and it is assumed that it is largely located within dolomite bedrock, as the average depth of dolomite bedrock is 15 m below ground surface. A minor portion of the Centurion CBD area is situated in the Fountains East Groundwater Compartment where the groundwater level is situated relatively close to surface (ranging from 11 m to 20 m below ground surface) and assumed to be situated slightly above or at dolomite bedrock level.

Therefore, the overall hazard of sinkhole formation in terms of a dewatering scenario is generally considered to be low in the Fountains West Groundwater Compartment, and medium in the Fountains East Groundwater Compartment.

6. Various classification systems have been proposed since the 1970's in an attempt to evaluate the stability of sites on dolomite in South Africa. The aim of these classification systems was to identify zones or areas of similar geological and geotechnical conditions and to assign a certain risk or hazard value to each zone accordingly. Each of the classification systems has been well documented, and a summary of each are provided in the dissertation.

   Buttrick (1992) proposed the Method of Scenario Supposition and this became an 'accepted method' to classify the risk of sinkhole formation in dolomite land in South Africa.

7. Since there are no numerical limits to the Scenario of Supposition classification system, draft guidelines for allocation of each hazard class, based on experience, has been developed in this study. This is mainly based on the dolomite bedrock depth and the mobilization potential of the overlying horizons. The size of sinkhole that could develop is inter alia a function of the depth of dolomite bedrock. This method is not totally in line with the Method of Scenario Supposition, and therefore it has been referred to as the proposed 'Modified Method of Scenario Supposition'.

8. A total of 3587 boreholes are situated within the Centurion CBD area of approximately 1657 hectares, which constitute 2,16 boreholes per hectare. A total of 3333 percussion boreholes (situated in and in the immediate surrounds of the Centurion CBD area) were used to assess the dolomite stability conditions. These boreholes were each classified in the eight different, Inherent Hazard Classes, using the proposed 'Modified Method of Scenario Supposition'.

   The borehole points are not evenly distributed with fewer borehole points present in the area south of the Hennops River compared to north of the Hennops River in the Lyttelton Agricultural Holdings, Die Hoewes and the Lyttelton Manor residential areas.

9. The depth to dolomite bedrock is very irregular in the Centurion CBD area with a minimum bedrock depth of 0 m and a maximum of 66 m. The average bedrock depth of the area is 15 m below ground surface. An assessment of the depth to

dolomite bedrock indicates that dolomite bedrock is generally shallow north of the Hennops River whereas it deepens in the area south of the Hennops River where moderate depth conditions were encountered.

10. A dolomite bedrock elevation map was compiled which shows that the dolomite bedrock elevation generally follows the surface elevation, where a valley is present in the area of the Hennops River with higher gradients on either side of the river. In the area south of the Hennops River the average dolomite bedrock elevation is 1420 mamsl and in the area north of the Hennops River the average dolomite bedrock elevation is 1436 mamsl. It is assumed that the dolomite bedrock elevation will not reflect the actual bedrock topography, due to the wide spacing of boreholes and the large scale at which the map was created.

11. There is a good correlation between the depth to dolomite distribution and the sinkhole size distribution. Buttrick et al. (2001) indicated that the size of sinkhole that could develop is a function of the depth to dolomite bedrock. This is revealed in the Centurion CBD area, where 61,2 % of the boreholes intersected dolomite bedrock at a depth less than 15 m from ground surface and 64,2 % of the sinkholes is smaller than or equal to 5 m in diameter.

12. The residual gravity (Relly, 1976) indicates generally an area of gravity lows and steep gradients, especially in the north-eastern and the eastern corners. A broad gravity low, extending northwest-southeast is present along the western boundary of the gravity survey area, followed by an area of a broad gravity high in the centre of the gravity survey area, also stretching northwest-southeast in the area of Wren Street in the south to North street in the north. The north-eastern boundary of the gravity survey is mainly characterized by some gravity low areas. The gravity does not correlate well with the dolomite bedrock map and this could be because the gravity points are widely spaced (45 m), and the borehole points are not evenly spaced. In this study, the gravity survey was not used in the assessment of the dolomite stability conditions, due to the limited area for which gravity is available.

13. A total of 119 sinkholes have been recorded in the Centurion CBD area since the early 1970's. The average sinkhole depth is 3,3 m for the area whereas the average sinkhole size is 5,1 m. Three lives have been lost as a result of a sinkhole in the area and a total of 7 houses or units had to be demolished.

According to the information in the available databases, 40% sinkholes or subsidences formed as a result of leaking water bearing services, 29% as a result of poor surface / storm water management and 22% as a result of inadequate or poor precautionary measures. Only one sinkhole (2%) occurred as a result of a poorly backfilled borehole whereas 7% occurred as a result of poor subsurface conditions. Using this limited information (49% of the database) it is evident that 93% of the events in the Centurion CBD area occurred as a result of man's disturbance of the natural ground conditions.

Just less than half of the sinkholes, 49,1% in the area are considered as being medium size sinkholes, with 30,2 % classified as large-sized sinkholes. Small sinkholes constitute 15,1 % of the events with only 5,7 % of sinkholes being more than 15 m in diameter, i.e. very large sinkholes.

14. The hazard map of the Centurion CBD area generally indicates a medium to high susceptibility to sinkhole formation with pockets of low hazard areas. Based on limited information, the following conclusions could be made from the hazard classification of Centurion CBD and surrounding areas:

- The conditions are not as poor as was always perceived.
- The largest area of high hazard conditions is present in the area immediately north and east of the Hennops River and Centurion Lake.
- The largest area of low hazard conditions is present in the area of Zwartkop.
- The Centurion CBD area is mostly represented by medium hazard conditions (Inherent Hazard Classes 3 and 4), which constitutes 50,5% of the boreholes in the area.
- Only 2,3% of the boreholes in the Centurion CBD area were classified as Inherent Hazard Class 1, whereas 2,8% of the boreholes were classified as Inherent Hazard Class 8.
- Almost two thirds of the Centurion CBD area represents a medium hazard for sinkhole formation, with almost a third of the area considered as having a high hazard for the formation of sinkholes and only a small portion of the area (5%) representing low hazard conditions.

15. The comparison between the hazard map and the previous occurrence of sinkholes does not correlate well. The map does show that no sinkholes occurred in the areas classified as having a low susceptibility to the formation of sinkholes, which suggest that the areas of low hazard were delineated well and that the classification system define these areas well.

The vast majority (70%) of the sinkholes in the Centurion CBD area occurred in areas classified as having a medium hazard for the formation of sinkholes, which could suggest that medium hazard areas are equally vulnerable to sinkhole formation as high hazard areas. Another influencing factor could be that the high hazard areas are generally not developed, whereas the medium hazard areas are densely developed. The position, volume, type and age of wet services also contribute to the type, size and time of sinkhole formation. This is only briefly discussed in this dissertation and not studied in detail.

16. Recommendations regarding the various types of land uses are made. In general, the majority of the Centurion CBD and surrounding areas would be suitable for most types of residential and commercial type developments, with commercial type developments being more suitable in the CBD area, surrounded by the Centurion Lake and residential type developments being more suitable towards the outskirts.

17. Buttrick and van Schalkwyk (1995) indicated that the number of ground-movement events could be predicted based on statistics of inappropriate and poor service design and management over a 20 year period. Using this method, a total of 409 sinkholes should have occurred over the last 20 years in the Centurion CBD area. Compared to actual data, a total of 119 sinkholes have occurred over a period of 40 years in a ‘well-managed area’ where appropriate foundation and service designs are present.

18. Using the Buttrick et al. (1995) system where the anticipated number of sinkholes in a low, medium and high risk area can be determined, the Centurion CBD area can be classified as a low to a medium hazard area, as 0,03 events per hectare have occurred in the past 40 years in the area. This figure may be unrealistic, since many of the sinkhole data points do not have all the relevant information to make precise comparisons. If no time period is correlated to the sinkhole events, the number of actual events indicates that the Centurion CBD area can be viewed as having a medium hazard for the formation of sinkholes, at 0,07 events per hectare.

    Using the actual number of sinkholes that have occurred in the Centurion CBD area, the number of sinkholes per hectare was calculated over a 20 year period. This indicates that 0,067 sinkholes occurred in the medium hazard areas whereas 0,076 sinkholes occurred in the high hazard areas. Therefore, there does not seem to be a substantial difference in the hazard of sinkhole formation in a ‘well-managed area’ between medium and high hazard areas.

    Although there is no substantial difference in sinkhole occurrence between medium and high hazard areas in the Centurion CBD area, it does indicate that there is a lower probability of sinkhole formation in this area than the area used by Buttrick (1992), referred to as the abused land situation. Centurion CBD and surrounding areas may perhaps not realistically be a 'well-managed' area, but more water precautionary measures and rational foundation designs were implemented in this area than the area used by Buttrick (1992). Therefore, this confirms that less sinkholes occur in areas where appropriate precautionary measures are implemented. Better managed services may need a different approach to correlate the Inherent Hazard Class and events in future.

19. Application of different methods of sinkhole prediction shows that various parameters have an influence on the hazard of sinkhole formation for areas considered as low, medium or high hazard. In the Centurion CBD area, the area south of the Hennops River shows a very low hazard for sinkhole formation, compared to the area north of the Hennops River. Different geological formations also show variable hazard ratings, and the Lyttelton Formation proves to have a slightly higher hazard for sinkhole formation as the Monte Christo Formation, although it is still considered as mainly a medium hazard for sinkhole formation.

20. The hazard classification map shows that the Centurion CBD area can mainly be classified as having a medium to high hazard for sinkhole formation, although calculations using the actual sinkhole events show the area can be classified as a low to medium hazard for sinkhole formation. The reasoning behind this could be explained as follows:
    a) The method used to classify the boreholes is too conservative, and the actual hazard for sinkhole formation is much lower.
    b) Not all the sinkhole events were recorded in the Centurion CBD area which causes the calculations to show a lower probability of sinkhole occurrence.

21. 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. This could be ascribed to the following factors:
    a) The Scenario Supposition Method by Buttrick and van Schalkwyk (1995) is based on a military area, north of the Centurion CBD area. This military area is mainly situated on the Eccles Formation, whereas the Centurion CBD area is

mainly situated on the Monte Christo Formation and to a lesser extent the Lyttelton and Oaktree Formations.

b) Development on the high hazard areas are not as common as on the medium and low hazard areas, therefore, not as many services are present on the high hazard areas and the probability of a leaking pipe is lower. This will reduce the probability of a sinkhole occurring.

c) The probability of sinkhole occurrence is not dependant on the classification of a specific area, but merely the consequence of a certain event happening, such as a leaking pipe. This would imply that a sinkhole will occur on a medium or high hazard area if a leaking pipe and some compressible subsurface material is present.

22. Based on the results of this study, it would seem that there is not a good comparison between a 'well-managed' area and the abused land situation (used by Buttrick, 1995). It seems the hazard for sinkhole formation in medium and high hazard areas is generally the same (0,07 events per hectare in a 20 year period) in the 'well-managed', Centurion CBD area.

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Appendix A:

List of the available Dolomite Stability Reports within the Centurion CBD Area

FOLDER NO.	REPORT NAME	PORTION / STAND	FARM NAME	CONTENT	SAGEOLIT	GEOREF	NR OF BOREHOLES IN REPORT	REPORT DATE
F78	Lyttelton Manor Ext 3	Stand 1704		Report	90584271	2528CC10	2	February 2008
F90	Lyttelton Manor Ext 3	Stand 1706		Report	90589096	2528CC10	3	January 2010
F102	Clubview Ext 39	Holding 16		Report	90079031	2528CC09		September 1985
F111	Lyttelton A/H(Die Hoewes Ext 241)	Holding 267/R		Report	90482189	2528CC09	2	October 2003
F112	Zwartkop 356 JR	Portion 549	Zwartkop 356 JR	Report	90575084	2528CC09	4	October 2007
F112	Clubview Ext 62	Holding 17		Report	90126445	2528CC09	3	October 1995
F113	Lyttelton Manor	Stand 375/R		Report	90574998	2528CC10	2	August 2007
F114	De Montiel (Lyttelton A/H)	Plot 174		Report	90229504	2528CC09	8	March 1997
F115	Die Hoewes	Holding 180	Lyttelton 381 JR	Report	90079067	2528CC09	4	August 1973
F117	Die Hoewes Ext 6			Report	90079150	2528CC09	8	May 1976
F120	Die Hoewes Ext 6			Report	90079151	2528CC09	8	January 1976
F121	Die Hoewes Ext 22	Stand 53		Report	90117232	2528CC09	4	June 1992
F122	Die Hoewes Ext 26	Holding 44 (Lyttelton A/H)		Report	90065530	2528CC14	5	June 1982
F122	Die Hoewes Ext 28	Holding 269 (Lyttelton A/H)	Highlands 359 JR	Report	90065555	2528CC09	5	February 1983
F122	Die Hoewes Ext 83	Stand 269	Highlands 359 JR	Report	90065687	2528CC09	9	May 1991
F122	Die Hoewes Ext 28	Holding 269 (Lyttelton A/H)	Highlands 359 JR	Report	90065554	2528CC09	14	November 1983
F122	Die Hoewes Ext 83	Stand 269		Report	90065685	2528CC09	35	March 1991
F123	Die Hoewes Ext 42	Holding 263 (Lyttelton A/H)		Report	90065577	2528CC09	3	September 1983
F125	Die Hoewes Ext 54	Stand 136		Report	90079060	2528CC09	3	August 1987
F126	Lyttelton Manor Ext 3	Stand 1675		Report	90584350	2528CC10	2	May 2008
F130	Die Hoewes Ext 83	Stands 272 & 276		Report	90065677	2528CC09	38	November 1988
F131	Die Hoewes Ext 84	Portion 1	Highlands 359 JR	Report	90065690	2528CC09	3	October 1987
F132	Die Hoewes Ext 88	Holding 273 (Lyttelton A/H)	Zwartkop 356 JR	Report	90584389	2528CC09	2	29 March 1989
F132	Die Hoewes Ext 88	Holding 273 (Lyttelton A/H)	Zwartkop 356 JR	Report	90065697	2528CC09	11	October 1981
F133	Die Hoewes Ext 91	Holding 147 (Lyttelton A/H)	Zwartkop 356 JR	Report	90065715	2528CC09	7	May 1992
F133	Die Hoewes Ext 91	Holding 145 (Lyttelton A/H)	Zwartkop 356 JR	Report	90065568	2528CC09		February 1985
F133	Die Hoewes Ext 91	Holding 145 (Lyttelton A/H)	Zwartkop 356 JR	Report	90065720	2528CC09		March 1993
F134	Die Hoewes Ext 93	Portion 320 & Portion of Portion 321	Zwartkop 356 JR	Report	90065723	2528CC09	4	April 1983
F134	Die Hoewes Ext 93	Portion 320	Zwartkop 356 JR	Report	90584292	2528CC09	4	January 2007
F135	Die Hoewes Ext 95			Report	90065729	2528CC09	6	February 1993
F136	Die Hoewes Ext 96	Holding 101 (Lyttelton A/H)		Report	90079064	2528CC09	8	December 1992
F137	Die Hoewes Ext 105	Holding 103 (Lyttelton A/H)		Report	90124726	2528CC09	4	March 1994
F139	Die Hoewes Ext 113	Holding 98 (Lyttelton A/H)		Report	90116410	2528CC09	5	March 1994
F140	Lyttelton A/H	Holding 113		Report	90575030	2528CC14	14	September 2007
F141	Die Hoewes Ext 115	Holding 94 (Lyttelton A/H)		Report	90124619	2528CC09	7	November 1994
F142	Die Hoewes Ext 119	Holding 100 (Lyttelton A/H)		Report	90126124	2528CC09	5	August 1995
F143	Die Hoewes Ext 143	Portion 8	Highlands 359 JR	Report	90229337	2528CC09	3	February 1997
F145	Highlands	Portion 20	Highlands 359 JR	Report	90229103	2528CC10	3	September 1996
F150	Lyttelton A/H	Holding 33		Report	90374100	2528CC09	3	May 1984
F151	Lyttelton A/H	Holding 78		Report	90125188	2528CC09	7	May 1995
F152	Lyttelton A/H Ext 1	Holding 97		Report	90126372	2528CC09	3	October 1995
F153	Lyttelton A/H Ext 1	Holding 99		Report	90124625	2528CC09	8	August 1994
F154	Lyttelton A/H	Holding 106		Report	90128219	2528CC09	3	July 1996
F155	Die Hoewes Ext 35(Lyttelton A/H)	Holding 135		Report	90116959	2528CC15	5	October 1994
F157	Lyttelton A/H	Holding 150		Report	90374709	2528CC09	7	October 2000
F158	Lyttelton A/H	Stand 172		Report	90420421	2528CC09	8	January 2001
F159	Lyttelton A/H	Holding 179		Report	90128765	2528CC09	5	August 1995
F160	Lyttelton A/H	Holding 202		Report	90124735	2528CC09	6	March 1995
F160	Lyttelton A/H	Holding 202		Report	90124733	2528CC09	9	April 1995
F162	Lyttelton A/H	Holding 251		Report	90126435	2528CC09	8	September 1992
F163	Lyttelton A/H Ext 1	Holding 161		Report	90229850	2528CC09	4	18 November 1997
F163	Lyttelton A/H Ext 1	Holding 161		Report	90229627	2528CC09	9	June 1997
F164	Lyttelton A/H Ext 1	Holding 182		Report	90124628	2528CC09	9	September 1994
F165	Lyttelton A/H Ext 1	Holding 192		Report	90117229	2528CC09	4	September 1994
F166	Lyttelton A/H Ext 1(Die Hoewes Ext 43)	Holding 216(Portion 73)		Report	90373860	2528CC09	6	March 1998
F167	Lyttelton A/H Ext 1	Holding 219		Report	90230743	2528CC09	8	October 1998
F168	Monument View			Borehole Profiles	90079114	2528CC09	6	February 1974

FOLDER NO.	REPORT NAME	PORTION / STAND	FARM NAME	CONTENT	SAGEOLIT	GEOREF	NR OF BOREHOLES IN REPORT	REPORT DATE
F168	Monument View			Borehole Profiles	90079113	2528CC09	6	February 1974
F168	Monument View & Ext 1			Borehole Profiles	90079115	2528CC09	6	June 1974
F168	Monument View			Borehole Profiles	90079118	2528CC09	9	February 1975
F172	Die Hoewes Ext 124	Holding 140 (Lyttelton A/H)		Report	90125996	2528CC10	2	July 1995
F173	Die Hoewes Ext 126	Holding 138		Report	90125836	2528CC10	2	August 1995
F175	Lyttelton Manor	Stand 412/R		Report	90564520	2528CC10	2	November 2006
F178	Lyttelton Manor Ext 3	Stand 1525		Report	90564517	2528CC09	2	December 2006
F179	Lyttelton Manor Ext 3	Stand 1532		Report	90564518	2528CC09	2	December 2006
F180	Lyttelton A/H	Holding 263/1		Report	90589067	2528CC09	2	January 2010
F180	Lyttelton A/H	Holding 263/1		Report	90575231	2528CC09	4	November 2006
F180	Lyttelton A/H	Holding 263/1		Report	90584248	2528CC09	4	November 2007
F181	Lyttelton Manor Ext 3	Stand 1531		Report	90584351	2528CC10	2	May 2008
F182	Lyttelton A/H Ext 1	Holding 139		Report	90374684	2528CC10	9	July 2000
F183	Lyttelton A/H	Holding 141		Report	90374348	2528CC10	8	December 1999
F184	Lyttelton Manor Ext 1	Stands 638 - 641 & 636		Report	90128270	2528CC10	4	July 1996
F187	Lyttelton Manor Ext 1	Stand 593		Report	90574995	2528CC10	2	August 2007
F192	Lyttelton Manor Ext 1	Stand 658		Report	90564557	2528CC10	3	5 March 2007
F214	Doringkloof	Stands 1033, 1034		Report	90589003		4	October 2009
F218	Lyttelton Manor Ext 3	Stand 1890		Report	90564553	2528CC10	2	February 2007
F218	Lyttelton Manor Ext 3	Stand 1890		Report	90588681	2528CC10	5	October 2008
F233	Brakfontein 390 JR	Portion 22 (of portion 2)	Brakfontein 390 JR	Report	90230600	2528CC14	6	October 1998
F235	Centurion Lake Comfort Inn	Stand 2008		Report	90229327	2528CC14	3	20 February 1997
F236	Lyttelton Manor	Stand 2450		Report	90584201	2528CC10	2	December 2007
F238	Die Hoewes Ext 16	Holdings 120 - 123		Report	90083047	2528CC14	12	6 December 1978
F239	Die Hoewes Ext 148(Ext 61)	Holding 63 (Lyttelton A/H)		Report	90083097	2528CC14	10	April 1985
F239	Die Hoewes Ext 61	Holding 63 (Lyttelton A/H)		Report	90083098	2528CC14		May 1985
F240	Die Hoewes Ext 57	Holding 289/R(47)		Report	90083090	2528CC14	12	December 1984
F241	Die Hoewes Ext 65	Holding 151 (Lyttelton A/H)		Report	90083110	2528CC14	5	September 1984
F241	Die Hoewes Ext 65	Holding 151 (Lyttelton A/H)		Report	90083107	2528CC14		October 1986
F243	Die Hoewes Ext 77(was ext 33)	Portion 77(of Port. 30)(stand 225)	Lyttelton 381 JR	Report	90100326	2528CC14	4	April 1991
F243	Die Hoewes Ext 77(was ext 33)	Holding 115 (Lyttelton A/H Ext 1)(stand 225)		Report	90083117	2528CC14		August 1983
F245	Die Hoewes Ext 104	Holding 128 (Lyttelton A/H Ext 1)		Report	90109044	2528CC15	4	October 1993
F247	Die Hoewes Ext 144 & 145 (Ovel Gardens Development)	Holding 58		Report	90230637	2528CC14	6	January 1998
F247	Die Hoewes Ext 144 & 145 (Ovel Gardens Development)	Stands 410,412		Report	90420472	2528CC14	6	2 February 2001
F248	Lyttelton 381 JR	Portion 137	Lyttelton 381 JR	Report	90575007	2528CC09	12	July 2007
F250	Die Hoewes Ext 189 (was ext 101)	Holding 73	Lyttelton 381 JR	Report	90127162	2528CC14	6	February 1996
F250	Die Hoewes Ext 189 (was ext 101)	Portion of Holding 73	Lyttelton 381 JR	Report	90482011	2528CC14	6	July 2003
F250	Die Hoewes Ext 189	Holding 73	Lyttelton 381 JR	Report	90562919	2528CC14	20	7 August 2004
F250	Die Hoewes Ext 189(Lakefield Office Development)	Holding 73 & R/71	Lyttelton 381 JR	Report	90564328	2528CC14		July 2004
F252	Die Hoewes Ext 199	Holding 190		Report	90474020	2528CC09	6	5 April 2002
F252	Die Hoewes Ext 199	Holding 190		Report	90474123	2528CC09	9	5 April 2002
F253	Die Hoewes Ext 203 (Highrise Development)	Holding 59		Report	90481947	2528CC14	31	July 2003
F253	Die Hoewes Ext 203 (Highrise Development)	Holding 59		Report	90482038	2528CC14		September 2003
F255	Die Hoewes Ext 52	Holding 143/R		Report	90065608	2528CC14	5	October 1981
F255	Die Hoewes Ext 204(was Ext 52)	Holding 143/1		Report	90474669	2528CC09	7	January 2003
F255	Die Hoewes Ext 204(was Ext 52)	Holding 143/1		Report	90562950	2528CC09	7	April 2005
F256	Die Hoewes Ext 197	Holding 169 (Lyttelton A/H)		Report	90482092	2528CC09	4	September 2003
F256	Die Hoewes Ext 197	Holding 169 (Lyttelton A/H)		Report	90562920	2528CC09	5	May 2004
F256	Die Hoewes Ext 197	Holding 169 (Lyttelton A/H)		Report	90474771	2528CC09	10	May 2002
F257	Lyttelton Manor Ext 3	Stand 1901		Report	90574997	2528CC10	2	August 2007
F259	Lyttelton Manor	Stand 536		Report	90564536	2528CC10	2	January 2007
F261	Die Hoewes Ext 207 (The Pines)	Holding 108		Report	90474357	2528CC09	48	August 2002
F262	Die Hoewes Ext 213	Holding 260	Highlands 359 JR	Report	90474823	2528CC09	6	16 March 2003
F262	Die Hoewes Ext 213	Holding 260	Highlands 359 JR	Report	90474362	2528CC09	16	August 2002
F263	Die Hoewes Ext 218	Holding 157/1		Report	90562326	2528CC09	9	November 2002
F263	Die Hoewes Ext 218	Holding 157/1		Report	90564305	2528CC09	17	November 2004
F264	Die Hoewes Ext 220 (Cherry-Wood)	Holdings 91, 93 & 95		Report	90421075	2528CC09	6	September 2001

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F264	Die Hoewes Ext 220	Holdings 91, 93 & 95		Report	90562951	2528CC09	7	9 September 2004
F264	Die Hoewes Ext 220	Holding 91, 93		Report	90420677	2528CC09	8	May 2001
F264	Die Hoewes Ext 220 (Cherry-Wood)	Holdings 91, 93 & 95		Report	90474038	2528CC09	12	April 2002
F264	Die Hoewes Ext 220 (Cherry-Wood)	Holdings 91, 93 & 95		Report	90421219	2528CC09	16	January 2002
F264	Die Hoewes Ext 220	Holdings 91, 93 & 95		Report	90562952	2528CC09	47	May 2004
F264	Die Hoewes Ext 220	Holdings 91, 93 & 95		Report	90481980	2528CC09		September 2003
F264	Die Hoewes Ext 220 (Cherry-Wood)	Holdings 91, 93 & 95		Report	90481784	2528CC09		June 2003
F265	Momentum Life Phase 3	Holding 76		Report	90589056	2528CC14	10	December 2008
F265	Die Hoewes Ext 222 (Momentum Life)	Holdings 75,77,79 & 81	Lyttelton 381 JR	Report	90482320	2528CC14	36	15 November 2003
F266	Die Hoewes Ext 226	Holding 262		Report	90474949	2528CC09	14	April 2003
F268	Die Hoewes Ext 227	Holding 186		Report	90481916	2528CC09	8	August 2003
F268	Die Hoewes Ext 227	Holding 186		Report	90482150	2528CC09	15	October 2003
F269	Die Hoewes Ext 236 (Was Ext 229)	Holding 104		Report	90564307	2528CC09	25	December 2003
F269	Die Hoewes Ext 236 (Was Ext 229)	Holding 104		Report	90504188	2528CC09		June 2004
F269	Die Hoewes Ext 236 (Was Ext 229)	Holding 104		Report	90564308	2528CC09		September 2005
F270	Die Hoewes Ext 237	Holding 90		Report	90564310	2528CC09	13	November 2004
F270	Die Hoewes Ext 237	Holding 90		Report	90564311	2528CC09	13	May 2005
F270	Die Hoewes Ext 237	Holding 90		Report	90504187	2528CC09		June 2004
F273	Die Hoewes Ext 175	Holding 95		Report	90420476	2528CC09	10	February 2001
F274	Lyttelton A/H	Holding 172/R		Report	90575034	2528CC09	14	July 2007
F275	Lyttelton A/H Ext 2	Holding 259/R		Report	90482551	2528CC09	19	20 January 2004
F277	Die Hoewes Ext 31	Holding 282		Report	90482559	2528CC09	3	February 2004
F277	Die Hoewes Ext 31	Holding 282		Report	90065559	2528CC09		August 1984
F278	Die Hoewes Ext 45	Holding 173		Report	90065596	2528CC09	9	October 1983
F279	Die Hoewes Ext 46	Stand 140		Report	90562922	2528CC09	6	5 August 2005
F280	Die Hoewes Ext 51	Holding 205		Report	90065606	2528CC09	2	May 1985
F280	Lyttelton A/H	Holding 205		Report	90081881	2528CC10	5	March 1987
F284	Die Hoewes Ext 56	Holding 164/1		Report	90374539	2528CC09	8	June 2000
F284	Die Hoewes Ext 56(Die Hoewes Ext 265)	Holdings 162/1 & 164/1		Report	90065624	2528CC09		December 1985
F287	Die Hoewes Ext 100	Holding 105/R		Report	90420932	2528CC09	6	November 2001
F287	Die Hoewes Ext 100	Holding 105		Report	90421084	2528CC09	9	August 1993
F288	Die Hoewes Ext 107	Holding 163		Report	90115441	2528CC09	4	February 1994
F289	Die Hoewes Ext 108	Holding 255 , 257		Report	90115426	2528CC09	3	October 1993
F291	Die Hoewes Ext 111	Holding 166/1		Report	90116177	2528CC09	5	May 1994
F292	Die Hoewes Ext 117	Holding 147 (Lyttelton A/H)		Report	90065715	2528CC09	7	May 1992
F292	Die Hoewes Ext 117	Stand 257		Report	90374687	2528CC09	8	September 2000
F293	Die Hoewes Ext 125	Portion 37	Highlands 359 JR	Report	90125819	2528CC09	4	April 1995
F294	Die Hoewes Ext 127	Holding 212 & 214/R		Report	90126127	2528CC09	3	16 August 1995
F295	Die Hoewes Ext 128	Holding 286(Portion of)		Report	90126714	2528CC09	8	February 1996
F295	Die Hoewes Ext 128	Stand 347		Report	90562923	2528CC09	13	August 2005
F296	Die Hoewes Ext 131	Holding 209		Report	90374457	2528CC09	2	May 2000
F296	Die Hoewes Ext 131	Holding 209		Report	90230172	2528CC09	4	February 1997
F296	Die Hoewes Ext 131	Holding 209		Report	90374665	2528CC09	4	July 2000
F297	Doringkloof	Stand 735		Report	90575081	2528CC10	2	December 2007
F298	Lyttelton Manor Ext 1	Stand 983		Report	90575082	2528CC10	6	29 November 2007
F298	Lyttelton Manor Ext 1	Stand 983		Report	90588669	2528CC10	13	12 September 2008
F300	Die Hoewes Ext 145	Portion 175(Port of Holding 58)	Lyttelton 381 JR	Report	90562924	2528CC09	6	5 February 2005
F301	Die Hoewes Ext 160	Holding 170/1		Report	90374367	2528CC09	7	February 2000
F303	Die Hoewes Ext 163	Holdings 231 & 232		Report	90420614	2528CC10	14	June 2001
F304	Die Hoewes Ext 168	Holding 290		Report	90374765	2528CC09	7	November 2000
F305	Die Hoewes Ext 188 (Venice)	Holding 82		Report	90420889	2528CC14	9	October 2001
F305	Die Hoewes Ext 188 (Venice)	Holding 82		Report(addendum)	90421122	2528CC14	10	October 2001
F305	Die Hoewes Ext 188 (Venice)	Holding 82		Report	90374101	2528CC14	11	April 1990
F306	Lyttelton A/H	Holding 129/2		Report	90575078	2528CC15	30	26 November 2007
F307	Die Hoewes Ext 99	Holding 124/R		Report	90482191	2528CC14	3	October 2003
F307	Die Hoewes Ext 99	Holding 124		Report	90108523	2528CC14	8	August 1993
F308	Die Hoewes Ext 50	Holding 45		Report	90083087	2528CC14	8	21 May 1985

FOLDER NO.	REPORT NAME	PORTION / STAND	FARM NAME	CONTENT	SAGEOLIT	GEOREF	NR OF BOREHOLES IN REPORT	REPORT DATE
F309	Die Hoewes Ext 82	Holding 62		Report	90083129	2528CC14	9	July 1982
F310	Die Hoewes Ext 29	Holding 68		Report	90374542	2528CC14	9	June 2000
F310	Die Hoewes Ext 29	Holding 68		Report	90083060	2528CC14	15	February 1984
F312	Die Hoewes Ext 29	Holding 68		Report	90083061	2528CC14		February 1984
F316	Die Hoewes Ext 150(Ext 273)	Holding 62/R		Report	90230204	2528CC15	10	May 1998
F325	Hennopspark Ext 80 - 86	Portion 7		Report	90562928	2528CC14	17	April 2005
F335	Die Hoewes Ext 232	Portion 44 (Holding 152)	Lyttelton 381 JR	Report	90562093	2528CC14	20	June 2005
F346	Die Hoewes Ext 244 & 245	Holding196/R.199/1,Portion103	Lyttelton 381 JR	Report	90562101	2528CC09	21	May 2004
F346	Die Hoewes Ext 244 & 245	Holding196/R.199/1,Portion103	Lyttelton 381 JR	Report	90574992	2528CC09		September 2006
F346	Zwartkop Ext 7	Stand 1194		Report	90474772	2528CC14	3	December 2002
F346	Zwartkop Ext 7	Stand 1190 , 1135/1 (1954)		Report	90474037	2528CC14	2	March 2002
F377	Zwartkop	Stand 1656		Report	90482010	2528CC14	2	September 2003
F378	Zwartkop Ext 7	Stands 1284/2 & 1285/R		Report	90474283	2528CC14	7	March 2002
F378	Zwartkop Ext 7	Stands 1284/2 & 1285/R		Report	90482131	2528CC14		4 October 2002
F380	Zwartkop Ext 7	Stands 1348 & 1349		Report	90474270	2528CC14	6	25 July 2002
F383	Verwoerdburgstad	Stand 81		Report	90481728	2528CC14	1	May 2003
F420	Highveld Ext 58 (Eco Park)now Ext 67,68,71	P/Portion 60	Brakfontein 390 JR	Report	90563939	2528CC14	18	February 2005
F420	Highveld Ext 58 (Eco Park)now Ext 67,68,71	P/Portion 60	Brakfontein 390 JR	Report	90563940	2528CC14	18	February 2005
F421	Doringkloof	Stand 293		Report	90564629	2528CC15	2	June 2007
F422	Highveld Ext 59& 60 (Ext 59, 70)Eco Park	P/Portion 60	Brakfontein 390 JR	Report	90563941	2528CC14	19	February 2005
F422	Highveld Ext 59& 60 (Ext 59.70)Eco Park	P/Portion 60	Brakfontein 390 JR	Report	90562094	2528CC14	19	August 2004
F456	Lyttelton Manor Ext 3	Stand 1530		Report	90589104	2528CC09	1	March 2010
F498	Hennopspark Ext 7	Portion 7	Brakfontein 390 JR	Report	90083257	2528CC14	8	7 May 1973
F520	Lyttelton Manor Ext 16	Portion 759/55	Doornkloof 391 JR	Report	90589011	2528CC15	44	October 2009
F528	Lyttelton A/H	Holding 67		Report	90229599	2528CC14	8	July 1997
F529	Lyttelton A/H	Holding 125/R		Report	90574969	2528CC14	7	July 2007
F529	Lyttelton A/H	Holding 125/R		Report	90584396	2528CC14	7	July 2007
F530	Lyttelton A/H	Portion 409/R,411/C&D	Zwartkop 356 JR	Report	90564634	2528CC09	12	June 2007
F541	Verwoerdburgstad (KVA Center)			Report	90092902	2528CC14	54	1987
F543	Verwoerdburgstad	Stand 46/1		Report	90564577	2528CC14	7	March 2007
F544	Verwoerdburg(Extensions to Post Office)	Portion 7		Report	90108434	2528CC14	7	July 1979
F552	Zwartkop Ext 2	Portion 5	Zwartkop 356 JR	Report	90092912	2528CC14	1	December 1971
F554	Zwartkop Ext 5	Portion 40	Zwartkop 356 JR	Report	90096957	2528CC14	3	May 1975
F555	Zwartkop Ext 6	Portion 4	Brakfontein 390 JR	Report	90092956	2528CC14	9	August 1975
F563	Zwartkop Ext 16	Portions 39,317,327	Zwartkop 356 JR	Report	90092968	2528CC14	4	June 1991
F565	Zwartkop Ext 18	Portion 3	Zwartkop 356 JR	Report	90116014	2528CC14	5	April 1994
F567	Zwartkop Ext 21 (Zwartkop Ext 9)	Holding 16	Zwartkop 356 JR	Report	90126369	2528CC14	2	April 1981
F568	Lyttelton A/H(Falcons Village)	Holding 130/R		Report	90373884	2528CC15	5	February 1999
F647	Lyttelton A/H(Sandolien)	Holding 96		Report	90421315	2528CC09	55	January 2002
F744	Lyttelton Manor Ext 4 (Verwoerdburg)			Report	90082131	2528CC10	2	January 1972
F744	Lyttelton Manor Ext 4			Report	90082140	2528CC10	4	September 1976
F744	Lyttelton Manor Ext 7(now Ext 11)			Report	90082167	2528CC10	4	May 1979
F744	Lyttelton Manor Ext 4		Droogregrond 380 JR	Report	90082137	2528CC10	8	May 1975
F744	Lyttelton Manor Ext 7 Part of (now Ext 11)			Report	90082164	2528CC10	10	August 1989
F744	Lyttelton Manor Ext 7(now Ext 11)			Report	90082163	2528CC10	11	July 1986
F744	Lyttelton Manor Ext 4(Lyttelton Industrial)			Report	90082130	2528CC10	23	June 1971
F744	Lyttelton Manor Ext 4		Droogregrond 380 JR	Report	90082132	2528CC10		1 November 1972
F745	Lyttelton Manor Ext 11	Stand 2218		Report	90474703	2528CC10	2	January 2003
F747	Lyttelton Manor Ext 11	Stand 2260		Report	90474354	2528CC10	3	September 2002
F749	Lyttelton Manor Ext 11	Stand 2269		Report	90421252	2528CC10	3	March 2002
F750	Lyttelton Manor Ext 11	Stand 2272 & 2273		Report	90420683	2528CC10	4	April 2001
F756	Lyttelton Manor Ext 11	Stand 2305		Report	90421187	2528CC10	3	December 2001
F760	Lyttelton Manor Ext 11	Stand 2285		Report	90474164	2528CC10	2	June 2002
F765	Lyttelton Manor	Stand 608		Report	90564562	2528CC10	2	March 2007
F828	Lyttelton Manor	Stand 391/3		Report	90474857	2528CC10	3	May 2003
F830	Lyttelton Manor Ext 1	Stand 460/R		Report	90474762	2528CC09	2	February 2001
F831	Lyttelton Manor	Stand 598/1		Report	90482488	2528CC10	1	January 2004

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F836	Lyttelton Manor Ext 1	Stand 627		Report	90481922	2528CC10	1	July 2002
F838	Lyttelton Manor Ext 1	Stand 705/1		Report	90474161	2528CC09		March 2002
F838	Lyttelton Manor Ext 1	Stand 705/1		Report	90474434	2528CC09	4	October 2002
F839	Lyttelton Manor Ext 1	Stand 719/1		Report	90474065	2528CC09	1	March 2002
F841	Lyttelton Manor Ext 1	Stand 893		Report	90482095	2528CC09	3	September 2003
F841	Lyttelton Manor Ext 1	Stand 893		Report	90482524	2528CC09	3	December 2003
F852	Lyttelton Manor Ext 3	Stand 1652		Report	90481987	2528CC10	1	May 2003
F854	Lyttelton Manor Ext 3	Stand 1828/1		Report	90482127	2528CC10	1	September 2003
F855	Lyttelton Manor Ext 3	Stand 1853/1		Report	90481986	2528CC10	2	August 2003
F856	Lyttelton Manor Ext 3	Stand 1899		Report	90482432	2528CC10	1	January 2004
F857	Lyttelton Manor Ext 3	Stand 2162		Report	90128069	2528CC10	5	June 1996
F858	Lyttelton Manor Ext 3	Stand 2455		Report	90420540	2528CC10	4	April 2001
F858	Lyttelton Manor Ext 3	Stand 2455/1		Report	90584368	2528CC10	15	June 2008
F889	Doringkloof	Stands 10 & 11		Report	90482495	2528CC15	2	February 2004
F890	Doringkloof	Stand 247		Report	90482655	2528CC15	1	February 2004
F891	Lyttelton Manor Ext 3	Stand 1968		Report	90482392	2528CC10	1	November 2003
F892	Doringkloof	Stand 586/1		Report	90229852	2528CC15	3	October 1997
F892	Doringkloof	Portions 2,3 & 4 of Stand 586		Report	90230281	2528CC15	5	June 1998
F916	Doringkloof	Stand 911		Report	90588833	2528CC15	2	April 2009
F947	Centurion	Stand 65/2	Lyttelton 381 JR	Report	90564035	2528CC14	6	July 1985
F947	Centurion	Stand 65/2	Lyttelton 381 JR	Report	90564062	2528CC14	7	18 May 2005
F947	Verwoerdburgstad	Porion 65/2	Lyttelton 381 JR	Report	90588859	2528CC14	19	April 2009
F947	Centurion(Splash)	Stand 65/2	Lyttelton 381 JR	Report	90482012	2528CC14		6 September 2003
F968	Zwartkop Ext 29 (was Zwartkop Ext 8)	Stand 1966 was stand 1462	Brakfontein 390 JR	Report	90562984	2528CC14	9	March 2005
F1003	Highveld Ext 63 (Vision Lifestyle Centre)	Portion 542	Doornkloof 391 JR	Report	90504082	2528CC14	10	May 2004
F1003	Highveld Ext 63 (Byls bridge West Hotel)			Report	90589162	2528CC14	7	June 2010
F1003	Irene Estates Computer Centre			Report	90575044	2528CC14	9	October 1986
F1003	Highveld Ext 63	Stand 2		Report	90588880	2528CC14	12	28 November 2008
F1003	Highveld Ext 63 (Office Park)			Report	90568739	2528CC14	13	25 November 2005
F1004	Lyttelton Manor Ext 3	Stand 1724/R		Report	90584272	2528CC10	2	February 2008
F1008	Die Hoewes Ext 233(Ext 114)	Portion 66	Lyttelton 381 JR	Report	90116382	2528CC14	3	July 1994
F1008	Die Hoewes Ext 233(Corporate 66)	Holding 74	Lyttelton A/H	Report	90564639	2528CC14	23	November 2006
F1008	Lyttelton A/H	Holding 74		Report	90481948	2528CC14	43	July 2003
F1008	Die Hoewes Ext 233(Corporate 66)	Holding 74	Lyttelton A/H	Report	90589336	2528CC14		1 September 2008
F1025	Unitas Hospital New Bunker Oncology			Report	90588860	2528CC09	5	18 Bebruary 2009
F1025	Lyttelton A/H (Unitas Hospital)	Stand 137		Report	90563000	2528CC09	7	26 September 2005
F1049	Irene Ext 16 & 21 (Van Der Bijl dev)			Report	90481888	2528CC15	7	September 2002
F1049	Irene Ext 16 & 21 (Van Der Bijl dev)			Report	90481877	2528CC15	71	July 2003
F1074	Highveld Ext 49		Doornkloof 391 JR	Report	90481809	2528CC15	13	12 December 2002
F1074	Swartland Commercial & Office Park (Highveld Ext 77)			Report	90421277	2528CC15	13	February 2002
F1080	Lyttelton A/H Ext 1(Die Hoewes Ext 21)	Holding 217		Report	90230389	2528CC09	13	July 1998
F1081	Lyttelton A/H Ext 1(Die Hoewes Ext 21)	Holding 218	Lyttelton 381 JR	Report	90564300	2528CC09	10	October 2005
F1081	Lyttelton A/H Ext 1(Die Hoewes Ext 21)	Holding 218	Lyttelton 381 JR	Report	90374215	2528CC09	11	September 1998
F1081	Lyttelton A/H Ext 1(Die Hoewes Ext 21)	Holding 218	Lyttelton 381 JR	Report	90374230	2528CC09		4 January 1984
F1082	Lyttelton A/H	Holding 170	Highlands 359 JR	Report	90562351	2528CC09	5	June 2004
F1083	Lyttelton A/H(Die Hoewes Ext 167)	Holding 171		Report	90374753	2528CC09	8	October 2000
F1083	Lyttelton A/H(Die Hoewes Ext 167)	Holding 171		Report	90562352	2528CC09	9	16 November 2004
F1084	Lyttelton A/H	Holding 196		Report	90420981	2528CC09	4	1983
F1085	Lyttelton A/H	Holding 204/R		Report	90562353	2528CC09	4	September 2005
F1087	Lyttelton A/H	Holding 247 ,248	Highlands 359 JR	Report	90112526	2528CC09	5	November 1993
F1087	Lyttelton A/H	Holding 247	Highlands 359 JR	Report	90474812	2528CC09	8	20 January 2003
F1087	Lyttelton A/H	Holding 247	Highlands 359 JR	Report	90481804	2528CC09	8	26 May 2003
F1088	Lyttelton A/H(Die Hoewes Ext 241)	Holding 267/2		Report	90420473	2528CC09	8	July 2000
F1088	Lyttelton A/H(Die Hoewes Ext 241)	Holding 267/1		Report	90504147	2528CC09	9	June 2004
F1088	Lyttelton A/H(Die Hoewes Ext 241)	Holding 267/1		Report	90562354	2528CC09	9	December 2004
F1089	Lyttelton A/H	Holding 110	Lyttelton 381 JR	Report	90230766	2528CC09	3	December 1998
F1089	Lyttelton A/H	Portion of Holding 110	Lyttelton 381 JR	Report	90564320	2528CC09	17	October 2005

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F1090	Lyttelton (Brolink Office Building)	Holding 86	Lyttelton 381 JR	Report	90229600	2528CC09	2	July 1997
F1090	Lyttelton Ext 1	Holding 86(Portion of)	Lyttelton 381 JR	Report	90229733	2528CC09	3	September 1997
F1090	Lyttelton A/H(de Baken Development)	Portion 157(prev Holding 86)	Lyttelton 381 JR	Report	90588884	2528CC09	17	April 2009
F1090	Lyttelton A/H	Portion 157(prev Holding 86)	Lyttelton 381 JR	Report	90564076	2528CC09	22	21 June 2006
F1094	Lyttelton A/H			Report	90474572	2528CC09	2	16 January 2003
F1096	Lyttelton A/H	Holding 89		Report	90564078	2528CC09	14	June 2006
F1097	Lyttelton A/H	Holding 97/R		Report	90482505	2528CC09	3	January 2004
F1098	Die Hoewes Ext 214	Holding 149		Report	90374670	2528CC09	3	June 1999
F1098	Die Hoewes Ext 214	Holding 149/R		Report	90481744	2528CC09	5	26 May 2003
F1098	Die Hoewes Ext 214	Holding 149/R		Report	90564387	2528CC09	5	November 2007
F1098	Die Hoewes Ext 214	Holding 149/R		Report	90481935	2528CC09	8	6 August 2003
F1100	Lyttelton A/H (Die Hoewes Ext 90)	Holding 286/R		Report	90079077	2528CC14	4	September 1991
F1100	Lyttelton A/H(Die Hoewes Ext 90)	Portion 147(Holding 286/R)	Lyttelton 381 JR	Report	90574956	2528CC14	5	December 2006
F1100	Die Hoewes Ext 256(Footprint drilling)	Portion 147	Lyttelton 381 JR	Report	90588946	2528CC14	10	June 2009
F1100	Lyttelton A/H(Die Hoewes Ext 90)	Holding 286/R		Report	90482678	2528CC14	11	January 2004
F1100	Die Hoewes Ext 256(Footprint drilling)	Portion 147	Lyttelton 381 JR	Report	90588832	2528CC14	17	February 2009
F1108	Lyttelton Manor	Stand 672		Report	90564081	2528CC10		15 March 1999
F1109	Lyttelton Manor	Stand 492		Report	90562849	2528CC09	4	July 2004
F1110	Lyttelton Manor	Stand 377		Report	90562850	2528CC10	3	February 2005
F1112	Lyttelton Manor	Stand 384/R		Report	90562854	2528CC10	2	25 April 2005
F1113	Lyttelton Manor	Stand 363/1		Report	90482657	2528CC10	1	March 2004
F1116	Lyttelton Manor	Stand 392/1		Report	90563023	2528CC10	2	September 2005
F1117	Lyttelton Manor	Portion 1 and Rem of Stand 336		Report	90421103	2528CC10	7	16 November 2001
F1118	Lyttelton Manor Ext 1	Stand 463		Report	90563024	2528CC10	2	May 2005
F1119	Lyttelton Manor Ext 1	Stand 538/1		Report	90482530	2528CC10	1	February 2004
F1121	Lyttelton Manor Ext 3	Stand 1976		Report	90482372	2528CC10	2	31 December 2003
F1121	Lyttelton Manor Ext 3			Report	90563025	2528CC10	14	October 1987
F1122	Lyttelton Manor Ext 3	Stand 1786/2		Report	90563026	2528CC10	2	October 2004
F1124	Lyttelton Manor Ext 1	Stand 349/R		Report	90481720	2528CC10	7	March 2002
F1124	Lyttelton Manor Ext 1	Stands 347 & 348		Report	90563027	2528CC10	7	June 2003
F1124	Lyttelton Manor	Stand 349/R		Report	90562852	2528CC10		May 2003
F1126	Lyttelton Manor	Stand 1821		Report	90504172	2528CC10	1	June 2004
F1127	Lyttelton Manor Ext 11	Stand 2306		Report	90563028	2528CC10	2	July 2005
F1127	Lyttelton Manor Ext 11	Stand 2306		Report	90421180	2528CC10	3	15 October 2001
F1128	Lyttelton Ext 1 (Filling Station)	Stand 2459		Report	90481945	2528CC09	6	June 2001
F1128	Lyttelton Ext 1 (Filling Station)	Stand 2459		Report	90481946	2528CC09		August 2001
F1129	Lyttelton Manor Ext 3	Stand 1689		Report	90482664	2528CC10	2	March 2004
F1130	Lyttelton Manor Ext 3	Stand 1775		Report	90482397	2528CC10	1	November 2003
F1139	Lyttelton Manor	Stand 1122/1		Report	90563031	2528CC10	1	13 September 2004
F1140	Lyttelton Manor Ext 1	Stand 1146/1		Report	90563032	2528CC10	3	30 March 2005
F1142	Lyttelton Manor Ext 1	Stand 1630		Report	90563033	2528CC10	2	June 2004
F1143	Lyttelton Manor	Stand 1060/1		Report	90563034	2528CC10	2	November 2004
F1143	Lyttelton Manor	Stand 1060/1		Report	90503957	2528CC10		April 2004
F1147	Lyttelton Ext 1	Stand 642		Report	90481956	2528CC10	1	August 2003
F1148	Lyttelton Manor	Stand 646		Report	90585003	2528CC10	1	August 2011
F1148	Lyttelton Manor	Stand 646		Report	90563038	2528CC10	3	February 2005
F1149	Lyttelton Manor	Stand 649		Report	90482396	2528CC10	2	November 2003
F1150	Lyttelton Manor	Stand 669		Report	90482478	2528CC10	1	February 2004
F1151	Lyttelton Manor	Stand 715		Report	90482479	2528CC09	1	February 2004
F1152	Lyttelton Manor	Stand 748		Report	90562855	2528CC09	1	June 2004
F1158	Lyttelton Manor Ext 11	Stand 2438/1		Report	90562857	2528CC10	2	4 May 2005
F1158	Lyttelton Manor Ext 11	Stand 2438/1		Report	90481846	2528CC10	1	19 July 2003
F1159	Lyttelton Manor	Stand 518		Report	90504071	2528CC10	1	May 2004
F1236	Doornkloof 391 JR	Portion 156	Doornkloof 391 JR	Report	90575008	2528CC15	6	October 2006
F1354	Zwartkop Ext 8	Stand 1387		Borehole Profiles	90563150	2528CC08	3	25 July 2005
F1395	Verwoerdburgstad	Stand 11		Report	90562312	2528CC08	2	March 2005
F1397	Lyttelton A/H (Village Montessori School)	Holding 166/R	Lyttelton 381 JR	Report	90562314	2528CC09	7	September 2004

FOLDER NO.	REPORT NAME	PORTION / STAND	FARM NAME	CONTENT	SAGEOLIT	GEOREF	NR OF BOREHOLES IN REPORT	REPORT DATE
F1508	Highlands 359 JR	Portion 8(Western Portion)	Highlands 359 JR	Report	90504114	2528CC09	4	May 2004
F1527	Centurion (Exel Service Station)			Report	90474174	2528CC14	3	March 2002
F1535	Die Hoewes Ext 40	Holding 127 (Lyttelton A/H)		Report	90564317	2528CC15	1	30 April 2001
F1535	Die Hoewes Ext 40	Holding 127 (Lyttelton A/H)		Report	90420514	2528CC15	9	May 2000
F1535	Die Hoewes Ext 40	Holding 127 (Lyttelton A/H)		Report	90083079	2528CC15		April 1985
F1536	Die Hoewes Ext 34(Die Hoewes Ext 129)	Holding 132/1 (Lyttelton A/H)		Report	90096867	2528CC15	9	June 1981
F1536	Die Hoewes Ext 212	Holding 132/1 (Lyttelton A/H)		Report	90474768	2528CC14	14	15 February 2003
F1536	Die Hoewes Ext 129	Holding 132/1 (Lyttelton A/H)		Report	90126365	2528CC14		October 1995
F1537	Die Hoewes Ext 151 & 152	Holding 80		Report	90374180	2528CC14	8	July 1999
F1537	Die Hoewes Ext 151 & 152	Holding 80		Report	90420633	2528CC14	17	June 2001
F1537	Die Hoewes Ext 169 (was Ext 67)(Liquid Amber)	Holding 277 (Lyttelton A/H)		Report	90420432	2528CC10	3	January 2001
F1537	Die Hoewes Ext 169 (was Ext 67)(Liquid Amber)	Holding 277 (Lyttelton A/H)		Report	90065637	2528CC10	4	August 1981
F1538	Die Hoewes Ext 169 (was Ext 67)(Liquid Amber)	Holding 277 (Lyttelton A/H)		Report	90065639	2528CC10	8	May 1985
F1538	Die Hoewes Ext 169 (was Ext 67)(Liquid Amber)	Holding 277 (Lyttelton A/H)		Report	90420985	2528CC10	37	October 2001
F1538	Die Hoewes Ext 169 (was Ext 67)(Liquid Amber)	Holding 277 (Lyttelton A/H)		Report	90065640	2528CC10		May 1985
F1539	Die Hoewes Ext 157	Portion RE/130 (Lyttelton A/H)		Report	90420501	2528CC10	6	March 2001
F1540	Die Hoewes Ext 164	Holding 70 (Lyttelton A/H)		Report	90374713	2528CC10	9	October 2000
F1541	Die Hoewes Ext 170	Holding 158 (Lyttelton A/H)	Lyttelton 381 JR	Report	90420433	2528CC09	4	January 2001
F1541	Die Hoewes Ext 27	Holding 158		Report	90474483	2528CC09	16	May 2001
F1541	Die Hoewes Ext 27	Holding 158		Report	90065540	2528CC09		September 1983
F1542	Die Hoewes Ext 171	Holding 72 (Lyttelton A/H)		Report	90420474	2528CC09	7	February 2001
F1543	Die Hoewes Ext 179	Holding 81 (Lyttelton A/H)	Lyttelton 381 JR	Report	90420647	2528CC14	3	May 2001
F1543	Die Hoewes Ext 179	Portion 112	Lyttelton 381 JR	Report	90420646	2528CC14	7	May 2001
F1543	Die Hoewes Ext 179	Portion 112	Lyttelton 381 JR	Report	90564509	2528CC14	7	May 2001
F1543	Die Hoewes Ext 179	Holding 81 (Lyttelton A/H)	Lyttelton 381 JR	Report	90564640	2528CC14		June 2001
F1543	Die Hoewes Ext 180 (was Ext 173)	Holding 69 (Lyttelton A/H)		Report	90420498	2528CC14	4	February 2001
F1544	Die Hoewes Ext 180 (was Ext 173)	Holding 69 (Lyttelton A/H)		Report	90420707	2528CC14	12	July 2001
F1545	Die Hoewes Ext 191	Holding 290/3 (Lyttelton A/H)		Report	90474303	2528CC14	5	November 2001
F1546	Die Hoewes Ext 192 (Picollo Development)	Holding 117 (Lyttelton A/H)		Report	90474081	2528CC09	21	April 2002
F1546	Die Hoewes Ext 192 (Picollo Development)	Holding 117 (Lyttelton A/H)		Report	90474229	2528CC14	28	July 2002
F1547	Die Hoewes Ext 201 (Oaklands)	Holding 61 (Lyttelton A/H)		Report	90474391	2528CC14	13	September 2002
F1547	Die Hoewes Ext 201 (Oaklands)	Holding 61 (Lyttelton A/H)		Report	90474390	2528CC14	54	August 2002
F1548	Die Hoewes Ext 202 (Bateleur)	Holding 111 (Lyttelton A/H)		Report	90474358	2528CC14	55	August 2002
F1549	Die Hoewes Ext 206	Holding 102/R (Lyttelton A/H)		Report	90374686	2528CC09	6	September 2000
F1551	Lyttelton A/H	Portion 51	Highlands 359 JR	Report	90588815	2528CC09	2	March 2009
F1552	Die Hoewes Ext 216	Holding 258 (Lyttelton A/H)	Highlands 359 JR	Report	90474400	2528CC09	9	July 2002
F1552	Lyttelton Manor Ext 3	Stand 1774,1745		Report	90575050	2528CC10	3	August 2007
F1553	Die Hoewes Ext 221	Holding 266 (Lyttelton A/H)		Report	90229777	2528CC09	6	July 1997
F1553	Die Hoewes Ext 221	Holding 266 (Lyttelton A/H)		Report	90229867	2528CC09	9	31 October 1997
F1553	Die Hoewes Ext 221	Holding 266 (Lyttelton A/H)		Report	90482391	2528CC09	34	November 2003
F1554	Doringkloof	Stand 93	Doornkloof 391 JR	Report	90421127	2528CC14	1	February 2002
F1566	Green Acres Development			Report	90420893	2528CC14	4	October 2001
F1566	Green Acres Development			Report	90474080	2528CC14	4	February 2002
F1570	Lyttelton Manor Ext 1	Stand 1327		Report	90564589	2528CC10	2	May 2007
F1571	Highlands 359 JR	Portion 17	Highlands 359 JR	Report	90373883	2528CC09	4	July 1995
F1585	Die Hoewes Ext 68(Lyttelton A/H Ext 1)	R/ Portion 68(Holding 156)	Lyttelton 381 JR	Report	90474464	2528CC09	3	18 October 2002
F1586	Lyttelton 381 JR	Portion 149	Lyttelton 381 JR	Report	90420832	2528CC09	14	September 2001
F1587	Lyttelton Ext 1	Stand 507/1		Report	90482126	2528CC09	1	September 2003
F1588	Lyttelton Ext 1	Stand 577		Report	90562330	2528CC09	1	June 2003
F1589	Lyttelton Ext 1	Stand 660		Report	90481844	2528CC10	1	July 2003
F1591	Lyttelton Ext 3			Report	90374004	2528CC09	3	11 June 1999
F1592	Lyttelton Ext 3	Stand 1761/R		Report	90482235	2528CC10	1	November 2003
F1593	Lyttelton Ext 3	Portion of Stand 1933		Report	90481917	2528CC10	1	August 2003
F1595	Lyttelton A/H	Holding 2/125		Report	90574964	2528CC15	4	July 2007
F1596	Lyttelton A/H	Holding 71/R		Report	90420541	2528CC14	4	July 2000
F1596	Lyttelton A/H	Holding 71/R		Report	90482393	2528CC10	5	November 2003
F1596	Lyttelton A/H	Holding 71/1		Report	90230099	2528CC14	5	October 1997

FOLDER NO.	REPORT NAME	PORTION / STAND	FARM NAME	CONTENT	SAGEOLIT	GEOREF	NR OF BOREHOLES IN REPORT	REPORT DATE
F1597	Lyttelton A/H	Holding 146		Report	90420829	2528CC14	7	September 2001
F1598	Lyttelton A/H(Die Hoewes Ext 262)	Portion of Holding 201 & 203		Report	90229758	2528CC14	7	August 1997
F1599	Lyttelton A/H	Holding 236		Report	90474083	2528CC09	3	May 2002
F1599	Lyttelton A/H	Holding 236		Report	90421260	2528CC09	5	January 2002
F1599	Lyttelton A/H	Holding 236		Report	90481738	2528CC09	15	March 2003
F1599	Die Hoewes Ext 59	Portion 3(Holding 236)	Highlands 359 JR	Report	90065631	2528CC09		November 1985
F1600	Lyttelton A/H	Holding 238		Report	90482410	2528CC09	2	January 2004
F1600	Lyttelton A/H	Holding 238		Report	90482052	2528CC09	8	August 2003
F1601	Lyttelton A/H	Holdings 255 & 257		Report	90374671	2528CC09	3	October 1993
F1601	Lyttelton A/H	Holdings 257		Report	90374672	2528CC09	8	29 August 2000
F1602	Lyttelton A/H	Holding 260(Portion of)		Report	90126663	2528CC09	1	December 1995
F1603	Lyttelton A/H (Maple Mews)	Holding 274		Report	90474228	2528CC09	12	June 2002
F1603	Lyttelton A/H (Maple Mews)	Holding 274		Report	90474112	2528CC09	40	May 2002
F1604	Lyttelton A/H	Holding 275		Report	90374117	2528CC09	5	May 1984
F1606	Lyttelton A/H Ext 1	Holding 157/R		Report	90110120	2528CC09	3	December 1981
F1607	Lyttelton A/H Ext 1(Die Hoewes Ext 141)	Holding 211		Report	90374385	2528CC09	4	October 1997
F1607	Lyttelton A/H Ext 1(Die Hoewes Ext 141)	Holding 211/1		Report	90374485	2528CC09	12	May 2000
F1613	Highveld Ext 34			Report	90374194	2528CC15	8	September 1999
F1613	Highveld Ext 34 (was Ext 2 & 3)		Doornkloof 391 JR	Report	90093040	2528CC15	25	February 1991
F1613	Highveld Extensions (Ext 34)			Report	90093056	2528CC15	6	July 1991
F1616	Zwartkop Ext 8(was Ext 4)	Portions 6 & 7	Brakfontein 390 JR	Report	90092927	2528CC14	8	February 1975
F1619	Lyttelton A/H	Holding 129/1		Report	90568737	2528CC15	5	July 2005
F1620	Lyttelton A/H	Holding 126		Report	90230579	2528CC15	6	October 1998
F1621	Lyttelton Manor Ext 1	Stand 484/1		Report	90562297	2528CC15	2	August 2005
F1642	Zwartkop Ext 20 (Centurion Gate) Phase 1	Stand 1938 & 1939 & R/Port 4	Brakfontein 390 JR	Report	90563947	2528CC14	13	September 2004
F1642	Zwartkop Ext 20(Zwartkop Ext 11,14)	Portion 6,4	Brakfontein 390 JR	Report	90096933	2528CC14	13	July 1984
F1642	Zwartkop Ext 20 (Centurion Gate) Phase 2		Brakfontein 390 JR	Report	90563946	2528CC14	21	November 2005
F1642	Zwartkop Ext 20 (Centurion Gate) Phase 2		Brakfontein 390 JR	Report	90568881	2528CC14	40	March 2006
F1642	Zwartkop Ext 20 (Centurion Gate) Phase 2		Brakfontein 390 JR	Report	90564692	2528CC14	57	April 2007
F1642	Zwartkop Ext 20 (Centurion Gate) Phase 1 Filling Station	Stand 1938	Brakfontein 390 JR	Report	90563944	2528CC14		September 2005
F1647	Zwartkop Ext 7	Stand 1208		Report	90563184	2528CC14	2	November 2005
F1649	Centurion	Stand 45		Report	90563186	2528CC14	11	December 2004
F1651	Die Hoewes Ext 47 (Lake Tower)	Stand 218		Report	90562099	2528CC14	13	June 2005
F1658	Verwoerdburgstad(Tshwane South College)	Stand 43 & p/Stands 48 & 49		Borehole Profiles	90564322	2528CC14	21	October 2005
F1664	Lyttelton A/H Ext 1	Holding 116/1		Report	90563193	2528CC14	9	July 2005
F1664	Lyttelton A/H Ext 1	Holding 116/1		Report	90575009	2528CC14	10	August 2007
F1666	Zwartkop Ext 24	Portion 47	Brakfontein 390 JR	Report	90562936	2528CC14	6	August 1990
F1666	Verwoerdburgstad	Stand 47		Report	90563195	2528CC14	14	October 2005
F1666	Centurion	Stand 47		Report	90564602	2528CC14		April 2006
F1685	Zwartkop 356 JR	Portion 380	Zwartkop 356 JR	Report	90584349	2528CC09	10	May 2008
F1692	Lyttelton (Die Hoewes Ext 257)	Portion 12	Highlands 359 JR	Report	90563913	2528CC09	8	October 2005
F1692	Lyttelton	Portion 12	Highlands 359 JR	Report	90564188	2528CC09	16	January 2006
F1730	Die Hoewes Ext 1	Holding 176		Report	90079080	2528CC09	3	April 1974
F1733	Zwartkop 356 JR	Portion 227	Zwartkop 356 JR	Report	90127735	2528CC09	3	May 1996
F1746	Lyttelton A/H	Holding 136		Borehole Profiles	90568799	2528CC15	3	July 2002
F1855	Lyttelton Manor	Stand 334/2		Report	90584294	2528CC10	2	April 2008
F2016	Lyttelton Manor	Stand 695		Report	90584202	2528CC09	2	January 2008
F2017	Lyttelton Manor	Stand 681		Report	90584203	2528CC10	2	January 2008
F2018	Doringkloof	Stand 1038		Report	90584204	2528CC15	2	February 2008
F2019	Doringkloof	Stand 1039		Report	90584205	2528CC15	2	February 2008
F2025	Lyttelton Manor Ext 11	Stand 2289		Report	90584211	2528CC10	1	January 2008
F2036	Lyttelton Manor Ext 1	Stand 1120		Report	90584270	2528CC10	2	March 2008
F2266	Lyttelton Manor Ext 4 (Lyttelton Industrial)		Droogregrond 380 JR	Report	90082131	2528CC10	2	January 1972
F2303	Lyttelton A/H	Portion 81	Lyttelton 381 JR	Report	90588857	2528CC15	5	April 2009
F2370	Lyttelton Manor	Stand 693		Report	90584185	2528CC09	2	January 2008
F2373	Lyttelton Manor Ext 3	Stand 1815		Report	90589107	2528CC10	2	March 2010
F2376	Lyttelton A/H			Report	90568707	2528CC09	5	May 1970

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F2376	Lyttelton A/H			Report	90065874	2528CC09	50	17 March 1976
F2458	Doringkloof	Stand 1071		Report	90584274	2528CC15	2	February 2008
F2589	Highveld Ext 82	Stand 742		Report	90588901	2528CC14	5	12 November 2008
F2609	Highveld Ext 34	Stand 1		Report	90588723	2528CC14	6	November 2008
F3034	Tshwane International Convention Centre	Stands 48 & 49 and 57/58		Report	90568864	2528CC14	25	May 2006
F3034	Verwoerdburgstad(Tshwane International Convention Centre)	Stands 48 & 49 and 57/58		Report	90564025	2528CC14	27	January 2006
F3039	Lyttelton A/H Ext 1	Holding 116/R		Report	90564141	2528CC14	23	February 2006
F3069	Lyttelton A/H	Holding 60/R		Report	90564324	2528CC14	3	27 March 2006
F3069	Lyttelton A/H	Holding 60/1		Report	90564601	2528CC14	6	April 1982
F3072	Doringkloof Shopping Centre	Stand 1123 & 1124		Report	90564163	2528CC15	16	November 2005
F3073	Zwartkop Ext 26	Portion 322	Doornkloof 391 JR	Report	90568802	2528CC14	4	August 2005
F3074	Lyttelton Manor	Stand 1137		Report	90564164	2528CC10	2	March 2006
F3076	Takihami Restaurant	Portion 156/R	Zwartkop 356 JR	Report	90584434	2528CC14	4	April 2006
F3076	Centurion West/Gerhard St(Takihami Restaurant)	Portion 156/R	Zwartkop 356 JR	Report	90584433	2528CC14	7	April 2008
F3093	Lyttelton A/H	Holding 102/2		Report	90568885	2528CC09	55	August 2006
F3093	Die Hoewes Ext 206(Centurion Close)	Holding 102/2		Report(construction)	90588874	2528CC09		29 May 2009
F3096	Lyttelton Manor	Stand 628		Report	90568804	2528CC10	2	January 2006
F3122	Zwartkop Ext 8	Stand 1591		Report	90589066	2528CC14	1	February 2010
F3102	Die Hoewes Ext 247 (was p/of A/H 218)	Holding 168		Report	90568814	2528CC09	5	March 2006
F3102	Lyttelton A/H	Holding 168		Report	90564563	2529CC09	7	October 2006
F3102	Lyttelton A/H (Malachite Heights)	Holding 168		Report	90584236	2529CC09	12	February 2008
F3140	Zwartkop Ext 4	Stand 1173/R		Report	90584427	2528CC14	8	August 2008
F3140	Zwartkop Ext 4	Stand 1173/R		Report	90575046	2528CC14	11	October 2007
F3149	Die Hoewes Ext 219	Portion 30	Lyttelton 381 JR	Report	90584911	2528CC14	9	March 2011
F3166	Lyttelton Manor Ext 3	Stand 2131		Report	90575222	2528CC10	1	22 November 2006
F3169	Lyttelton Louis Leipoldt Primary School			Report	90081882	2528CC10	11	February 1979
F3170	Lyttelton Manor Ext 3	Stand 1651		Report	90574994	2528CC10	2	August 2007
F3185	Verwoerdburg Police Station	Portion 9	Droogegrond 350 JR	Report	90108856	2528CC09	3	7 July 1975
F3185	Verwoerdburg Police Station	Portion 9	Droogegrond 350 JR	Report	90108857	2528CC09	5	8 April 1975
F3185	Verwoerdburg Emergency Services	Portion 9	Droogegrond 350 JR	Report	90124775	2528CC09	7	January 1995
F3191	Zwartkop Ext 8	Stand 1578		Report	90564342	2528CC14	3	May 2006
F3216	Zwartkop Ext 4	Stand 675		Report	90568825	2528CC14	2	July 2006
F3221	Lyttelton Manor Ext 3	Stand 1811		Report	90564360	2528CC10	2	May 2006
F3224	Lyttelton A/H(additional drilling)	Holding 27		Report	90574951	2528CC09	5	December 2006
F3224	Lyttelton A/H	Holding 27		Report	90564363	2528CC09	13	June 2006
F3252	Centurion Supersport Park			Report	90564375	2528CC14	10	July 2006
F3252	Centurion Supersport Park(Southern Pavilion)			Report	90588814	2528CC14	10	19 November 2008
F3259	Lyttelton A/H	Holdings 24 & 285		Report	90564379	2528CC09	12	July 2006
F3259	Lyttelton A/H	Holding 24,285		Report	90564539	2528CC09	15	April 2007
F3280	Lyttelton Manor Ext 3	Stand 1924		Report	90564598	2528CC10	2	May 2007
F3285	Lyttelton Manor Ext 3	Stand 2179/1		Report	90568859	2528CC15	2	September 2006
F3293	Lyttelton Manor	Stand 341		Borehole Profiles	90564383	2528CC10	2	October 2006
F3296	Lyttelton Manor	Stand 286		Report	90584836	2528CC10	2	February 2011
F3309	Zwartkop Ext 8	Stand 1590		Report	90589065	2528CC14	2	February 2010
F3317	Lyttelton A/H	Holding 77		Report	90574941	2528CC09	14	October 2005
F3317	Lyttelton A/H	Portion 77/R		Report	90584187	2528CC09	14	February 2007
F3326	Lyttelton Manor Ext 3	Stand 1840		Report	90575229	2528CC10	2	November 2006
F3335	Lyttelton A/H	Holding 267/R(Portion 66)	Highlands 359 JR	Report	90564411	2528CC09	5	February 2006
F3404	Zwartkop Ext 4	Stand 913		Report	90589047	2528CC14	1	January 2010
F3433	Lyttelton Manor Ext 3	Stand 2179/R		Report	90584311	2528CC10	1	April 2008
F3461	Lyttelton Manor	Stand 412/1		Report	90584363	2528CC10	2	June 2008
F3463	Lyttelton Manor Ext 3	Stand 1683		Report	90584366	2528CC10	2	June 2008
F3468	Lyttelton Manor Ext 3	Stand 1578		Report	90584376	2528CC10	2	May 2008
F3476	Lyttelton Manor Ext 3	Stand 1668		Report	90584395	2528CC10	1	July 2008
F3489	Lyttelton Manor Ext 3	Stand 1830		Report	90589130	2528CC10	2	May 2010
F3591	Lyttelton Manor Ext 1	Stand 1518		Report	90588707	2528CC10	2	October 2008
F3615	Lyttelton Manor	Stand 709		Report	90588751	2528CC09	2	November 2008

FOLDER NO.	REPORT NAME	PORTION / STAND	FARM NAME	CONTENT	SAGEOLIT	GEOREF	NR OF BOREHOLES IN REPORT	REPORT DATE
F3647	Lyttelton Manor	Stand 361/1		Report	90588770	2528CC10	1	December 2008
F3672	Lyttelton Manor	Stand 261		Report	90588818	2528CC10	2	March 2009
F3685	Lyttelton A/H	Holding 154		Report	90588867	2528CC09	4	May 2009
F3686	Lyttelton Manor	Stand 830,872 874		Report	90588868	2528CC10	6	May 2009
F3687	Lyttelton Manor	Stand 370/R		Report	90588869	2528CC10	2	May 2009
F3692	Highveld Ext 73 AFGRI Building			Report	90588877	2528CC15	5	27 May 2009
F3692	Highveld Ext 73 Byls Bridge East		Doornkloof 391 JR	Report	90589025	2528CC15	9	16 November 2009
F3692	Highveld Ext 73 Byls Bridge east	Stand 3084,3085	Doornkloof 391 JR	Report	90589128	2528CC15	18	May 2010
F3692	Highveld Ext 73 Nedbank Building Byls Bridge		Doornkloof 391 JR	Report	90589026	2528CC15	14	25 August 2009
F3692	Highveld Ext 73 Nedbank Building Byls Bridge		Doornkloof 391 JR	Report	90589089	2528CC15	14	9 March 2010
F3692	Highveld Ext 73 Nedbank Building nine Byls Bridge east		Doornkloof 391 JR	Report	90589114	2528CC15	10	April 2010
F3697	Lyttelton Manor	Stand 365/R		Report	90588882	2528CC10	2	June 2009
F3697	Lyttelton Manor	Stand 365/R		Report	90588921	2528CC10	3	June 2009
F3719	Centurion (Verwoerdburgstad)	Stand 60/6		Report	90588986	2528CC14	2	15 October 2009
F3721	5 o Clock Land			Report	90589052	2528CC15	217	3 December 2009
F3721	Irene Ext 71 (5 o clock land)			Report	90588920	2528CC15	20	14 November 2008
F3721	Irene Ext 71,78,80 & 81 (5 o clock land)			Report	90588985	2528CC15	9	29 September 2009
F3721	Irene Ext 78 & 79 (5 o clock land)			Report	90588917	2528CC15	63	13 May 2008
F3721	Irene Ext 78 & 79 (5 o clock land)			Report	90588918	2528CC15	18	12 September 2008
F3721	Irene Ext 78 (5 o clock land)			Report	90588984	2528CC15	3	22 September 2009
F3721	Irene Ext 80, 81,82 (5 o clock land)			Report	90588919	2528CC15	52	19 September 2008
F3745	Lyttelton Manor	Stand 1133		Report	90588963	2528CC10	2	September 2009
F3768	Doringkloof	Stand 393		Report	90589023	2528CC15	2	November 2009
F3770	Zwartkop Ext 8	Stand 1671		Report	90589034	2528CC14	1	December 2009
F3789	Lyttelton Manor	Stand 61		Report	90589079	2528CC10	1	January 2010
F3819	West Ave and Ancilliary and Bridge Works			Report	90589228	2528CC09	21	3 July 2010
F3820	Vista Clinic Centurion	Portion 21 & 65	Lyttelton 381 JR	Report	90589230	2528CC09	6	September 2010
F3824	Die Hoewes Ext 281	Holding 290/1		Report	90589269	2528CC09	11	October 2010
F3846	Die Hoewes Ext 14 (Knikkie Kleuterskool)	Stand 24		Report	90584862	2528CC15	2	April 2011
F3846	Die Hoewes Ext 14 (Knikkie Kleuterskool)			Report	90589275	2528CC15	1	4 November 2010
F3853	Lyttelton Manor Ext 3	Stand 1726		Report	90589288	2528CC10	1	November 2010
F3862	Lyttelton Manor Ext 3	Stand 1725		Report	90589299	2528CC10	1	June 2006
F3865	Lyttelton Manor Ext 1	Stand 537		Report	90589303	2528CC10	1	December 2010
F3867	Lyttelton Manor	Stand 376		Report	90589305	2528CC10	2	December 2010
F3873	Zwartkop Ext 28	Portion 58 & 59	Brakfontein 390 JR	Report	90589317	2528CC14	7	December 2010
F3874	Lyttelton Manor	Stand 613		Report	90589318	2528CC10	2	January 2011
F3878	Lyttelton Manor Ext 3	Stand 1872		Report	90584838	2528CC10	4	16 February 2011
F3890	Lyttelton Manor	Stand 450		Report	90584857	2528CC09	2	March 2011
F3917	Lyttelton Manor	Stand 964		Report	90584909	2528CC10	1	May 2011
F3951	Lyttelton Manor Ext 3	Stand 1825		Report	90584972	2528CC10	1	August 2011
F3952	Verwoerdburgstad	Stand 69		Report	90584973	2528CC14	2	August 2011
F3958	Lyttelton Manor Ext 3	Stand 1707		Report	90585039	2528CC10	2	September 2011
F3959	Lyttelton Manor Ext 3	Stand 1571		Report	90585040	2528CC09	1	September 2011
F3964	Lyttelton Manor Ext 3	Stand 1814		Report	90585059	2528CC10	1	September 2011
F3971	Doringkloof	Stand 1032		Report	90585081	2528CC15	2	september 2011
F3975	Doringkloof	Stand 1031		Report	90585088	2528CC15		March 2006
F3985	Centurion Meerlus building Lakeside Development	Stand 153		Report	90585101	2528CC14	16	4 November 2011
F3986	Doringkloof	Stand 314		Report	90585102	2528CC15	1	October 2011
F4000	Lyttelton Manor Ext 3	Stand 1574		Report	90585139	2528CC09	2	December 2011
F4006	Zwartkop Ext 4	Stand 855		Report	90585146	2528CC14	2	January 2012

Appendix B:

Table indicating the Information of the Centurion CBD Boreholes

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F1003	90588880	A12	28.196018	-25.850577	10	4	dry					5
F1004	90584272	BH1724-1	28.205032	-25.848117	10	2	dry					5
F1004	90584272	BH1724-2	28.205091	-25.848379	17	11	dry					3
F1008	90116382	C3	28.195593	-25.85345	30	>30	dry					4
F1008	90116382	E1	28.195026	-25.853509	30	>30	dry					4
F1008	90116382	H3	28.194982	-25.854122	30	26	dry					7
F1008	90481948	BH1	28.194187	-25.854083	20	19	dry					4
F1008	90481948	BH10	28.194852	-25.853642	40	33	dry					4
F1008	90481948	BH11	28.194965	-25.853374	68	59	dry					2
F1008	90481948	BH12	28.195219	-25.853095	23	15	dry					6
F1008	90481948	BH13	28.195299	-25.853155	36	30	dry					7
F1008	90481948	BH14	28.1945	-25.854319	40	33	dry					4
F1008	90481948	BH15	28.194627	-25.854179	26	20	dry					6
F1008	90481948	BH16	28.194613	-25.854049	20	14	dry					3
F1008	90481948	BH17	28.194693	-25.854108	37	31	dry					7
F1008	90481948	BH18	28.19474	-25.85391	40	35	dry					7
F1008	90481948	BH19	28.194883	-25.8539	42	35	dry					4
F1008	90481948	BH2	28.194377	-25.853872	28	22-Jan	dry					4
F1008	90481948	BH20	28.195123	-25.853491	32	26	dry					4
F1008	90481948	BH21	28.195189	-25.853423	50	46	dry					8
F1008	90481948	BH22	28.195506	-25.853074	10	4	dry					5
F1008	90481948	BH23	28.194834	-25.854098	35	30	dry					7
F1008	90481948	BH24	28.194912	-25.854157	40	34	dry					4
F1008	90481948	BH25	28.194961	-25.853957	42	38	dry					4
F1008	90481948	BH26	28.195293	-25.85374	25	19	dry					4
F1008	90481948	BH27	28.19501	-25.853761	41	35	dry					7
F1008	90481948	BH28	28.195359	-25.85367	29	23	dry					7
F1008	90481948	BH29	28.195342	-25.85354	32	25	dry					7
F1008	90481948	BH3	28.19457	-25.853663	41	35	dry					4
F1008	90481948	BH30	28.195532	-25.853332	17	11	dry					3
F1008	90481948	BH31	28.194688	-25.854551	26	20	dry					6
F1008	90481948	BH32	28.194802	-25.854429	19	12	dry					3
F1008	90481948	BH33	28.19507	-25.854275	36	27	dry					4
F1008	90481948	BH34	28.194992	-25.854218	27	21	dry					4
F1008	90481948	BH35	28.195514	-25.853788	13	7	dry					3
F1008	90481948	BH36	28.19558	-25.85372	43	37	dry					8
F1008	90481948	BH37	28.195563	-25.85359	19	12	dry					6
F1008	90481948	BH38	28.195643	-25.853648	20	14	dry					6
F1008	90481948	BH39	28.194814	-25.854557	30	24	dry					4
F1008	90481948	BH4	28.194887	-25.853312	29	23	dry					4
F1008	90481948	BH40	28.194957	-25.854546	43	36	dry					8
F1008	90481948	BH41	28.195848	-25.853567	21	13	dry					6
F1008	90481948	BH42	28.195324	-25.853997	23	13	dry					3
F1008	90481948	BH43	28.194785	-25.854299	28	21	dry					4
F1008	90481948	BH5	28.194342	-25.854202	30	24	dry					4
F1008	90481948	BH6	28.194458	-25.853932	52	15-Feb	dry					4
F1008	90481948	BH7	28.194599	-25.853921	23	17	dry					4
F1008	90481948	BH8	28.194585	-25.853793	40	33	dry					4
F1008	90481948	BH9	28.194726	-25.85378	82	22	dry					4
F1008	90564639	1	28.195967	-25.853457	53	9	dry					3
F1008	90564639	10	28.195211	-25.854119	33	23	dry					7
F1008	90564639	11	28.194972	-25.854354	52	46	dry					8
F1008	90564639	12	28.195208	-25.853951	39	29	dry					4
F1008	90564639	13	28.195331	-25.853799	26	20	dry					4
F1008	90564639	14	28.195226	-25.853722	37	26	dry					4
F1008	90564639	15	28.195097	-25.853868	40	34	32m					7
F1008	90564639	16	28.19453	-25.854091	31	20	dry					4
F1008	90564639	17	28.194419	-25.853985	34	28	dry					7
F1008	90564639	18	28.194548	-25.853735	31	25	dry					4
F1008	90564639	19	28.194724	-25.853556	40	20	dry					4
F1008	90564639	2	28.195658	-25.853223	30	24	dry					4
F1008	90564639	20	28.194833	-25.853405	40	24	dry					4
F1008	90564639	21	28.194957	-25.853503	48	40	dry					4
F1008	90564639	22	28.195105	-25.853591	45	39	dry					4
F1008	90564639	23	28.194945	-25.853771	33	27	dry					4

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of: Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F1008	90564639	3	28.195684	-25.853337	30	45	dry					8
F1008	90564639	4	28.195668	-25.853587	21	15-Jan	dry					3
F1008	90564639	5	28.195799	-25.853446	33	27	dry					4
F1008	90564639	6	28.195779	-25.853659	21	9	dry					3
F1008	90564639	7	28.195551	-25.853918	16	4	dry					5
F1008	90564639	8	28.195349	-25.854103	48	42	dry					4
F1008	90564639	9	28.195143	-25.854355	43	37	dry					4
F102	90079021	1	28.18071	-25.839	25	20	dry					4
F102	90079021	2	28.180427	-25.838867	16	6	dry					3
F102	90079021	3	28.180098	-25.839027	21	12	dry					3
F102	90079021	4	28.17973	-25.83923	16	6	dry					3
F102	90079021	5	28.180559	-25.839151	17	11	dry					3
F102	90079021	6	28.180624	-25.838709	22	15	dry					3
F102	90079032	7	28.1808	-25.838792	15	9	dry					3
F102	90079032	8	28.180806	-25.838981	19	12	dry					3
F102	90079032	9	28.180626	-25.839031	20	15	dry					3
F1025	90563000	BH1	28.195275	-25.83185	59	42	dry					4
F1025	90563000	BH2	28.19529	-25.832067	60	44	dry					4
F1025	90563000	BH3	28.195556	-25.831983	60	44	dry					4
F1025	90563000	BH4	28.195251	-25.832617	60	46	dry					4
F1025	90563000	BH5	28.196337	-25.831578	45	32	dry					4
F1025	90563000	BH6	28.195867	-25.831845	56	50	dry					4
F1025	90563000	BH7	28.195888	-25.83175	51	45	dry					4
F1025	90588860	BH1	28.195433	-25.831612	60	>60	dry					4
F1025	90588860	BH2	28.195366	-25.831626	60	>60	dry					4
F1025	90588860	BH3	28.195351	-25.831704	85	>85	dry	76-85				4
F1025	90588860	BH4	28.195449	-25.831679	85	>85	dry	78-85			78-85	4
F1025	90588860	BH5	28.19554	-25.831718	60	>60	dry					4
F1025	90589132	BH10	28.19591	-25.831224	58	51	dry					4
F1025	90589132	BH11	28.196383	-25.831275	35	29	dry					4
F1025	90589132	BH8	28.196275	-25.831011	61	>61	dry		25-29		29-61	8
F1025	90589132	BH9	28.196033	-25.831167	36	29	dry					4
F1049	90481877	3002	28.223768	-25.858083	7	2	dry					5
F1074	90481809	5222	28.205268	-25.862979	30	>30	dry	1-30				1
F1080	90230389	BH1	28.190834	-25.835878	21	4	dry				12-15	5
F1080	90230389	BH10	28.189895	-25.836402	13	6	dry					3
F1080	90230389	BH11	28.189856	-25.837072	8	1	dry					5
F1080	90230389	BH12	28.190578	-25.836696	9	2	dry					5
F1080	90230389	BH13	28.190446	-25.836836	30	6	dry					5
F1080	90230389	BH2	28.190546	-25.836234	10	1	dry					5
F1080	90230389	BH3	28.190404	-25.836605	52	46	dry				11-21;26-3	8
F1080	90230389	BH4	28.189996	-25.836711	10	1	dry					5
F1080	90230389	BH5	28.189668	-25.836753	39	34	dry		19-24		9-19	7
F1080	90230389	BH6	28.189727	-25.836942	23	18	dry					4
F1080	90230389	BH7	28.189797	-25.836486	30	28	dry				24-28	4
F1080	90230389	BH8	28.190788	-25.836505	15	8	dry					3
F1080	90230389	BH9	28.19095	-25.835535	15	8	dry					3
F1081	90374215	BH1	28.193239	-25.834815	27	>27	dry					4
F1081	90374215	BH10	28.192159	-25.835689	28	21-Jan	dry					4
F1081	90374215	BH2	28.193275	-25.835262	50	>50	dry				41-42	4
F1081	90374215	BH3	28.192737	-25.835287	60	>60	dry	6-31			42-60	8
F1081	90374215	BH4	28.192694	-25.835768	35	27	dry	11-25			25-27	4
F1081	90374215	BH5	28.192398	-25.836275	39	>39	dry		22-26		26-31	4
F1081	90374215	BH6	28.192092	-25.835909	10	1	dry					5
F1081	90374215	BH7	28.19246	-25.836084	15	8	dry				6-8	3
F1081	90374215	BH8	28.192504	-25.83559	15	10	dry				8-10	3
F1081	90374215	BH9	28.192082	-25.836092	16	10	dry				7-10	3
F1081	90374215	LAH-A 20/36	28.193615	-25.835002	31	>31	dry	29-31				4
F1081	90564300	218/1	28.193637	-25.835259	40	>40	dry	18-40				2
F1081	90564300	218/10	28.193776	-25.835107	30	>30	dry	18-30				2
F1081	90564300	218/2	28.193328	-25.835502	40	>40	dry	23-40				4
F1081	90564300	218/3	28.193057	-25.835573	40	>40	dry	30-40				4
F1081	90564300	218/4	28.192857	-25.83594	35	24	dry	9-24				4
F1081	90564300	218/5	28.192628	-25.83615	25	15	dry	2-8				3
F1081	90564300	218/6	28.192162	-25.836228	26	21	dry	2-20				2

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F1081	90564300	218/7	28.192272	-25.836404	30	24	dry					4
F1081	90564300	218/8	28.193064	-25.83573	30	>30	dry					4
F1081	90564300	218/9	28.193462	-25.835342	30	>30	dry	14-30				2
F1082	90562351	3104	28.191626	-25.839158	40	>40	dry	20-40				1
F1082	90562351	3108	28.19135	-25.838898	40	>40	dry	18-40				1
F1082	90562351	3302/3201	28.191686	-25.839415	40	>40	dry	14-40				1
F1082	90562351	3505/3604	28.191264	-25.839404	40	>40	dry	10-40				1
F1082	90562351	3607/3508	28.191064	-25.839212	40	36	dry	6-36				2
F1083	90374753	3004/3104	28.188771	-25.84115	11	5	dry					5
F1083	90374753	3101	28.188367	-25.8416	13	3	dry					5
F1083	90374753	3107	28.189235	-25.840837	30	24	dry				8-22	7
F1083	90374753	3110	28.189672	-25.840442	10	4	dry					5
F1083	90374753	3305	28.189241	-25.841344	10	2	dry					5
F1083	90374753	3308/9	28.189699	-25.840886	15	9	dry					3
F1083	90374753	3401	28.188803	-25.841976	21	15	dry				10-15	6
F1083	90374753	3403/3504	28.189218	-25.841679	27	21	dry				8-21	7
F1083	90562352	DT1	28.188608	-25.841898	13	1	dry					5
F1083	90562352	DT2	28.188805	-25.841727	13	3	dry					5
F1083	90562352	DT3	28.188794	-25.841856	22	0	dry					5
F1083	90562352	DT4	28.189352	-25.841546	17	3	dry					5
F1083	90562352	DT5	28.1891	-25.841352	10	1	dry					5
F1083	90562352	DT6	28.188949	-25.841435	15	3	dry					5
F1083	90589118	BH171/1	28.188269	-25.841598	20	6	dry					3
F1083	90589118	BH171/10	28.18897	-25.841232	22	10	dry					3
F1083	90589118	BH171/2	28.188468	-25.841698	21	5	dry					5
F1083	90589118	BH171/3	28.188915	-25.841926	25	3	dry					5
F1083	90589118	BH171/4	28.189166	-25.84172	40	39	dry				16-39	8
F1083	90589118	BH171/5	28.188967	-25.841692	23	17	dry				10-17	6
F1083	90589118	BH171/6	28.18875	-25.841384	16	7	dry					3
F1083	90589118	BH171/7	28.18863	-25.841338	16	10	dry		3-6		6-10	6
F1083	90589118	BH171/8	28.188848	-25.84152	29	0	dry					5
F1083	90589118	BH171/9	28.189187	-25.841621	17	11	dry		4-8			3
F1083	90589156	BH171/11	28.188548	-25.841618	23	12	dry					3
F1083	90589156	BH171/12	28.18843	-25.841481	23	9	dry					3
F1084	90420981	1	28.184663	-25.831462	45	>45	dry					4
F1084	90420981	2	28.185024	-25.831479	25	14	dry					3
F1084	90420981	3	28.185027	-25.831075	25	14	dry					3
F1084	90420981	4	28.184565	-25.831018	25	4	dry					5
F1085	90562353	BH1103/1203	28.189315	-25.831775	29	>29	dry					1
F1085	90562353	BH1201	28.188924	-25.831834	30	>30	dry	3-18			20-25	4
F1085	90562353	BH1205/1304	28.189621	-25.831938	28	>28	dry	19-28				2
F1085	90562353	BH1211	28.190781	-25.832011	25	19	dry					4
F1085	90589146	BH1	28.190027	-25.831964	33	26	dry	16-26				4
F1085	90589146	BH2	28.190029	-25.831716	35	31	dry				7-12	7
F1085	90589146	BH3	28.189632	-25.831729	30	21	dry	15-21				4
F1085	90589146	BH4	28.189781	-25.831797	38	34	dry	12-34				4
F1085	90589146	BH5	28.188927	-25.831638	35	29	dry	10-25			25-29	4
F1085	90589146	BH6	28.189145	-25.831828	23	16	dry	5-16				4
F1087	90112526	BH10-11/7	28.195035	-25.83335	13	7	dry					3
F1087	90112526	BH2/2-3	28.193195	-25.833813	25	>25	dry					4
F1087	90112526	BH3/8	28.194108	-25.834403	25	>25	dry					4
F1087	90112526	BH5-6/5	28.194046	-25.833701	25	>25	dry					4
F1087	90112526	BH9/4	28.194399	-25.83315	25	>25	dry					4
F1087	90481804	BH1	28.194394	-25.834469	50	>50	dry	47-50				4
F1087	90481804	BH2	28.193971	-25.834242	30	>30	dry			24-30	16-24	7
F1087	90481804	BHA	28.194044	-25.834737	55	>55	dry	38-55				2
F1087	90481804	BHB	28.193689	-25.834447	48	40	dry					4
F1087	90481804	BHC	28.193945	-25.834168	37	>37	dry					4
F1087	90481804	BHD	28.194051	-25.834266	22	16	dry				14-16	6
F1087	90481804	BHE	28.193946	-25.834339	50	>50	dry	45-50				4
F1087	90481804	BHF	28.193824	-25.834228	50	>50	dry					4
F1088	90420473	BH1	28.195825	-25.842067	33	27	dry					7
F1088	90420473	BH11/3-4	28.195594	-25.842226	15	>15	dry					6
F1088	90420473	BH2	28.19551	-25.841988	11	5	dry					5
F1088	90420473	BH3	28.195442	-25.842277	16	10	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F1088	90420473	BH4	28.195688	-25.842322	21	15	dry					3
F1088	90420473	BH5	28.195864	-25.842038	10	3	dry					5
F1088	90420473	BH9/6	28.195633	-25.841942	16	11	dry					3
F1088	90504147	BH1	28.194982	-25.841884	49	44	dry					4
F1088	90504147	BH2	28.194938	-25.841686	10	2	dry					5
F1088	90504147	BH2/9	28.19536	-25.841309	7	1	dry					5
F1088	90504147	BH3	28.195421	-25.841688	21	15	dry					3
F1088	90504147	BH4	28.195222	-25.842013	24	18	dry					6
F1088	90504147	BH5	28.19522	-25.841694	13	6	dry					3
F1088	90504147	BH5	28.195898	-25.841343	13	6	dry					3
F1088	90504147	BH6	28.195858	-25.841202	45	09-Feb	dry				38-41	4
F1088	90504147	BH7	28.195711	-25.841305	19	12	dry				6-9	3
F1089	90564320	1	28.194326	-25.849295	21	12	dry					3
F1089	90564320	10	28.194786	-25.848814	21	14	dry					3
F1089	90564320	11	28.195002	-25.84898	25	13	dry					3
F1089	90564320	12	28.195196	-25.849116	20	10	dry					3
F1089	90564320	13	28.194749	-25.849617	20	14	dry	3-10				3
F1089	90564320	14	28.194822	-25.849613	27	17	dry	5-13			13-17	6
F1089	90564320	2	28.194555	-25.849475	24	18	dry					4
F1089	90564320	3	28.194788	-25.84965	30	28	dry				17-28	7
F1089	90564320	5	28.194676	-25.849339	25	12	dry	5-11				3
F1089	90564320	6	28.194909	-25.849518	26	17	dry					3
F1089	90564320	7	28.194635	-25.848939	17	9	dry	12-16				3
F1089	90564320	8	28.194874	-25.849114	21	14	dry					3
F1089	90564320	9	28.195107	-25.849293	20	13	dry					3
F1089	90564320	BH1	28.194898	-25.848423	14	8	dry					3
F1089	90564320	BH2	28.195084	-25.849033	20	15	dry					3
F1089	90564320	BH3	28.194358	-25.849557	34	20	dry					4
F1090	90229600	LA1	28.188676	-25.84915	25	>25	dry					8
F1090	90229600	LA2	28.188196	-25.848765	25	>25	dry					8
F1090	90229733	BH1	28.188523	-25.849451	10	3	dry					5
F1090	90229733	BH2	28.188473	-25.849148	26	21	27m		45-48		12-14;37-4	7
F1090	90229733	BH3	28.188162	-25.849515	25	21	dry					7
F1090	90564076	BH1	28.187639	-25.848937	39	34	dry			28-33		7
F1090	90564076	BH10	28.18881	-25.84848	28	22	dry				17-21	7
F1090	90564076	BH11	28.188587	-25.848499	10	0	dry					5
F1090	90564076	BH12	28.18832	-25.848352	49	>49	39m					4
F1090	90564076	BH13	28.18927	-25.848599	57	54	dry		26-30		19-26;31-5	8
F1090	90564076	BH14	28.189109	-25.848806	15	9	dry					6
F1090	90564076	BH15	28.189207	-25.848703	47	43	dry				12-43	8
F1090	90564076	BH15A	28.189104	-25.848621	14	8	dry					3
F1090	90564076	BH16	28.189028	-25.848757	37	31	dry				14-31	7
F1090	90564076	BH17	28.188821	-25.848632	50	44	dry				24-44	8
F1090	90564076	BH18	28.188962	-25.848569	41	35	dry				32-35	4
F1090	90564076	BH19	28.18881	-25.848477	17	11	dry					3
F1090	90564076	BH2	28.187936	-25.848684	57	52	37m					8
F1090	90564076	BH20	28.188712	-25.848561	37	31	dry					4
F1090	90564076	BH21	28.188627	-25.848373	38	32	dry				28-32	7
F1090	90564076	BH3	28.188279	-25.848844	41	36	dry				18-35	8
F1090	90564076	BH4	28.187928	-25.84916	33	27	dry				6-12	7
F1090	90564076	BH5	28.187961	-25.848904	21	15	dry				6-9	6
F1090	90564076	BH6	28.188979	-25.849073	22	16	dry					4
F1090	90564076	BH7	28.189142	-25.848501	30	24	dry					4
F1090	90564076	BH8	28.188785	-25.848284	60	>60	33m					4
F1090	90564076	BH9	28.18848	-25.848156	60	55	dry					8
F1090	90588884	A1	28.188109	-25.84907	20	>20	dry					6
F1090	90588884	A10	28.188988	-25.848886	17	12	dry					3
F1090	90588884	A2	28.188249	-25.848936	13	>13	dry					3
F1090	90588884	A3	28.18816	-25.848818	18	>18	dry				7-9	6
F1090	90588884	A4	28.188241	-25.848674	20	>20	dry				11-18	7
F1090	90588884	A5	28.18843	-25.848792	20	>20	dry				11-20	7
F1090	90588884	A6	28.188391	-25.848549	20	>20	dry					4
F1090	90588884	A7	28.18854	-25.848649	15	>15	dry				7-12	6
F1090	90588884	A8	28.18866	-25.848713	20	>20	dry				7-20	7
F1090	90588884	A9	28.188789	-25.848758	20	15	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F1090	90588884	B1	28.188829	-25.848713	30	24	dry				6-19	7
F1090	90588884	B2	28.189121	-25.848381	45	40	dry		30-31		14-30;32-3	8
F1090	90588884	B3	28.18844	-25.848693	27	21	dry				3-5	4
F1090	90588884	B4	28.188379	-25.848882	22	16	dry				5-13	6
F1090	90588884	B5	28.188171	-25.848719	25	19	dry				9-19	6
F1090	90588884	B6	28.188149	-25.848944	16	11	dry					3
F1090	90588884	B7	28.188029	-25.849016	23	13	dry				10-13	6
F1094	90474572	1	28.19547	-25.845075	34	>34	dry	2-20			23-30	4
F1094	90474572	2	28.195739	-25.845279	30	15	dry	1-15				3
F1096	90564078	1	28.184664	-25.84413	10	2	dry					5
F1096	90564078	10	28.184218	-25.843948	10	4	dry					5
F1096	90564078	11	28.184306	-25.843909	12	6	dry					3
F1096	90564078	12	28.183945	-25.844195	11	4	dry					5
F1096	90564078	13	28.18437	-25.844631	21	9	dry				5-9	6
F1096	90564078	14	28.184183	-25.844434	39	36	dry				8-33	8
F1096	90564078	2	28.184602	-25.844233	10	3	dry					5
F1096	90564078	3	28.184719	-25.844333	25	19	dry				9-15	6
F1096	90564078	4	28.184722	-25.844241	10	1	dry					5
F1096	90564078	5	28.184699	-25.844311	27	24	dry				11-24	7
F1096	90564078	6	28.184636	-25.844291	19	15	dry					4
F1096	90564078	7	28.184408	-25.844243	26	19	dry				12-19	6
F1096	90564078	8	28.184203	-25.844058	44	37	dry					4
F1096	90564078	9	28.184765	-25.84413	15	9	dry				8-9	3
F1097	90482505	BH1	28.187229	-25.846292	8	2	dry					5
F1097	90482505	BH2	28.187176	-25.846172	9	3	dry					5
F1097	90482505	BH3	28.187241	-25.846062	12	1	dry					5
F1098	90374670	3103	28.19708	-25.846848	30	27	dry	1-13			13-27	7
F1098	90374670	3201	28.196967	-25.847239	19	12	dry	2-12				3
F1098	90374670	3303	28.197412	-25.847094	28	24	dry	1-15			15-24	7
F1098	90481935	BH204	28.19612	-25.847784	28	16	dry					4
F1098	90481935	BH206	28.196317	-25.847579	28	21	dry					4
F1098	90481935	BH401	28.196074	-25.848256	25	15	dry					3
F1098	90481935	BH403	28.196264	-25.848042	19	12	dry					3
F1098	90481935	BH408	28.19676	-25.847543	14	4	dry					5
F1098	90481935	BH507	28.196742	-25.847755	10	1	dry					5
F1098	90481935	BH604	28.196586	-25.848132	40	34	dry				27-34	4
F1098	90481935	BH606	28.196786	-25.847933	11	5	dry					5
F1098	90564387	1	28.195852	-25.848055	20	14	dry					3
F1098	90564387	2	28.196236	-25.848364	26	20	dry				13-17; 18-2	6
F1098	90564387	3	28.196406	-25.84826	23	17	dry					4
F1098	90564387	4	28.196064	-25.847883	48	15	dry					3
F1098	90564387	5	28.196596	-25.847903	15	9	dry					3
F1100	90482678	1	28.19546	-25.862311	34	31	dry					4
F1100	90482678	2	28.196294	-25.862465	20	15	dry					3
F1100	90482678	3	28.196708	-25.86272	24	>24	dry					7
F1100	90482678	4	28.197199	-25.86278	20	11	dry					3
F1100	90482678	BH1	28.196892	-25.862424	30	24	dry		8-10		18-20; 22-2	7
F1100	90482678	BH2	28.196582	-25.86256	29	>29	dry					4
F1100	90482678	BH3	28.196874	-25.862644	30	28	dry			14-17	25-26	7
F1100	90482678	BH4	28.196373	-25.862638	19	13	dry	0-7				3
F1100	90482678	BH5	28.197607	-25.862322	33	27	dry				16-23	7
F1100	90482678	BH6	28.197372	-25.862578	21	13	dry					3
F1100	90482678	BH7	28.195231	-25.86249	29	23	dry					4
F1100	90574956	BH10	28.196536	-25.86223	30	25	dry	4-17				4
F1100	90574956	BH11	28.195893	-25.862233	20	9	dry	1-9				3
F1100	90574956	BH12	28.196298	-25.862183	25	8	dry	4-8				3
F1100	90574956	BH13	28.196029	-25.862012	20	12	dry	4-12				3
F1100	90574956	BH8	28.195922	-25.861847	20	11	dry					3
F1100	90574956	BH9	28.196257	-25.862033	45	>45	dry	5-17		27-34	17-27; 34-4	8
F1100	90588832	S1	28.196175	-25.862016	20	15	dry					3
F1100	90588832	S10	28.195744	-25.862074	21	17	dry					3
F1100	90588832	S11	28.196915	-25.862639	26	16	dry					4
F1100	90588832	S12	28.197171	-25.862602	27	16	dry				14-16	6
F1100	90588832	S13	28.197373	-25.862336	23	16	dry					4
F1100	90588832	S14	28.197646	-25.862525	25	20	dry				15-18	6

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F1100	90588832	S15	28.197476	-25.862752	23	8	dry					3
F1100	90588832	S16	28.197318	-25.862942	16	10	dry					3
F1100	90588832	S17	28.196828	-25.862825	30	>30	dry				27-30	7
F1100	90588832	S2	28.196205	-25.862105	17	11	dry				8-11	3
F1100	90588832	S3	28.196279	-25.862105	13	7	dry					3
F1100	90588832	S4	28.196597	-25.862389	21	15	dry					3
F1100	90588832	S5	28.196464	-25.862516	20	13	dry					3
F1100	90588832	S6	28.196177	-25.862538	20	13	dry					3
F1100	90588832	S7	28.196173	-25.862375	16	9	dry					3
F1100	90588832	S8	28.195962	-25.862403	22	15	dry					3
F1100	90588832	S9	28.195799	-25.862186	23	14	dry					3
F1100	90588946	FT1	28.197686	-25.862416	30	21	21					4
F1100	90588946	FT10	28.196182	-25.86191	18	11	dry					3
F1100	90588946	FT2	28.196913	-25.8628	20	14	dry					3
F1100	90588946	FT3	28.19612	-25.861745	25	23	dry				15-23	7
F1100	90588946	FT4	28.196251	-25.861837	23	9	dry					3
F1100	90588946	FT5	28.196422	-25.861982	22	15	dry				12-15	6
F1100	90588946	FT6	28.196602	-25.86214	20	10	dry				7-10	6
F1100	90588946	FT7	28.196728	-25.862268	20	14	dry				7-14	6
F1100	90588946	FT8	28.197513	-25.862307	11	2	dry					5
F1100	90588946	FT9	28.196344	-25.862056	23	18	dry				15-17	4
F1108	90564083	BH1	28.203793	-25.830969	12	5	dry					5
F1108	90564083	BH2	28.203814	-25.830994	13	8	dry					3
F1108	90564083	BH3	28.20372	-25.831068	11	6	dry					3
F1108	90564083	BH4	28.203676	-25.830935	11	5	dry					5
F1109	90562849	BH1	28.199599	-25.828882	12	6	dry					3
F111	90482189	BH276-1	28.196226	-25.841126	25	19	dry					4
F111	90482189	BH276-2	28.196404	-25.841199	18	12	dry				7-12	6
F1110	90562850	BH1	28.206479	-25.834318	31	25	dry				8-15	7
F1110	90562850	BH2	28.206299	-25.834377	18	12	dry					3
F1110	90562850	BH3	28.206198	-25.834444	41	>41	dry	20-33			13-19;37-4	7
F1112	90562854	BH1	28.204974	-25.831438	10	3	dry					5
F1112	90562854	BH2	28.205092	-25.831555	10	3	dry					5
F1113	90482657	BH1	28.208754	-25.840089	20	8	dry					3
F1116	90563023	BH1	28.208025	-25.839611	30	>30	dry	2-20				1
F1116	90563023	BH2	28.208239	-25.839588	25	19	dry	2-19				2
F1117	90421103	BH1	28.20987	-25.839595	18	12	dry				9-12	6
F1117	90421103	BH2	28.210029	-25.83948	14	7	dry					3
F1117	90421103	BH3	28.210321	-25.839613	10	1	dry					5
F1117	90421103	BH4	28.210276	-25.839731	17	11	dry				7-11	6
F1117	90421103	BH5	28.210133	-25.839696	12	6	dry					3
F1117	90421103	BH6	28.210265	-25.839537	12	6	dry					3
F1117	90421103	BH7	28.209821	-25.839682	13	7	dry					3
F1118	90563024	BH1	28.197396	-25.824925	15	9	dry					3
F1118	90563024	BH2	28.197301	-25.824974	14	8	dry					3
F1119	90482530	BH1	28.202806	-25.835259	26	21	dry					4
F112	90126445	BG1	28.18126	-25.838933	14	8	dry					3
F112	90126445	BG2	28.181867	-25.838818	11	1	dry					5
F112	90126445	BG3	28.182185	-25.838759	30	>30	dry	3-30				2
F1121	90482372	BH1	28.212077	-25.849106	16	6	dry					3
F1121	90482372	BH2	28.212023	-25.84904	16	5	dry					5
F1121	90563025	1	28.21576	-25.849631	30	2	dry			11-13		5
F1121	90563025	2	28.214912	-25.848514	19	>19	dry			8-9	15-17	7
F1121	90563025	3	28.213478	-25.847101	14	11	dry			8-9	9-10	6
F1121	90563025	4	28.21323	-25.845531	30	4	dry					5
F1121	90563025	5	28.213451	-25.84924	15	1	dry					5
F1121	90563025	6	28.214514	-25.846923	15	3	dry				1-3	5
F1121	90563025	7	28.213167	-25.847901	15	2	dry					5
F1121	90563025	8	28.213725	-25.846309	9	>9	dry			9-?		6
F1122	90563026	BH1	28.206676	-25.84625	35	29	dry				20-29	7
F1122	90563026	BH2	28.206677	-25.846328	16	10	dry					3
F1124	90481720	BH1	28.207671	-25.83452	26	>26	dry	1-26				1
F1124	90481720	BH2	28.207325	-25.83464	29	>29	dry	1-29				1
F1124	90481720	BH3	28.207553	-25.83481	25	>25	dry	1-25				1
F1124	90481720	BH4	28.207871	-25.834869	23	>23	dry	1-23				1

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F1124	90481720	BH5	28.208075	-25.835254	25	>25	dry	1-25				1
F1124	90481720	BH6	28.207955	-25.835363	21	>21	dry	1-21				1
F1124	90481720	BH7	28.2075	-25.834234	19	>19	dry	1-19				1
F1126	90504172	BH1	28.206676	-25.8435	39	30	dry	17-29				4
F1127	90563028	BH2306/1	28.214569	-25.848369	11	5	dry					5
F1127	90563028	BH2306/2	28.214649	-25.848286	10	2	dry					5
F1128	90481945	BH3305.5	28.195047	-25.819578	28	22	dry				9-22	7
F1128	90481945	BH3308.10	28.194977	-25.820015	12	6	dry					3
F1128	90481945	BH3408.15	28.195183	-25.82004	24	18	dry				9-18	6
F1128	90481945	BH3506.5	28.195239	-25.819773	32	26	dry			23-25	4-23; 25-2	7
F1128	90481945	BH3507.4	28.195258	-25.819966	35	29	dry				8-29	7
F1128	90481945	BH3705	28.195635	-25.819798	20	14	dry				8-14	6
F1129	90482664	BH1	28.203261	-25.84466	35	>35	dry				28-32	7
F1129	90482664	BH2	28.203126	-25.844417	35	>35	dry					4
F113	90574998	BH375-5	28.206379	-25.835224	35	29	dry					4
F113	90574998	BH375-6	28.206278	-25.83533	40	34	dry					4
F1130	90482397	BH1	28.205132	-25.843571	33	27	dry	12-19			19-27	7
F1139	90563031	BH1122/1	28.20738	-25.824372	25	>25	dry	2-25				2
F114	90229504	BH3101	28.188903	-25.839145	20	13	dry	0-13				3
F114	90229504	BH3203	28.188773	-25.838758	13	8	dry	1-7				3
F114	90229504	BH3301	28.189193	-25.838896	31	25	dry	2-8	9-20	20-25		7
F114	90229504	BH3303	28.188916	-25.838634	25	16	dry	1-11				4
F114	90229504	BH3401	28.189338	-25.83877	27	15	dry	1-13				3
F114	90229504	BH3601	28.189626	-25.838521	26	19	dry	1-19				4
F114	90229504	BH3702	28.189633	-25.838267	30	25	dry	3-25				2
F114	90229504	BH4003	28.189921	-25.837762	28	>28	dry	10-28	2-10			2
F1140	90563032	BH1	28.20605	-25.821079	12	7	dry				5-6	3
F1140	90563032	BH2	28.205967	-25.820952	14	8	dry					3
F1140	90563032	BH3	28.20609	-25.820961	16	8	dry					3
F1142	90563033	BH1	28.202316	-25.840418	38	31	dry					4
F1142	90563033	BH2	28.202388	-25.840548	30	26	dry				14-16;17-1	7
F1143	90563034	BH1	28.200543	-25.816375	30	24	dry					4
F1143	90563034	BH2	28.200622	-25.816509	26	20	dry					4
F1147	90481956	BH1	28.20332	-25.832954	12	5	dry					5
F1148	90563038	BH1	28.203032	-25.832655	10	3	dry					5
F1148	90563038	BH2	28.203183	-25.832717	29	27	dry		19-22		12-19;22-2	7
F1148	90563038	BH3	28.203083	-25.832756	10	4	dry					5
F1148	90585003	BH646/4	28.203508	-25.832643	17	7	dry					3
F1149	90482396	BH1	28.202699	-25.832614	6	1	dry					5
F1149	90482396	BH2	28.20281	-25.832571	8	2	dry					5
F115	90079067	12/1	28.19056	-25.833465	32	>32	dry	12-32				2
F115	90079067	17/7	28.190559	-25.834457	46	33	dry					7
F115	90079067	28-19/1	28.189847	-25.83407	20	17	dry					4
F115	90079067	7/4	28.19137	-25.833253	41	>41	dry	13-41				1
F1150	90482478	BH1	28.201349	-25.829793	15	>15	dry	1-15				2
F1151	90482479	BH1	28.196939	-25.821291	12	6	dry					3
F1152	90562855	BH1	28.197407	-25.818384	50	>50	dry					4
F1158	90562857	1	28.21342	-25.848199	10	2	dry					5
F1158	90562857	2	28.213443	-25.848103	10	3	dry					5
F1159	90504071	138/2	28.201605	-25.832506	10	2	dry					5
F117	90079150	BH1	28.183585	-25.845654	15	7	dry					3
F117	90079150	BH1(OLD)	28.182765	-25.846118	30	19	30m					4
F117	90079150	BH2	28.182885	-25.846029	42	>42	dry			12.5-15		8
F117	90079150	BH2(OLD)	28.184178	-25.845333	34	29	32.9					4
F117	90079150	BH3	28.181924	-25.846519	11	5	dry					5
F117	90079150	BH4	28.183541	-25.844641	23	18	dry					4
F117	90079150	BH5	28.18477	-25.845967	50	>50	dry					4
F117	90079150	BH6	28.184571	-25.84519	22	17	dry			13-17	8.5-13	6
F120	90117232	BG1	28.204775	-25.849818	20	14	dry	1-13				3
F120	90117232	BG2	28.204107	-25.849668	20	13	dry	1-11				3
F120	90117232	BG3	28.203239	-25.849717	35	>35	dry					4
F120	90117232	BG4	28.203394	-25.85089	25	20	dry					4
F121	90065530	13/4	28.188082	-25.8511	20	>20	dry	2-4				4
F121	90065530	3/2	28.188877	-25.851984	15	>20	dry					7
F121	90065530	4/6	28.188435	-25.852129	20	>20	dry					4

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F121	90065530	5-6/3-4	28.18859	-25.85182	13	11	dry					3
F121	90065530	8/6	28.188192	-25.851727	12	2	dry					5
F122	90065685	1	28.199327	-25.839588	30	>30	dry	6-16			17-30	7
F122	90065685	10	28.199753	-25.840118	30	25	dry	8-21				4
F122	90065685	10A	28.199689	-25.840229	25	>25	dry	11-25				2
F122	90065685	11	28.199394	-25.839731	30	>30	dry	5-30				1
F122	90065685	11A	28.198916	-25.839579	25	>25	dry	1-18				4
F122	90065685	12	28.19921	-25.839706	30	>30	dry	11-30				1
F122	90065685	12A	28.199093	-25.839484	25	>25	dry	2-21				2
F122	90065685	13	28.19956	-25.84001	30	>30	dry	2-30				1
F122	90065685	13A	28.199268	-25.839431	25	19	dry	3-19				4
F122	90065685	14	28.199258	-25.83951	30	>30	dry	8-30				1
F122	90065685	14A	28.199415	-25.839344	25	>25	dry	5-30				1
F122	90065685	15A	28.199537	-25.83932	25	>25	dry	2-19				4
F122	90065685	16A	28.199672	-25.839311	25	14	dry					3
F122	90065685	17A	28.199761	-25.839223	25	8	dry					3
F122	90065685	18A	28.1996	-25.839442	25	>25	dry					4
F122	90065685	19A	28.199507	-25.839492	25	>25	dry					4
F122	90065685	1A	28.199823	-25.840345	25	>25	dry					4
F122	90065685	2	28.200337	-25.839741	21	>21	dry					4
F122	90065685	20A	28.199584	-25.839624	25	>25	dry	2-5;10-11				4
F122	90065685	21A	28.199174	-25.839619	25	>25	dry	2-16				4
F122	90065685	22A	28.1994	-25.839467	25	>25	dry	10-25				2
F122	90065685	2A	28.199893	-25.84013	25	13	dry	2-13				3
F122	90065685	3	28.200029	-25.83989	25	>25	dry					4
F122	90065685	3A	28.199886	-25.84	25	19	dry	3-18				4
F122	90065685	4	28.199943	-25.83963	30	>30	dry	6-16;24-30				2
F122	90065685	4A	28.199752	-25.839992	25	>25	dry	1-21				2
F122	90065685	5	28.200246	-25.839073	16	6	dry					3
F122	90065685	5A	28.199799	-25.839883	23	>23	dry	1-23				1
F122	90065685	6	28.199837	-25.839353	30	8	dry					3
F122	90065685	6A	28.199555	-25.839832	25	20	dry					4
F122	90065685	7	28.199642	-25.839732	30	21	dry					4
F122	90065685	7A	28.199394	-25.839974	25	22	dry	8-22				4
F122	90065685	8	28.199992	-25.839939	30	>30	dry	4-30				1
F122	90065685	8A	28.199269	-25.839834	25	17	dry	2-17				4
F122	90065685	9	28.199953	-25.840252	30	>30	dry	6-30				1
F122	90065685	9A	28.199586	-25.840127	25	13	dry	4-10				3
F123	90065577	BG1	28.194102	-25.840855	20	>20	dry					3
F123	90065577	BG2	28.193763	-25.840506	20	>20	dry					4
F123	90065577	BG3	28.19423	-25.840517	20	8	dry					3
F1236	90575008	BH1	28.213792	-25.860207	12	4	dry					5
F1236	90575008	BH2	28.213367	-25.860367	10	3	dry					5
F1236	90575008	BH3	28.213043	-25.860117	12	6	dry					3
F1236	90584968	1	28.212614	-25.860109	24	18	dry				15-17	4
F1236	90584968	2	28.212752	-25.860308	28	22	dry				10-20	7
F125	90079060	BH1	28.195743	-25.831109	25	>25	dry					2
F125	90079060	BH2	28.195596	-25.83067	25	>25	dry					2
F125	90079060	BH3	28.195917	-25.830314	25	>25	dry					4
F126	90584350	BH1675/1	28.20288	-25.841796	27	21	dry					4
F126	90584350	BH1675/2	28.202772	-25.841651	26	20	dry					4
F130	90065677	1	28.199903	-25.84119	25	>25	dry				9-25	7
F130	90065677	10	28.199628	-25.84232	20	4	dry					5
F130	90065677	11	28.199874	-25.841928	20	>20	dry	4-12				4
F130	90065677	12	28.200068	-25.840988	20	>20	dry	5-10				4
F130	90065677	13	28.200332	-25.840811	30	13	dry	4-9	14-21			3
F130	90065677	14	28.200138	-25.841277	30	10	dry					3
F130	90065677	15	28.200206	-25.841633	30	>30	dry					4
F130	90065677	16	28.20019	-25.840916	30	>30	dry	11-14			23-30	7
F130	90065677	17	28.200027	-25.841383	23	>23	dry	3-9	9-13		15-20	7
F130	90065677	18	28.200103	-25.84174	30	26	dry	6-21				4
F130	90065677	19	28.19983	-25.841267	30	>30	dry	18-30				4
F130	90065677	2	28.199993	-25.841777	17	4	dry					5
F130	90065677	20	28.199994	-25.841877	30	>30	dry	19-30				4
F130	90065677	22	28.200442	-25.842785	30	>30	dry					4

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F130	90065677	23	28.20039	-25.842504	30	>30	dry					4
F130	90065677	24	28.20023	-25.842143	30	6	dry					3
F130	90065677	25	28.200189	-25.84286	30	12	dry					3
F130	90065677	26	28.200055	-25.842453	30	7	dry					3
F130	90065677	27	28.200456	-25.84199	30	>30	dry					4
F130	90065677	28	28.200722	-25.842298	30	>30	dry					4
F130	90065677	29	28.200497	-25.842458	30	>30	dry					4
F130	90065677	3	28.199409	-25.841867	20	>20	dry	12-20			8-12	4
F130	90065677	30	28.199824	-25.842711	30	>30	dry					4
F130	90065677	31	28.199603	-25.842777	30	>30	dry					4
F130	90065677	32	28.199813	-25.842519	30	>30	dry					4
F130	90065677	33	28.200025	-25.842251	30	>30	dry					4
F130	90065677	34	28.199935	-25.843024	30	>30	dry	11-30				2
F130	90065677	35	28.199649	-25.841745	30	16-Jan	dry		5-10	10-16		4
F130	90065677	36	28.199852	-25.841546	30	>30	dry	7-17;22-30				2
F130	90065677	37	28.199642	-25.84141	30	21	dry					4
F130	90065677	38	28.199428	-25.841641	30	>30	dry					4
F130	90065677	4	28.199366	-25.842373	17	6	dry					3
F130	90065677	5	28.19898	-25.842188	14	2	dry					5
F130	90065677	6	28.19938	-25.842135	14	4	dry					5
F130	90065677	7	28.199772	-25.842176	20	>20	dry	12-17			17-20	7
F130	90065677	8	28.199196	-25.841897	15	>15	dry	7-15				4
F130	90065677	9	28.1996	-25.841998	10	5	dry					5
F131	90065690	BG1	28.199864	-25.844052	25	>25	dry	7-10				4
F131	90065690	BG2	28.200068	-25.844292	25	5	dry					5
F131	90065690	BG3	28.199975	-25.843695	25	>25	dry	5-18				4
F132	90065697	2/7	28.197477	-25.842076	20	>20	dry	6-13				4
F132	90065697	3/15	28.196866	-25.8426	14	8	dry				4-8	6
F132	90065697	3/3	28.197673	-25.841724	11	1	dry					5
F132	90065697	3-4/10	28.197167	-25.842211	8	3	dry					5
F132	90065697	4-5/18-19	28.196519	-25.84277	20	15	dry				9-15	6
F132	90065697	6/7-14/15	28.196632	-25.842363	8	2	dry					5
F132	90065697	7/20	28.196224	-25.842733	7	2	dry					5
F132	90065697	7/4	28.197297	-25.841565	20	18	dry				15-18	4
F132	90065697	8/8	28.196955	-25.841802	20	>20	dry					7
F132	90065697	9/17	28.196279	-25.8424	14	9	dry					3
F132	90584389	BH1	28.196609	-25.842079	25	>25	dry	15-19	6-10;13-15			4
F132	90584389	BH2	28.196766	-25.842537	25	>25	dry				12-25	7
F133	90065711	1	28.198282	-25.848315	25	14	dry	2-10				3
F133	90065711	10	28.197936	-25.84886	25	4	dry					5
F133	90065711	11	28.197503	-25.848991	25	4	dry					5
F133	90065711	12	28.19755	-25.849296	25	1	dry					5
F133	90065711	2	28.198312	-25.848824	20	5	dry					5
F133	90065711	3	28.197682	-25.848893	17	5	dry					5
F133	90065711	4	28.197789	-25.849372	16	6	dry					3
F133	90065711	5	28.197333	-25.849146	22	15	dry					3
F133	90065711	6	28.197785	-25.848651	25	9	dry					3
F133	90065711	7	28.19867	-25.848551	25	12	dry	4-12				3
F133	90065711	8	28.198341	-25.848057	25	19	dry	2-18				4
F133	90065711	9	28.198058	-25.848592	25	9	dry					3
F133	90065715	BG1	28.197061	-25.84894	15	5	dry					5
F133	90065715	BG2	28.19755	-25.848399	20	15	dry				9-12; 13-1	6
F133	90065715	BG3	28.197865	-25.847681	20	14	dry	2-11				3
F133	90065715	BG4	28.19734	-25.848016	16	11	dry					3
F133	90065715	BG5	28.197203	-25.848492	20	13	dry					3
F133	90065715	BG6	28.196872	-25.848629	20	16	dry				14-16	4
F133	90065715	BG7	28.197443	-25.84779	11	>11	dry					3
F134	90065723	2-3/5	28.186005	-25.847995	11	>11	dry					3
F134	90065723	4/7	28.185896	-25.848205	20	12	dry					3
F134	90065723	5/4-5	28.186162	-25.848176	18	>18	16m					6
F134	90065723	5/9	28.185772	-25.848371	20	>20	dry					4
F134	90584292	BH1	28.186297	-25.848366	32	26	dry					4
F134	90584292	BH2	28.186265	-25.848514	31	27	dry					4
F134	90584292	BH3	28.186097	-25.848666	28	22	dry					4
F134	90584292	BH5	28.186225	-25.848999	18	12	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of: Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F135	90065729	BH1	28.186079	-25.835224	9	1	dry					5
F135	90065729	BH2	28.186443	-25.834673	30	>30	dry					4
F135	90065729	BH3	28.186936	-25.834798	28	22	dry			15-16	16-22	7
F135	90065729	BH4	28.1856	-25.835372	30	>30	dry	23-30			17-23	4
F135	90065729	BH5	28.185269	-25.835844	30	>30	dry	15-30				2
F135	90065729	BH6	28.184888	-25.836618	30	5	dry	1-4				5
F1354	90563150	1387/1	28.172274	-25.872632	10	0	dry					5
F1354	90563150	1387/2	28.172435	-25.872615	8	2	dry					5
F1354	90563150	1387/3	28.172337	-25.872471	10	1	dry					5
F136	90079064	1	28.189109	-25.847813	15	14	dry					3
F136	90079064	2	28.189365	-25.847677	30	15	dry		0-6		6-7	3
F136	90079064	3	28.188798	-25.847175	30	16	dry					4
F136	90079064	4	28.189168	-25.846814	30	8	dry					3
F136	90079064	5	28.189119	-25.847552	20	4	dry					5
F136	90079064	6	28.188536	-25.847515	18	3	dry					5
F136	90079064	7	28.18912	-25.847152	18	11	dry	6-10				3
F136	90079064	8	28.189572	-25.8473	15	0	dry					5
F137	90124726	BH1	28.191516	-25.845934	24	10	dry	4-10				3
F137	90124726	BH2	28.191219	-25.845362	17	>17	dry	13-17			5-13	6
F137	90124726	BH3	28.191003	-25.845711	15	6	dry	1-6				3
F137	90124726	BH4	28.190585	-25.845907	24	19	dry				9-19	6
F139	90116410	BH14/5	28.189797	-25.844062	10	6	dry					3
F139	90116410	BH2/2	28.188946	-25.845376	14	9	dry				5-6	3
F139	90116410	BH4/5-6	28.188784	-25.844879	13	7	dry					3
F139	90116410	BH9/2-3	28.189584	-25.844729	14	10	dry					3
F139	90116410	BHC-3/46	28.189295	-25.844153	30	11	dry	4-11				3
F1395	90562312	BH1	28.180558	-25.862777	39	34	dry	9-23				4
F1395	90562312	BH2	28.180466	-25.862803	38	32	dry	8-32				2
F1397	90562314	BH1	28.192485	-25.840359	57	48	dry	11-44				1
F1397	90562314	BH5	28.192766	-25.840341	25	5	dry					5
F1397	90562314	BH6	28.192621	-25.8403	30	>30	dry	7-30				1
F1397	90562314	BH7	28.192596	-25.840572	30	>30	dry	7-30				1
F140	90575030	BH1	28.194245	-25.85174	25	23	dry				16-20	7
F140	90575030	BH1101/1102	28.194266	-25.851524	45	43	dry				16-35; 37-4	8
F140	90575030	BH1109	28.195261	-25.850455	19	10	dry				4-8	6
F140	90575030	BH1204	28.194439	-25.851064	30	25	dry					4
F140	90575030	BH1207/1307	28.194752	-25.850597	30	23	dry		10-13			4
F140	90575030	BH1208	28.194962	-25.850517	27	3	dry					5
F140	90575030	BH1305	28.194421	-25.850812	60	58	45m	41-58	13-21; 29-3			4
F140	90575030	BH14	28.194008	-25.851378	26	20	dry			11-17	17-19	6
F140	90575030	BH1403	28.194001	-25.85099	53	10	dry				44-46	3
F140	90575030	BH1406	28.194403	-25.850559	30	27	dry				17-27	7
F140	90575030	BH1501	28.19362	-25.851168	22	11	dry	5-11	1-5			3
F140	90575030	BH3	28.194527	-25.851417	35	29	dry				17-19; 23-2	7
F140	90575030	BH32	28.194554	-25.850307	32	26	dry				15-21; 22-2	4
F140	90575030	BH7	28.194979	-25.850851	30	>30	dry		5.5-13		13-16; 20-3	7
F140	90584896	BH1104	28.194578	-25.851182	47	41	dry	33-41	30-33			4
F140	90584896	BH1106	28.195021	-25.850607	32	26	dry	23-25				4
F140	90584896	BH1108	28.195021	-25.850607	19	13	dry					3
F140	90584896	BH1205	28.19464	-25.850885	40	34	dry					4
F140	90584896	BH1206	28.19473	-25.850786	25	12	dry					3
F140	90584896	BH13	28.193957	-25.851486	24	11	dry	5-7				3
F140	90584896	BH1306	28.194571	-25.850668	60	>60	dry					4
F140	90584896	BH1402	28.19387	-25.851106	40	34	dry	10-15				4
F140	90584896	BH1404	28.194573	-25.850415	50	30	dry					4
F140	90584896	BH1405	28.194272	-25.850693	60	>60	dry	35-60				2
F140	90584896	BH1407	28.194573	-25.850415	60	48	dry					4
F140	90584896	BH15	28.194387	-25.851389	60	>60	dry	31-40				4
F140	90584896	BH33	28.194695	-25.850145	13	7	dry					3
F141	90124619	P1	28.188638	-25.842749	25	19	dry					4
F141	90124619	P2	28.188225	-25.843636	30	>30	dry	22-30				2
F141	90124619	P3	28.18757	-25.843852	21	15	dry				4-14	6
F141	90124619	P4	28.188332	-25.842624	10	7	dry					3
F141	90124619	P5	28.187553	-25.843663	13	8	dry					3
F141	90124619	P6	28.187774	-25.843875	13	7	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F141	90124619	P7	28.187466	-25.843943	15	9	dry					3
F142	90126124	BH10-11/8-9	28.190827	-25.844931	19	8	dry	12-19				3
F142	90126124	BH11/2	28.190401	-25.844465	22	>22	dry	15-22				2
F142	90126124	BH3/8-9	28.190295	-25.845382	13	6	dry	1-3				3
F142	90126124	BH4-5/4-5	28.190114	-25.845021	26	16	dry	2-8			14-16	4
F142	90126124	BH8-7/7	28.190509	-25.845007	23	18	dry	6-13			13-16	4
F143	90229337	BH1	28.194104	-25.830917	30	>30	dry					4
F143	90229337	BH2	28.194322	-25.831498	28	>28	dry					4
F143	90229337	BH3	28.194735	-25.831881	30	>30	dry					7
F145	90229103	202	28.199856	-25.845522	10	4	dry					5
F145	90229103	504	28.200556	-25.845346	25	>25	dry	2-9				4
F145	90229103	901	28.200598	-25.844428	30	28	dry					7
F150	90374100	1	28.180475	-25.84277	20	8	dry					3
F150	90374100	2	28.180349	-25.842605	20	>20	dry	3-11				4
F150	90374100	3	28.18029	-25.842823	20	15	dry					3
F1508	90504114	BG1	28.193254	-25.831095	60	>60	dry					4
F1508	90504114	BG2	28.193694	-25.830707	60	>60	dry					4
F1508	90504114	BG3	28.194335	-25.831248	60	>60	dry					4
F1508	90504114	BG4	28.194033	-25.831633	40	>40	dry					4
F151	90125188	BG1	28.192917	-25.852129	22	16	dry					4
F151	90125188	BG2	28.1926	-25.85264	25	19	dry					4
F151	90125188	BG3	28.193367	-25.851658	10	3	dry					5
F151	90125188	BG4	28.193347	-25.852052	25	>25	dry		14-17			4
F151	90125188	BG5	28.192964	-25.852559	16	9	dry					3
F151	90125188	BG6	28.193	-25.85302	14	8	dry					3
F151	90125188	BG7	28.193731	-25.852232	16	8	dry					3
F152	90126372	3/5	28.188002	-25.846032	10	1	dry					5
F152	90126372	5/2-3	28.188167	-25.845514	14	7	dry					3
F152	90126372	6/5	28.187698	-25.845754	14	4	dry					5
F1527	90474174	1	28.179329	-25.858561	52	46	dry	24-46				2
F1527	90474174	2	28.17917	-25.858834	50	44	dry	26-44				2
F1527	90474174	3	28.178613	-25.859064	43	37	dry	15-31				2
F1527	90584865	BH1	28.178903	-25.858992	56	50	dry	29-50				2
F1527	90584865	BH2	28.179173	-25.858958	56	50	dry	26-50				2
F1527	90584865	BH3	28.178984	-25.85883	56	49	dry	13-49				1
F1527	90584865	BH5	28.179484	-25.858625	51	>51	dry	10-51				1
F1527	90584865	BH7	28.179465	-25.858535	50	>50	dry	26-50				2
F153	90124625	BG1	28.187746	-25.846946	20	15	dry					3
F153	90124625	BG2	28.18833	-25.847032	14	8	dry					3
F153	90124625	BG3	28.188336	-25.846565	30	25	dry				9-11; 19-25	7
F153	90124625	BG4	28.188776	-25.846129	14	7	dry					3
F153	90124625	BG5	28.187845	-25.847108	26	>26	dry				10-11	4
F153	90124625	BG6	28.187979	-25.846756	16	9	dry					3
F153	90124625	BG7	28.188418	-25.84682	19	13	dry	6-7	7-12			3
F153	90124625	BG8	28.188577	-25.84632	26	20	dry	3-12;23-26			11-12	4
F1535	90420414	3101.5	28.202796	-25.855629	31	>31	dry	1-31				2
F1535	90420414	3105.5	28.201547	-25.854814	30	23	dry	1-15			15-23	7
F1535	90420414	3202	28.202178	-25.855703	30	27	dry	1-15		23-27	15-23	7
F1535	90420414	3203	28.201929	-25.85555	31	22	dry	1-12			18-22	4
F1535	90420414	3205	28.201418	-25.855237	28	22	dry	3-12				4
F1535	90420414	3205.3	28.201348	-25.85519	31	>31	dry	1-3			11-31	7
F1535	90420414	3400.5	28.202327	-25.856263	29	23	dry	2-15				4
F1535	90420414	3403.5	28.201633	-25.855841	23	16	dry	2-10			11-13	4
F1535	90420414	3406.5	28.201089	-25.855438	25	19	dry	1-4			6-19	6
F1535	90564317	BH SS/1	28.20133	-25.855574	23	17	dry					4
F1536	90096867	BG1	28.206113	-25.850803	6	3	dry					5
F1536	90096867	BG2	28.20587	-25.851596	8	3	dry					5
F1536	90096867	BG3	28.205505	-25.851398	11	5	dry					5
F1536	90096867	BG4	28.205834	-25.851172	10	4	dry					5
F1536	90096867	BG5	28.206196	-25.851211	6	3	dry					5
F1536	90096867	BG6	28.20566	-25.850812	6	3	dry					5
F1536	90096867	BG7	28.205991	-25.851292	21	>21	dry				11-21	7
F1536	90474768	BH1	28.205616	-25.851142	21	14	dry				5-14	6
F1536	90474768	BH2	28.205525	-25.850976	17	11	dry		3-5		5-8	6
F1536	90474768	BH3	28.205319	-25.851241	19	12	dry				3-12	6

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F1536	90474768	BH4	28.205782	-25.851497	11	5	dry				3-5	5
F1536	90474768	BH5	28.205981	-25.851582	11	4	dry					5
F1536	90474768	BH6	28.20573	-25.851569	10	4	dry					5
F1536	90474768	BH7	28.205487	-25.851255	30	>30	dry				20-30	7
F1536	90474768	BH8	28.205256	-25.851258	15	10	dry		3-7		7-9	3
F1536	90474768	BH9	28.20546	-25.851039	10	1	dry					5
F1537	90374180	BH3204	28.191841	-25.851956	13	8	dry					3
F1537	90374180	BH3302	28.192256	-25.852056	17	12	dry					3
F1537	90374180	BH3502	28.19251	-25.851766	13	8	dry					3
F1537	90374180	BH3601	28.192795	-25.851744	17	12	dry				6-12	6
F1537	90374180	BH3904.5	28.192769	-25.851084	25	20	dry				4-15	7
F1537	90374180	BH6	28.192616	-25.851106	10	8	dry				2-3	3
F1537	90374180	BH7	28.192771	-25.851258	30	>30	dry		9-10		10-30	7
F1537	90374180	BH8	28.192685	-25.851017	9	2	dry					5
F1537	90420633	BH3101	28.192133	-25.852447	12	6	dry					6
F1537	90420633	BH3103	28.191891	-25.85219	22	16	dry				7-9;13-15	4
F1537	90420633	BH3105	28.19156	-25.851956	36	21	dry				13-21;30-3	7
F1537	90420633	BH3202	28.192133	-25.852205	45	45	dry				17-24;25-3	8
F1537	90420633	BH3301	28.192395	-25.852187	16	11	dry			6-9		6
F1537	90420633	BH3304	28.191975	-25.851828	32	29	dry				13-16;23-2	7
F1537	90420633	BH3500	28.192783	-25.851975	15	12	dry				4-12	6
F1537	90420633	BH3503	28.192373	-25.851644	13	9	dry					3
F1537	90420633	BH3504	28.192228	-25.85153	22	17	dry		7-10;12-15		10-12;15-1	6
F1537	90420633	BH3602	28.192745	-25.851528	5	1	dry					5
F1537	90420633	BH3603	28.192505	-25.851497	33	15	dry				7-15	6
F1537	90420633	BH3605	28.192228	-25.851286	17	14	dry				11-14	6
F1537	90420633	BH3701	28.19292	-25.85161	7	2	dry					5
F1537	90420633	BH3704	28.192484	-25.851251	14	8	dry		1-4			3
F1537	90420633	BH3802	28.19291	-25.851335	12	7	dry					3
F1537	90420633	BH3901	28.193188	-25.851309	7	1	dry					5
F1537	90420633	BH3903	28.192966	-25.851149	6	2	dry					5
F1538	90065637	2/8	28.199224	-25.843042	10	4	dry					5
F1538	90065637	3-4/5	28.199166	-25.843348	10	3	dry					5
F1538	90065637	5-6/9-10	28.199669	-25.843128	20	>20	dry	12-20				4
F1538	90065637	7/6	28.19954	-25.843459	10	6	dry					3
F1538	90065639	1	28.199685	-25.843542	25	22	dry				10-15	4
F1538	90065639	2	28.199164	-25.84366	25	>25	dry	8-25				2
F1538	90065639	3	28.198872	-25.844183	25	15	dry					3
F1538	90065639	4	28.198446	-25.844265	24	8	dry					3
F1538	90065639	5	28.199512	-25.843737	25	>25	dry				13-25	7
F1538	90065639	6	28.198475	-25.844121	25	>25	dry					4
F1538	90065639	7	28.19879	-25.843795	25	8	dry					3
F1538	90065639	8	28.199313	-25.843168	25	1	dry					5
F1538	90420432	BH10	28.199834	-25.843388	32	27	dry				8-14;17-27	7
F1538	90420432	BH11	28.199296	-25.844023	10	3	dry					5
F1538	90420432	BH9	28.199375	-25.843594	47	>47	dry			34-40	8-34;40-47	8
F1538	90420985	BH12	28.199041	-25.843812	53	49	dry					4
F1538	90420985	BH13	28.19881	-25.844539	11	7	dry					3
F1538	90420985	BH14	28.198566	-25.844626	24	22	dry					4
F1538	90420985	BH15	28.199146	-25.84419	12	7	dry					3
F1538	90420985	BH16	28.198967	-25.843508	35	29	dry	4-13				4
F1538	90420985	BH17	28.19938	-25.843366	28	24	dry	6-16				4
F1538	90420985	BH18	28.199548	-25.843244	29	24	dry					4
F1538	90420985	BH19	28.199464	-25.842989	27	23	dry				13-18	4
F1538	90420985	BH20	28.198218	-25.84428	33	29	dry					4
F1538	90420985	BH22	28.198671	-25.844292	6	3	dry					5
F1538	90420985	BH23	28.198428	-25.84399	4	1	dry					5
F1538	90420985	BH24	28.198983	-25.844361	8	5	dry					5
F1538	90420985	BH25	28.198659	-25.844004	39	36	dry				11-36	8
F1538	90420985	BH26	28.19899	-25.844233	7	4	dry					5
F1538	90420985	BH27	28.199296	-25.843777	7	4	dry					5
F1538	90420985	BH28	28.199183	-25.843863	8	5	dry					5
F1538	90420985	BH29	28.199068	-25.843963	8	5	dry					5
F1538	90420985	BH30	28.198618	-25.844116	31	28	dry				9-28	7
F1538	90420985	BH31	28.198522	-25.843948	9	6	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F1538	90420985	BH32	28.198769	-25.843948	30	27	dry				21-27	7
F1538	90420985	BH33	28.198655	-25.843823	9	6	dry					3
F1538	90420985	BH34	28.198647	-25.844459	9	6	dry				2-6	6
F1538	90420985	BH35	28.198767	-25.844624	33	30	dry					4
F1538	90420985	BH36	28.199481	-25.843945	18	15	dry				10-14	6
F1538	90420985	BH37	28.198959	-25.843661	16	13	dry	9-13			5-9	6
F1538	90420985	BH38	28.198796	-25.843635	40	37	dry				6-10;13-19	8
F1538	90420985	BH39	28.198999	-25.843356	5	2	dry					5
F1538	90420985	BH40	28.199153	-25.843478	20	>20	dry	12-20				2
F1538	90420985	BH41	28.199256	-25.843386	9	6	dry					3
F1538	90420985	BH42	28.199391	-25.843508	5	2	dry					5
F1538	90420985	BH43	28.199315	-25.843255	4	1	dry					5
F1538	90420985	BH44	28.199533	-25.843325	31	28	dry	11-14			14-28	7
F1538	90420985	BH45	28.199152	-25.8432	11	8	dry					3
F1538	90420985	BH46	28.199352	-25.842914	6	3	dry					5
F1538	90420985	BH47	28.199612	-25.843034	26	23	dry				13-23	7
F1538	90420985	BH48	28.198681	-25.843695	12	9	dry					3
F1538	90420985	BH49	28.19928	-25.843579	5	2	dry					5
F1539	90420501	1	28.20412	-25.852997	15	9	dry				3-9	6
F1539	90420501	2	28.204379	-25.852919	10	4	dry					5
F1539	90420501	3	28.204503	-25.853279	34	31	dry		5-8	17-30	8-17	7
F1539	90420501	4	28.2043	-25.853105	10	5	dry					5
F1539	90420501	5	28.204209	-25.852843	7	2	dry					5
F1539	90420501	6	28.204718	-25.85311	23	17	dry					4
F154	90128219	1	28.193246	-25.848048	19	12	dry					3
F154	90128219	2	28.192943	-25.847819	20	14	dry	7-13				3
F154	90128219	3	28.193159	-25.847291	16	10	dry	4-7				3
F1540	90374713	BH1	28.197489	-25.854693	15	3	dry					5
F1540	90374713	BH2	28.196782	-25.854608	11	6	dry					3
F1540	90374713	BH3	28.196442	-25.855544	30	>30	dry				18-25	7
F1540	90374713	BH4	28.196411	-25.855014	40	35	dry				4-35	7
F1540	90374713	BH5	28.196975	-25.855249	13	6	dry		0-3			3
F1540	90374713	BH6	28.195997	-25.855448	22	15	dry					3
F1540	90374713	BH7	28.196141	-25.855297	18	8	dry				6-8	3
F1540	90374713	BH8	28.196436	-25.855278	23	17	dry				4-17	6
F1540	90374713	BH9	28.196607	-25.85593	20	15	dry					3
F1541	90474483	3102	28.195786	-25.843094	24	>24	dry	18-24				4
F1541	90474483	3104	28.196002	-25.843284	10	4	dry					5
F1541	90474483	3201	28.195573	-25.84312	38	>38	dry	24-38	4-9		20-24	4
F1541	90474483	3203	28.1958	-25.843292	40	>40	dry	26-40			10-16	4
F1541	90474483	3304	28.195814	-25.843454	21	11	dry					3
F1541	90474483	3401	28.195385	-25.843328	26	>26	dry	23-26			2-23	6
F1541	90474483	3403	28.195604	-25.84348	26	>26	dry	19-26	2-8			4
F1541	90474483	3405	28.195842	-25.843678	25	>25	dry	18-25			5-18	6
F1541	90474483	3601	28.19522	-25.843553	35	>35	dry	18-35				4
F1541	90474483	3603	28.195418	-25.843713	17	12	dry					3
F1541	90474483	3705	28.195637	-25.843879	13	>13	dry	9-13	7-9			3
F1541	90474483	3802	28.19519	-25.843743	11	>11	dry	8-11				3
F1541	90474483	3804	28.195339	-25.844009	11	>11	dry	3-11				2
F1541	90474483	3904	28.195246	-25.84412	11	>11	dry	2-11				2
F1541	90474483	4205	28.195076	-25.844519	33	28	dry	1-28				2
F1541	90474483	4301	28.194514	-25.844267	31	27	dry	1-27				2
F1542	90420474	3104	28.195662	-25.855045	25	20	dry				13-19	6
F1542	90420474	3201	28.195333	-25.854566	36	30	dry	23-28				4
F1542	90420474	3304	28.195917	-25.854773	22	17	dry				11-15	6
F1542	90420474	3503	28.196014	-25.854387	27	22	dry					4
F1542	90420474	3600	28.195699	-25.85393	28	24	dry					4
F1542	90420474	3802	28.196227	-25.853851	11	6	dry					3
F1542	90420474	3805	28.196712	-25.854197	10	3	dry					5
F1543	90420647	BHA	28.189728	-25.852176	37	31	dry					7
F1543	90420647	BHB	28.189963	-25.852467	16	10	dry					3
F1543	90420647	BHC	28.190379	-25.851722	48	42	dry					8
F1543	90564509	BH1	28.189083	-25.851305	14	8	dry					6
F1543	90564509	BH2	28.189523	-25.851162	41	34	dry					7
F1543	90564509	BH3	28.189713	-25.851118	18	12	dry					6

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F1543	90564509	BH4	28.189417	-25.85159	44	39	dry					8
F1543	90564509	BH5	28.189509	-25.851776	44	38	dry					8
F1543	90564509	BH6	28.189945	-25.851388	45	39	dry					8
F1543	90564509	BH7	28.189918	-25.851838	17	1	dry					5
F1544	90420498	3205	28.195188	-25.857062	20	16	dry					4
F1544	90420498	3501	28.195109	-25.856329	45	>45	dry					4
F1544	90420498	4004	28.195898	-25.856096	34	28	dry					4
F1544	90420498	4307	28.196477	-25.856091	17	13	dry					3
F1544	90420707	3107	28.195293	-25.857361	23	19	dry					4
F1544	90420707	3202	28.194916	-25.856721	24	17	dry					4
F1544	90420707	3307	28.195501	-25.857145	32	27	dry					4
F1544	90420707	3504	28.195399	-25.85661	36	29	dry					3
F1544	90420707	3507	28.195694	-25.856933	21	14	dry					3
F1544	90420707	3702	28.195417	-25.85618	27	23	dry					4
F1544	90420707	3706	28.195794	-25.856612	37	31	dry					4
F1544	90420707	3804	28.195702	-25.856292	35	30	dry					4
F1544	90420707	3901	28.195497	-25.85588	32	26	dry					4
F1544	90420707	3906	28.19599	-25.8564	38	32	dry					7
F1544	90420707	4006	28.196175	-25.8563	18	11	dry					3
F1544	90420707	4202	28.19589	-25.855653	22	15	dry					3
F1545	90474303	DH1	28.194767	-25.846237	10	2	dry					5
F1545	90474303	DH2	28.194902	-25.846464	23	14	dry					6
F1545	90474303	DH7/3	28.194369	-25.846839	6	1	dry					5
F1545	90474303	DH7/7	28.194789	-25.846435	12	5	dry					5
F1545	90474303	DH7/9	28.194992	-25.846218	9	3	dry					5
F1546	90474081	BH 3101	28.195649	-25.852663	13	6	dry					3
F1546	90474081	BH 3103/3104	28.196063	-25.852976	21	16	dry					4
F1546	90474081	BH 3104	28.196148	-25.853037	20	15	dry					4
F1546	90474081	BH 3204	28.196273	-25.852898	10	5	dry					5
F1546	90474081	BH 3303	28.196236	-25.852638	12	7	dry					3
F1546	90474081	BH 3403	28.196363	-25.852497	10	4	dry					5
F1546	90474081	BH 3501	28.196157	-25.852108	10	5	dry					5
F1546	90474081	BH 3503	28.196489	-25.852358	10	5	dry					5
F1546	90474081	BH 3505/3604	28.196803	-25.852474	10	5	dry					5
F1546	90474081	BH 3601	28.196286	-25.851967	10	3	dry					5
F1546	90474081	BH 3604/3704	28.196846	-25.852274	16	10	dry					3
F1546	90474081	BH 3701/3800	28.196392	-25.851697	11	6	dry					3
F1546	90474081	BH 3702	28.196581	-25.851954	12	7	dry					3
F1546	90474081	BH 3703	28.196746	-25.85208	9	4	dry					5
F1546	90474081	BH 3705/3804	28.197056	-25.852196	9	4	dry					5
F1546	90474081	BH 3802	28.196706	-25.851815	21	15	dry					3
F1546	90474081	BH 3804	28.197038	-25.852065	15	10	dry					3
F1546	90474081	BH 3901	28.196664	-25.851553	16	12	dry					3
F1546	90474081	BH 3903	28.196999	-25.851802	21	16	dry					4
F1546	90474081	BH 9/20	28.195867	-25.852317	30	5	dry					5
F1546	90474081	BH3405/3504	28.196678	-25.852613	9	4	dry					5
F1546	90474229	BH 1	28.195801	-25.852923	6	1	dry					5
F1546	90474229	BH 10	28.196652	-25.852352	15	7	dry					3
F1546	90474229	BH 11	28.196451	-25.852093	12	6	dry					3
F1546	90474229	BH 12	28.197016	-25.851957	8	2	dry					5
F1546	90474229	BH 13	28.197197	-25.852074	20	15	dry					1
F1546	90474229	BH 14	28.19593	-25.852911	20	14	dry					3
F1546	90474229	BH 15	28.196233	-25.852983	9	3	dry					5
F1546	90474229	BH 16	28.196258	-25.852375	7	1	dry					5
F1546	90474229	BH 17	28.195928	-25.852169	16	10	dry					3
F1546	90474229	BH 18	28.196915	-25.852235	15	9	dry					3
F1546	90474229	BH 19	28.19678	-25.852212	11	5	dry					5
F1546	90474229	BH 2	28.19636	-25.853032	9	3	dry					5
F1546	90474229	BH 20	28.197157	-25.852237	12	5	dry					5
F1546	90474229	BH 21	28.196875	-25.85201	10	4	dry					5
F1546	90474229	BH 22	28.196844	-25.851827	8	2	dry					5
F1546	90474229	BH 23	28.19655	-25.851787	15	9	dry					3
F1546	90474229	BH 24	28.196196	-25.853108	20	14	dry					3
F1546	90474229	BH 25	28.196197	-25.852237	12	6	dry					3
F1546	90474229	BH 26	28.196586	-25.851636	16	10	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F1546	90474229	BH 27	28.196725	-25.851736	11	6	dry					3
F1546	90474229	BH 28	28.196055	-25.852135	13	7	dry					3
F1546	90474229	BH 3	28.195947	-25.852778	9	3	dry					5
F1546	90474229	BH 4	28.195753	-25.852539	11	5	dry					5
F1546	90474229	BH 5	28.196127	-25.852743	9	3	dry					5
F1546	90474229	BH 6	28.195944	-25.852501	10	4	dry					5
F1546	90474229	BH 7	28.196079	-25.852343	9	3	dry					5
F1546	90474229	BH 8	28.19656	-25.852771	13	6	dry					3
F1546	90474229	BH 9	28.196324	-25.852232	10	3	dry					5
F1547	90474390	2003/2102	28.199249	-25.857676	7	3	dry					5
F1547	90474390	2004/2103	28.199136	-25.857824	19	14	dry					3
F1547	90474390	2101	28.1995	-25.857504	15	6	dry					3
F1547	90474390	2103/2202	28.199414	-25.85778	30	24	dry				5-24	7
F1547	90474390	2104/2203	28.1993	-25.857927	11	4	dry					5
F1547	90474390	2105	28.199046	-25.858102	15	5	dry					5
F1547	90474390	2200/2201	28.199725	-25.857532	10	5	dry					5
F1547	90474390	2200/2301	28.199807	-25.857585	9	1	dry					5
F1547	90474390	2201/2202	28.199611	-25.857681	20	16	dry				5-16	6
F1547	90474390	2203/2302	28.199574	-25.857884	11	5	dry					5
F1547	90474390	2204	28.199326	-25.858054	5	0	dry					5
F1547	90474390	2300	28.199944	-25.857561	20	14	dry					3
F1547	90474390	2301	28.19983	-25.857712	13	9	dry					3
F1547	90474390	2301/2400	28.19997	-25.857688	21	16	dry					4
F1547	90474390	2302	28.199717	-25.857857	10	4	dry					5
F1547	90474390	2303	28.199603	-25.858006	14	9	dry				5-7	6
F1547	90474390	2303/2402	28.199744	-25.857984	10	4	dry					5
F1547	90474390	2304/2305	28.199432	-25.858228	8	2	dry					5
F1547	90474390	2304/2403	28.199627	-25.858132	10	4	dry					5
F1547	90474390	2305/2306	28.199318	-25.858381	20	16	dry					4
F1547	90474390	2400/2501	28.200138	-25.857791	25	21	dry					7
F1547	90474390	2401	28.199997	-25.857812	12	6	dry					3
F1547	90474390	2402/2502	28.199963	-25.858015	15	8	dry					3
F1547	90474390	2403/2503	28.199852	-25.85816	25	19	dry				8-19	6
F1547	90474390	2405	28.19954	-25.858407	9	4	dry					5
F1547	90474390	2405/2406	28.199483	-25.858482	24	18	dry				10-18	6
F1547	90474390	2405/2504	28.19968	-25.858383	15	10	dry					3
F1547	90474390	2501	28.200162	-25.857915	25	21	dry					4
F1547	90474390	2502/2603	28.200071	-25.858187	17	11	dry					3
F1547	90474390	2504	28.199818	-25.858362	17	8	dry					3
F1547	90474390	2505/2506	28.199668	-25.85856	5	1	dry					5
F1547	90474390	2505/2506	28.199668	-25.85856	5	1	dry					5
F1547	90474390	2600/2601	28.200383	-25.857945	19	14	dry					3
F1547	90474390	2602/2701	28.200349	-25.858141	18	12	dry					3
F1547	90474390	2603/2604	28.20004	-25.85839	14	7	dry					3
F1547	90474390	2604/2605	28.199926	-25.858534	14	7	dry					3
F1547	90474390	2604/2704	28.200064	-25.858515	11	6	dry					3
F1547	90474390	2605/2606	28.19981	-25.858687	10	3	dry					5
F1547	90474390	2700/2801	28.200629	-25.858096	18	12	dry					3
F1547	90474390	2702	28.200372	-25.858271	9	3	dry					5
F1547	90474390	2703	28.200262	-25.858416	18	11	dry					3
F1547	90474390	2703.2804	28.200286	-25.858543	9	3	dry					5
F1547	90474390	2704	28.200147	-25.858566	34	31	dry				16-31	7
F1547	90474390	2705	28.200032	-25.858713	11	5	dry					5
F1547	90474390	2705/2804	28.200172	-25.858694	9	3	dry					5
F1547	90474390	2800/2901	28.200793	-25.858201	40	33	dry					4
F1547	90474390	2801	28.200652	-25.858224	28	24	dry	2-8				4
F1547	90474390	2801/2902	28.200679	-25.858347	10	6	dry					3
F1547	90474390	2802	28.200536	-25.858371	15	7	dry					3
F1547	90474390	2804	28.200312	-25.858672	10	5	dry					5
F1547	90474390	2804/2903	28.200452	-25.858646	8	2	dry					5
F1547	90474390	2805/2906	28.200223	-25.858945	13	7	dry					3
F1547	90474390	2904/2805	28.200336	-25.858796	5	2	dry					5
F1547	90474391	BH1	28.199488	-25.857405	11	5	dry					5
F1547	90474391	BH10	28.200696	-25.858469	11	5	dry					5
F1547	90474391	BH11	28.200196	-25.858184	13	7	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F1547	90474391	BH12	28.200532	-25.858044	11	5	dry					5
F1547	90474391	BH13	28.199795	-25.857743	12	6	dry					3
F1547	90474391	BH2	28.199643	-25.857492	10	4	dry					5
F1547	90474391	BH3	28.199296	-25.857775	21	15	dry					3
F1547	90474391	BH4	28.19916	-25.858014	10	4	dry					5
F1547	90474391	BH5	28.199284	-25.858204	10	4	dry					5
F1547	90474391	BH6	28.199464	-25.858084	10	9	dry					3
F1547	90474391	BH7	28.200353	-25.858924	9	5	dry					5
F1547	90474391	BH8	28.200457	-25.858766	13	7	dry					3
F1547	90474391	BH9	28.200573	-25.858592	10	4	dry					5
F1548	90474358	3000/3101	28.19346	-25.851136	40	21	dry	8-16		23-26	16-19	7
F1548	90474358	3001/3102	28.193594	-25.851007	26	20	dry	11-17				4
F1548	90474358	3002/3103	28.193721	-25.850869	24	7	dry					3
F1548	90474358	3003/3103	28.193779	-25.850797	25	9	dry					3
F1548	90474358	3007/3107	28.194285	-25.850244	33	26	dry					4
F1548	90474358	3101	28.193455	-25.85102	18	11	dry					3
F1548	90474358	3102	28.193578	-25.85088	6	2	dry					5
F1548	90474358	3102/3203	28.193566	-25.850752	14	8	dry					3
F1548	90474358	3103/3104	28.193762	-25.850679	12	6	dry					3
F1548	90474358	3103/3204	28.193695	-25.850617	42	39	dry					4
F1548	90474358	3104	28.193834	-25.850601	30	24	dry					7
F1548	90474358	3105	28.193957	-25.850464	44	38	dry					8
F1548	90474358	3106	28.194085	-25.850327	43	20	dry					4
F1548	90474358	3107/3208	28.194194	-25.850059	19	13	dry					3
F1548	90474358	3109	28.194469	-25.849911	18	12	dry					3
F1548	90474358	3201	28.1933	-25.850905	20	13	dry					3
F1548	90474358	3201/3302	28.193286	-25.85078	13	7	dry					3
F1548	90474358	3202/3303	28.19341	-25.850639	18	12	dry					3
F1548	90474358	3203/3304	28.193542	-25.8505	15	8	dry					3
F1548	90474358	3204/3305	28.193666	-25.850363	25	19	dry					4
F1548	90474358	3205/3104	28.193817	-25.850474	42	26	dry					4
F1548	90474358	3205/3206	28.193867	-25.85028	35	30	dry					7
F1548	90474358	3206/3207	28.193995	-25.850143	30	25	dry					4
F1548	90474358	3207	28.194059	-25.850074	26	19	dry			15-18		6
F1548	90474358	3300/3401	28.193006	-25.850802	10	4	dry					5
F1548	90474358	3301/3402	28.193137	-25.850662	12	6	dry					3
F1548	90474358	3302/3403	28.193259	-25.850521	15	5	dry					5
F1548	90474358	3303/3404	28.193388	-25.850385	6	0	dry					5
F1548	90474358	3304	28.193528	-25.850373	45	42	dry	26-30		12-16;36-3	9-12;16-26	8
F1548	90474358	3304/3305	28.193594	-25.850298	10	4	dry					5
F1548	90474358	3305	28.193657	-25.850236	19	13	dry					3
F1548	90474358	3306	28.193779	-25.8501	13	6	dry					3
F1548	90474358	3306/3307	28.193844	-25.850028	31	25	dry			22-24		7
F1548	90474358	3307/3308	28.19397	-25.849886	20	14	dry					3
F1548	90474358	3309	28.194163	-25.849678	51	49	dry	9-24		35-41	41-44;46-4	8
F1548	90474358	3400/3501	28.192854	-25.850687	10	4	dry					5
F1548	90474358	3401/3502	28.192981	-25.850546	9	3	dry					5
F1548	90474358	3402	28.193118	-25.850536	5	0	dry					5
F1548	90474358	3402/3503	28.193108	-25.850409	10	4	dry					5
F1548	90474358	3403/3504	28.193235	-25.850272	13	7	dry					3
F1548	90474358	3404/3405	28.193436	-25.850189	9	3	dry					5
F1548	90474358	3405/3406	28.193564	-25.85005	18	7	dry					3
F1548	90474358	3408/3409	28.193942	-25.849632	28	22	dry					4
F1548	90474358	3500/3601	28.192727	-25.850589	10	4	dry					5
F1548	90474358	3501/3602	28.19283	-25.850433	19	11	dry					3
F1548	90474358	3502/3602	28.192895	-25.850366	10	4	dry					5
F1548	90474358	3503	28.193096	-25.850283	17	11	dry					3
F1548	90474358	3503/3604	28.193106	-25.850176	15	7	dry					3
F1548	90474358	3504/3505	28.193283	-25.850076	17	11	dry					3
F1548	90474358	3505	28.19335	-25.850004	20	13	dry					3
F1548	90474358	3506	28.193475	-25.849865	33	27	dry					4
F1548	90474358	3507	28.193602	-25.849728	30	24	dry					4
F1548	90474358	3507/3608	28.193612	-25.849618	40	33	dry					4
F1548	90474358	3508/3609	28.193739	-25.849479	45	38	dry					4
F1549	90374686	1	28.190283	-25.847451	18	7	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F1549	90374686	2	28.189697	-25.846847	27	6	dry					3
F1549	90374686	3	28.18973	-25.846363	17	10	dry					3
F1549	90374686	4	28.190283	-25.846974	19	13	dry					3
F1549	90374686	5	28.189499	-25.846589	17	9	dry					3
F1549	90374686	6	28.190502	-25.847225	35	30	dry			28-29	10-28	7
F155	90116959	202	28.202309	-25.850694	30	>30	dry					4
F155	90116959	408/508	28.202938	-25.851754	30	>30	dry					4
F155	90116959	6/10	28.20302	-25.852171	7	2	dry					5
F155	90116959	601/602	28.201711	-25.851191	30	>30	dry					4
F1551	90474400	1	28.195082	-25.836465	35	28	dry	10-28				4
F1551	90474400	2	28.194633	-25.836622	27	21	dry	2-21				4
F1551	90474400	2	28.195388	-25.836611	30	>30	dry	21-30				4
F1551	90474400	3	28.19533	-25.836828	40	33	dry	18-29				4
F1551	90474400	4	28.195487	-25.837233	30	>30	dry	11-30				2
F1551	90588815	BH7210-1	28.19459	-25.8362	51	38	dry	7-23				4
F1551	90588815	BH7210-2	28.194229	-25.836387	37	31	dry	8-18				4
F1552	90575050	BH1104/1105	28.204101	-25.844373	45	36	dry	19-25				4
F1552	90575050	BH1401	28.203603	-25.844316	60	52	dry					4
F1552	90575050	BH1605	28.203909	-25.843967	48	42	dry					4
F1553	90229867	BH1	28.196967	-25.839297	30	28	dry		6-10	17-22;27-2	12-17;22-2	7
F1553	90229867	BH2	28.196266	-25.839576	30	>30	dry		5-9		9-30	7
F1553	90229867	BH3	28.197323	-25.838555	25	20	dry	6-16				4
F1553	90229867	BH4	28.197417	-25.839181	25	>25	dry	2-25				2
F1553	90229867	BH5	28.196715	-25.839323	17	>17	dry	8-17				4
F1553	90229867	BH6	28.196675	-25.839825	19	14	dry				9-12	3
F1553	90229867	BH7	28.196468	-25.839438	19	10	dry					3
F1553	90229867	BH8	28.196734	-25.839613	18	12	dry					3
F1553	90229867	BH9	28.196724	-25.839365	30	24	dry	7-10			17-24	7
F1553	90482391	BH10	28.197648	-25.838861	27	21	dry	1-15				4
F1553	90482391	BH11	28.196883	-25.838812	17	11	dry	2-11				3
F1553	90482391	BH12	28.197147	-25.839063	35	28	dry	3-6		12-13;15-2	10-12;13-1	3
F1553	90482391	BH13	28.196593	-25.839099	25	19	dry	1-8		15-19	12-15	6
F1553	90482391	BH14	28.196972	-25.839567	20	14	dry	5-7				3
F1553	90482391	BH15	28.196208	-25.839519	40	>40	dry	20-40				2
F1553	90482391	BH16	28.196328	-25.839889	55	48	dry	18-24		41-48	35-41	8
F1553	90482391	BH17	28.196442	-25.840145	12	6	dry					3
F1553	90482391	BH18	28.196324	-25.840248	60	>60	dry			43-60		8
F1553	90482391	BH19	28.196217	-25.840114	58	52	dry			24-28;37-4	33-37	8
F1553	90482391	BH20	28.196101	-25.840004	28	22	dry			16-22	10-16	7
F1553	90482391	BH21	28.196106	-25.839915	60	>60	dry				25-42;55-6	8
F1553	90482391	BH22	28.196385	-25.839957	18	12	dry					3
F1553	90482391	BH23	28.196684	-25.839937	14	8	dry					3
F1553	90482391	BH24	28.196366	-25.839748	20	14	dry					3
F1553	90482391	BH25	28.196583	-25.839669	38	32	dry				10-23;27-3	7
F1553	90482391	BH26	28.196566	-25.839793	14	8	dry					3
F1553	90482391	BH27	28.196857	-25.839794	40	34	dry				12-33	7
F1553	90482391	BH28	28.196755	-25.839835	33	27	dry				8-25	7
F1553	90482391	BH29	28.197178	-25.839362	46	40	dry	0-15		36-39	15-36;39-4	8
F1553	90482391	BH30	28.196898	-25.839692	35	29	dry	3-15			15-29	7
F1553	90482391	BH31	28.196657	-25.83949	16	10	dry					3
F1553	90482391	BH32	28.196411	-25.839232	11	5	dry					5
F1553	90482391	BH33	28.197405	-25.839307	14	6	dry	1-3				3
F1553	90482391	BH34	28.196736	-25.838942	15	8	dry	2-7				3
F1553	90482391	BH35	28.197295	-25.838935	27	21	dry	1-9	13-18	18-21		7
F1553	90482391	BH36	28.196839	-25.839444	30	24	dry			8-14;16-20	14-16	7
F1553	90482391	BH37	28.196731	-25.839427	22	16	dry				10-16	6
F1553	90482391	BH38	28.196562	-25.839253	31	25	dry	1-6		17-23	8-17	7
F1553	90482391	BH39	28.197121	-25.838766	18	12	dry	2-10				3
F1553	90482391	BH40	28.197514	-25.838978	30	23	dry	1-8		12-18		7
F1553	90482391	BH41	28.196784	-25.839491	37	31	dry	9-20			20-31	7
F1553	90482391	BH42	28.196584	-25.83938	22	16	dry	4-6		6-10	10-16	6
F1553	90482391	BH43	28.197046	-25.839448	24	18	dry	1-14				4
F1554	90421127	BH1	28.202227	-25.862146	33	29	25					4
F1566	90474080	BH3033	28.199191	-25.85578	18	12	dry					6
F1566	90474080	BH3450	28.198369	-25.856011	18	14	dry					6

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F1566	90474080	BH4228.5	28.199489	-25.856319	24	23	dry					7
F1566	90474080	BH4734	28.19925	-25.85657	17	9	dry					6
F157	90374709	BH1	28.19811	-25.846157	30	>30	dry	8-30				2
F157	90374709	BH2	28.198056	-25.845647	20	>20	dry				7-10	6
F157	90374709	BH3	28.198782	-25.845719	8	3	dry					5
F157	90374709	BH4	28.198476	-25.845491	25	16	dry				7-16	6
F157	90374709	BH5	28.19837	-25.845867	22	>22	dry	18-22			7-18	6
F157	90374709	BH6	28.198649	-25.845864	9	4	dry					5
F157	90374709	BH7	28.198411	-25.846126	15	7	dry	11-15				3
F1570	90564589	BH1	28.206969	-25.817233	20	5	dry					5
F1570	90564589	BH2	28.207141	-25.817176	27	15	dry					3
F1571	90373883	1	28.193988	-25.829595	22	>22	dry				17-19	4
F1571	90373883	2	28.193665	-25.828817	18	13	dry					3
F1571	90373883	3	28.194593	-25.828874	18	>18	dry					4
F1571	90373883	4	28.194539	-25.82912	20	19	dry					4
F158	90420421	3104	28.18664	-25.843058	25	19	dry		8-9; 13-16		16-19	6
F158	90420421	3602	28.187313	-25.842944	12	5	dry	7-12				5
F158	90420421	3903	28.186916	-25.843085	16	10	dry		6-8		8-10	6
F158	90420421	4001	28.186927	-25.843576	16	10	dry		4-6		6-10	3
F158	90420421	BG2	28.187106	-25.843668	10	5	dry					5
F158	90420421	BH1	28.18723	-25.843346	11	7	dry					3
F158	90420421	BH2	28.187067	-25.84309	15	9	dry	3-6			6-9	6
F158	90420421	BH3	28.186607	-25.843217	22	16	dry		13-14		5-13; 14-16	6
F1585	90474464	BH1	28.195127	-25.844863	30	24	dry	6-19				4
F1585	90474464	BH2	28.195205	-25.84504	30	24	dry	6-24				4
F1585	90474464	BH3	28.195333	-25.844839	38	23	dry	1-23				4
F1586	90420832	5002/5102	28.191615	-25.844822	10	4	dry					5
F1586	90420832	5004/5105	28.191878	-25.845078	10	4	dry					5
F1586	90420832	5200/5301	28.191699	-25.844478	14	8	dry					3
F1586	90420832	5203/5204	28.19195	-25.844826	30	29	dry				12-29	7
F1586	90420832	5501	28.192027	-25.844273	12	5	dry					5
F1586	90420832	5503/5404	28.192244	-25.844552	30	>30	dry				11-30	7
F1586	90420832	5601	28.192147	-25.844165	19	13	dry		7-9		9-13	6
F1586	90420832	5603	28.192348	-25.844369	29	23	dry				7-20	7
F1586	90420832	5701	28.192231	-25.844086	30	>30	dry			15-19	12-15; 19-3	7
F1586	90420832	5702	28.192371	-25.844168	23	18	dry				7-18	6
F1586	90420832	5704	28.19258	-25.844365	12	6	dry				3-6	6
F1586	90420832	5801	28.19233	-25.844006	23	>23	dry		18-20	21-23	11-18	7
F1586	90420832	5803/5903	28.192648	-25.844112	24	21	dry				12-18	7
F1586	90420832	5901	28.192502	-25.84387	30	>30	dry	7-30				2
F1587	90482126	BH1	28.200349	-25.830987	12	6	dry					3
F1588	90562330	BH1	28.205282	-25.840765	20	14	dry				11-14	6
F1589	90481844	BH1	28.202247	-25.830685	21	7	dry					3
F159	90128765	BH1101	28.187392	-25.838229	26	22	dry	8-15			15-21	4
F159	90128765	BH304	28.185829	-25.838905	20	15	dry	3-8				3
F159	90128765	BH601	28.186674	-25.838878	23	19	dry					4
F159	90128765	BH702	28.18667	-25.8386	20	18	dry	2-5				4
F159	90128765	BH800.5	28.187018	-25.838684	14	9	dry				5-7	3
F1591	90374004	1	28.208379	-25.844435	23	>23	dry	2-23				2
F1591	90374004	2	28.208163	-25.844156	27	>27	dry	2-27				2
F1591	90374004	3	28.208463	-25.844061	21	>21	dry	2-21				2
F1592	90482235	BH1	28.20584	-25.848238	11	5	dry					5
F1593	90481917	BH1	28.206812	-25.849747	10	3	dry					5
F1595	90574964	BH1	28.200178	-25.85509	10	4	dry					5
F1595	90574964	BH2	28.200406	-25.855427	12	5	dry					5
F1595	90574964	BH3	28.200004	-25.855433	9	3	dry					5
F1596	90230099	1	28.194785	-25.856207	30	>30	dry				20-30	7
F1596	90230099	2	28.194541	-25.856483	30	>30	dry				11-16;21-3	7
F1596	90230099	3	28.193959	-25.856005	30	>30	dry				11-24	7
F1596	90230099	4	28.19426	-25.855638	30	>30	dry				17-30	4
F1596	90230099	5	28.194448	-25.855999	30	>30	dry				19-30	7
F1596	90420541	3203.5	28.194846	-25.855687	39	34	dry					7
F1596	90420541	3304.5	28.195045	-25.855566	33	27	dry					4
F1596	90420541	3401.5	28.194794	-25.855196	34	23	dry					7
F1596	90420541	3704.3	28.195421	-25.855248	37	31	dry					4

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Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F1596	90482393	3106/3205	28.195031	-25.855904	30	28	dry					1
F1596	90482393	3201	28.194551	-25.855459	25	18	dry					4
F1596	90482393	3502/3603	28.195064	-25.855223	50	43	dry					4
F1596	90482393	3505/3606	28.195416	-25.855485	33	28	dry					4
F1596	90482393	3701	28.195025	-25.854941	35	29	dry					4
F1597	90420829	3100	28.200516	-25.846737	30	>30	dry					4
F1597	90420829	3102	28.200168	-25.846467	30	28	dry			27-28	17-27	7
F1597	90420829	3401	28.199952	-25.847027	16	10	dry		3-5			3
F1597	90420829	3602	28.199516	-25.847175	15	7	dry					3
F1597	90420829	3803	28.199087	-25.847333	30	>30	dry	11-30	9-11		3-9	6
F1597	90420829	3901	28.19931	-25.847736	30	>30	dry	9-30	5-9			2
F1597	90420829	4002	28.199001	-25.847742	30	>30	dry	3-30				2
F1598	90229758	BH1	28.187338	-25.830355	11	6	dry					3
F1598	90229758	BH2	28.187705	-25.830836	18	13	dry					3
F1598	90229758	BH3	28.187923	-25.83026	30	>30	dry	6-20				4
F1598	90229758	BH4	28.188461	-25.830826	30	27	dry	3-7				4
F1598	90229758	BH5	28.188498	-25.830436	19	14	dry	4-12				3
F1598	90229758	BH6	28.1887	-25.830053	30	>30	dry					4
F1598	90584835	BH1001/1101	28.186818	-25.830039	16	10	dry					3
F1598	90584835	BH1003	28.18722	-25.830201	36	>36	dry				31-36	7
F1598	90584835	BH1005	28.187622	-25.830081	40	>40	dry	11-33				2
F1598	90584835	BH1100/1101	28.186707	-25.830313	11	6	dry					3
F1598	90584835	BH1102/1203	28.187098	-25.830361	22	16	dry					4
F1598	90584835	BH1109	28.188395	-25.830415	24	18	dry	6-15				4
F1598	90584835	BH1205	28.187595	-25.8305	40	>40	dry	11-40				2
F1598	90584835	BH1205-201	28.187605	-25.82972	24	22	dry	8-14				4
F1598	90584835	BH1207	28.187988	-25.830525	23	17	dry	13-15			16-17	4
F1598	90584835	BH1301	28.186773	-25.830524	12	7	dry					3
F1598	90584835	BH1302/1203	28.187082	-25.830489	15	8	dry					3
F1598	90584835	BH1310	28.188563	-25.830693	32	24	dry	3-15				4
F1598	90584835	BH1404	28.187358	-25.83075	25	>25	dry	2-13				4
F1598	90584835	BH1407	28.187955	-25.830788	29	23	dry					4
F1598	90584835	BH1502	28.186885	-25.830894	24	>24	dry				21-24	7
F1598	90584835	BH1502/3	28.187094	-25.830856	36	>36	dry					4
F1598	90584835	BH1507/1606	28.187835	-25.830966	27	20	dry					4
F1598	90584835	BH1508/1608	28.188138	-25.830994	26	20	dry					4
F1598	90584835	BH1509	28.188338	-25.830955	19	12	dry					3
F1598	90584835	BH1511	28.188741	-25.830971	28	23	dry	8-16				4
F1598	90584835	BH1600/1601	28.186644	-25.830941	30	>30	dry					4
F1598	90584835	BH1604	28.187346	-25.831011	40	>40	dry					4
F1598	90584912	BH201	28.186825	-25.829567	60	59	dry	14-30				2
F1598	90584912	BH202	28.187015	-25.829505	60	>60	dry	17-32				2
F1598	90584912	BH203	28.187425	-25.829453	60	>60	dry	18-48				1
F1598	90584912	BH204	28.187054	-25.829722	60	>60	dry	10-28	28-32			4
F1598	90584912	BH205	28.187373	-25.829688	60	>60	dry	15-37				1
F1598	90584912	BH206	28.186962	-25.829956	51	45	dry	6-14				4
F1598	90584912	BH207	28.187292	-25.829904	35	28	dry	2-14				4
F1598	90584912	BH208	28.187552	-25.82986	60	56	dry	14-36				2
F1598	90584912	BH209	28.186901	-25.830127	25	19	dry	2-6				4
F1598	90584912	BH210	28.18745	-25.830058	49	43	dry	4-28				2
F1598	90584912	BH211	28.187758	-25.830304	60	>60	dry	7-50				1
F1598	90584912	BH212	28.188715	-25.830372	35	>35	dry	7-18;24-35	22-24			1
F1598	90584912	BH213	28.188702	-25.830742	34	>34	dry	2-8; 12-34				1
F1598	90584912	BH214	28.188184	-25.830649	24	18	dry	4-7				4
F1598	90584912	BH215	28.187526	-25.830636	60	>60	dry	7-32;49-60	48-49			1
F1598	90584912	BH216	28.187735	-25.830683	21	9	dry					3
F1598	90584912	BH217	28.187574	-25.83088	12	5	dry					5
F1598	90584912	BH218	28.188551	-25.830967	33	>33	dry	27-33				2
F1599	90421260	3102	28.193058	-25.828952	55	51	dry					4
F1599	90421260	3401	28.192442	-25.828859	63	55	dry					4
F1599	90421260	3404	28.192536	-25.82939	44	41	dry	28-41				4
F1599	90421260	3702/3802	28.191784	-25.82913	24	18	dry					4
F1599	90421260	3904	28.191551	-25.829527	38	32	dry				18-32	7
F1599	90474083	3704	28.191945	-25.829471	50	45	dry				39-45	8
F1599	90474083	3801	28.191654	-25.828968	43	38	dry					4

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F1599	90474083	3902/3903	28.191503	-25.829261	32	27	dry					4
F1599	90481738	3001	28.193225	-25.828746	48	44	dry					4
F1599	90481738	3003	28.193287	-25.829103	60	55	dry					4
F1599	90481738	3100/3201	28.192911	-25.828699	60	52	dry					4
F1599	90481738	3101	28.193027	-25.828774	60	53	dry	13-17				4
F1599	90481738	3104	28.193123	-25.829306	30	>30	dry	1-30				2
F1599	90481738	3205/3305	28.19286	-25.829526	56	50	dry					4
F1599	90481738	3302	28.192668	-25.829009	30	>30	dry	0-30				2
F1599	90481738	3303/3204	28.19281	-25.829258	60	55	dry	1-37			48-50	2
F1599	90481738	3501/3600	28.192133	-25.82881	60	>60	dry	0-42;46-52				1
F1599	90481738	3502	28.192278	-25.829062	55	53	dry	0-26				2
F1599	90481738	3504/3603	28.192227	-25.82934	60	59	dry	5-20;31-33				2
F1599	90481738	3505	28.192372	-25.829596	60	54	dry					4
F1599	90481738	3602/3603	28.192097	-25.82918	60	54	dry	1-48				1
F1599	90481738	3700/3601	28.191933	-25.828838	55	49	dry	1-36				2
F1599	90481738	3901/3802	28.19157	-25.829069	60	55	dry	7-35				2
F160	90124733	B10	28.18949	-25.830469	25	>25	dry					4
F160	90124733	B11	28.189476	-25.831001	25	>25	dry	11-25	9-11			4
F160	90124733	B12	28.189081	-25.830539	22	15	dry					3
F160	90124733	B4	28.190844	-25.831201	14	8	dry		2-4			3
F160	90124733	B5	28.190645	-25.831187	15	8	dry					3
F160	90124733	B7	28.190065	-25.830667	16	10	dry		2-6			3
F160	90124733	B8	28.19005	-25.831019	20	>20	dry	16-20				4
F160	90124733	B9	28.189663	-25.830827	10	2	dry					5
F160	90124735	B1	28.190744	-25.831187	20	14	dry				9-14	6
F160	90124735	B2	28.18986	-25.83084	18	13	dry					3
F160	90124735	B3	28.18897	-25.831063	30	25	dry	8-24				4
F1600	90482052	1(3107/3208)	28.192474	-25.829856	36	30	dry	1-22				4
F1600	90482052	BH2(3204)	28.191933	-25.8299	60	59	dry	4-59				2
F1600	90482052	BH3(3401)	28.191449	-25.830142	15	9	dry					3
F1600	90482052	4(3306/3407)	28.1923	-25.830127	60	54	dry	36-54				2
F1600	90482052	BH5(3102)	28.191632	-25.829745	42	36	dry			30-36		8
F1600	90482052	BH6(3404)	28.191909	-25.830168	20	12	dry					3
F1600	90482052	7(3202/3201)	28.191544	-25.829875	16	8	dry					3
F1600	90482052	8(3003/3104)	28.191868	-25.829695	33	27	dry					4
F1600	90482410	0(3302/3303)	28.191688	-25.830021	47	39	dry					8
F1600	90482410	BH9(3305)	28.192072	-25.830044	58	51	dry	1-25				4
F1601	90374672	1	28.192531	-25.838691	60	>60	dry	50-60				2
F1601	90374672	2	28.192571	-25.838046	40	36	dry	18-30				4
F1601	90374672	3	28.193126	-25.838281	11	7	dry					3
F1601	90374672	4	28.192844	-25.83778	16	10	dry					3
F1601	90374672	5	28.193405	-25.837942	13	8	dry					3
F1601	90374672	6	28.193142	-25.837518	12	6	dry					3
F1601	90374672	7	28.192198	-25.839012	65	61	dry	11-54				1
F1602	90126663	3/2-3	28.195515	-25.836919	30	>30	dry	17-30				2
F1603	90474112	3002/3102	28.197421	-25.843487	7	3	dry					5
F1603	90474112	3003/3103	28.197548	-25.84335	9	4	dry					5
F1603	90474112	3005/3105	28.197802	-25.84307	42	38	dry				32-37	8
F1603	90474112	3008/3109	28.198243	-25.842581	18	14	dry					3
F1603	90474112	3101	28.197214	-25.843569	10	4	dry					5
F1603	90474112	3104	28.197599	-25.843151	22	15	dry				14-15	3
F1603	90474112	3105/3205	28.197648	-25.842954	19	14	dry					3
F1603	90474112	3106	28.197849	-25.842874	36	31	dry					4
F1603	90474112	3107	28.197979	-25.842734	65	62	dry				11-31;53-6	8
F1603	90474112	3107/3208	28.197968	-25.842605	17	12	dry					3
F1603	90474112	3108/3209	28.19809	-25.842465	18	13	dry					3
F1603	90474112	3110	28.198359	-25.842313	20	14	dry					3
F1603	90474112	3200/3201	28.197001	-25.843525	5	0	dry					5
F1603	90474112	3202	28.197193	-25.843314	10	5	dry					5
F1603	90474112	3203	28.19732	-25.843174	6	1	dry					5
F1603	90474112	3204	28.197447	-25.843035	18	15	dry					3
F1603	90474112	3206	28.197699	-25.842759	5	1	dry					5
F1603	90474112	3206/3307	28.197687	-25.84263	5	1	dry					5
F1603	90474112	3207	28.197828	-25.842618	35	30	dry					4
F1603	90474112	3208	28.197954	-25.842479	6	1	dry					5

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F1603	90474112	3209/3210	28.198145	-25.842268	24	19	dry					4
F1603	90474112	3301	28.196912	-25.843338	24	18	dry	9-15			15-18	6
F1603	90474112	3302/3303	28.197102	-25.843131	23	17	dry	3-15			15-17	4
F1603	90474112	3303/3404	28.197156	-25.842931	12	7	dry					3
F1603	90474112	3304/3405	28.197281	-25.842792	7	2	dry					5
F1603	90474112	3305	28.19742	-25.842779	14	8	dry					3
F1603	90474112	3307	28.197674	-25.842502	18	13	dry					3
F1603	90474112	3307/3408	28.197659	-25.842376	7	2	dry					5
F1603	90474112	3308/3209	28.197943	-25.842352	21	16	dry					4
F1603	90474112	3309	28.197927	-25.842224	18	14	dry					3
F1603	90474112	3310	28.198054	-25.842083	24	18	dry	6-12				4
F1603	90474112	3401	28.196758	-25.843222	15	12	dry					3
F1603	90474112	3402	28.196885	-25.843084	16	10	dry					3
F1603	90474112	3405	28.197268	-25.842665	17	5	dry					5
F1603	90474112	3406	28.197396	-25.842524	7	2	dry					5
F1603	90474112	3407	28.197522	-25.842388	9	4	dry					5
F1603	90474112	3408	28.197648	-25.842248	30	23	dry				19-23	7
F1603	90474112	3409	28.197777	-25.842108	23	18	dry					4
F1603	90474112	3410	28.197902	-25.841968	12	7	dry	4-7				3
F1603	90474112	3411	28.198028	-25.84183	7	2	dry					5
F1603	90474228	BH1	28.198163	-25.841978	25	19	dry	2-10				4
F1603	90474228	BH10	28.197693	-25.843044	21	15	dry					3
F1603	90474228	BH11	28.197666	-25.843297	9	1	dry					5
F1603	90474228	BH12	28.197372	-25.843311	9	3	dry					5
F1603	90474228	BH2	28.198321	-25.842093	23	17	dry					4
F1603	90474228	BH3	28.198546	-25.842256	26	20	dry					4
F1603	90474228	BH4	28.197793	-25.842355	10	4	dry					5
F1603	90474228	BH5	28.198095	-25.84271	21	15	dry					3
F1603	90474228	BH6	28.197635	-25.842533	10	4	dry					5
F1603	90474228	BH7	28.197546	-25.842653	10	4	dry					5
F1603	90474228	BH8	28.197779	-25.842895	22	15	dry					3
F1603	90474228	BH9	28.197497	-25.84278	8	1	dry					5
F1604	90374117	1	28.199113	-25.842816	13	2	dry					5
F1604	90374117	2	28.198948	-25.842934	15	>15	dry					4
F1604	90374117	3	28.19852	-25.843005	20	>20	dry				8-20	7
F1604	90374117	4	28.198744	-25.843151	15	2	dry					5
F1604	90374117	5	28.198717	-25.842915	15	4	dry					5
F1606	90110120	15/5	28.193702	-25.84595	20	16	dry	2-9				4
F1606	90110120	15-14/2	28.193457	-25.846308	20	12	dry	3-9				3
F1606	90110120	18/5	28.19335	-25.845672	20	13	dry	1-12				3
F1607	90374385	3501	28.188264	-25.834224	20	>20	dry					4
F1607	90374385	3604	28.188838	-25.8345	8	1	dry					5
F1607	90374385	3702/01	28.18863	-25.834049	13	7	dry					3
F1607	90374385	4002	28.189113	-25.833729	12	7	dry		4-5		5-7	6
F1607	90374485	BH1	28.18852	-25.834246	30	>30	dry					7
F1607	90374485	BH10	28.189005	-25.833887	15	9	dry				6-9	6
F1607	90374485	BH11	28.188882	-25.833992	15	>15	dry		4-8		8-15	7
F1607	90374485	BH12	28.188636	-25.833735	15	3	dry					5
F1607	90374485	BH2	28.188685	-25.834394	14	7	dry				7-8	3
F1607	90374485	BH3	28.188456	-25.834449	11	2	dry					5
F1607	90374485	BH4	28.189112	-25.834105	25	18	dry				7-18	6
F1607	90374485	BH5	28.188818	-25.833746	41	40	dry				10-40	8
F1607	90374485	BH6	28.188982	-25.834202	10	3	dry					5
F1607	90374485	BH7	28.189347	-25.83408	15	8	dry					6
F1607	90374485	BH8	28.188557	-25.833807	11	3	dry					5
F1607	90374485	BH9	28.188877	-25.833611	15	10	dry				4-10	6
F1613	90093040	40.5/17.2	28.199762	-25.865034	22	16	dry			15-16		3
F1616	90092927	Z4-1	28.170975	-25.875205	30	16	dry					5
F1616	90092927	Z4-2	28.173199	-25.8729	45	2	dry					5
F1616	90092927	Z4-3	28.175396	-25.873564	45	2	dry					5
F1616	90092927	Z4-4	28.1751	-25.868604	45	4	dry					5
F1616	90092927	Z4-5	28.175145	-25.872496	20	3	16,5					5
F1616	90564306	101	28.179737	-25.860984	31	>31	dry	9-31				1
F1616	90564306	102	28.181297	-25.860796	12	5	dry					5
F1616	90564306	103	28.186873	-25.859059	31	>31	dry	13-31				1

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F1616	90564306	104	28.188427	-25.859364	31	>31	dry	8-12;>25				4
F1616	90564306	105	28.190615	-25.860172	17	10	dry					3
F1616	90564306	106	28.188938	-25.857056	22	>22	dry				12-22	7
F1616	90564306	107	28.186455	-25.854818	19	>19	dry				11-19	7
F1616	90564306	108	28.182237	-25.862973	31	>31	dry	9-31				1
F1616	90564306	109	28.177183	-25.866167	23	>23	dry	2-23				1
F1616	90564306	110	28.177432	-25.868736	21	>21	dry	1-21				1
F1616	90564306	111	28.179027	-25.868319	15	>15	dry	6-15	5-6			2
F1616	90564306	112	28.180399	-25.867963	20	>20	dry	10-15				4
F1616	90564306	113	28.179379	-25.870658	17	>17	dry	2-17				2
F1616	90564306	114	28.180724	-25.870496	17	>17	dry	2-17				2
F1616	90564306	115	28.182529	-25.869945	14	>14	dry	4-14				2
F1616	90564306	116	28.182988	-25.864576	19	>19	dry	7-19				2
F1616	90564306	117	28.185603	-25.865063	15	12	dry	10-12				3
F1616	90564306	118	28.190458	-25.867433	18	>18	dry			14-16		6
F1616	90564306	119	28.192261	-25.8624	22	20	dry				9-16	6
F1616	90564306	120	28.187778	-25.865657	22	>22	dry	17-21				4
F1616	90564306	AC22	28.187782	-25.863967	28	4	dry					5
F1616	90564306	BH1	28.178976	-25.861543	49	>49	dry	21-49			12-16	2
F1616	90564306	BH2	28.178826	-25.863478	54	>54	dry	20-54				1
F1616	90564306	BH3	28.179436	-25.863364	57	33	dry	8-33	3-6			2
F1616	90564306	BH4	28.184587	-25.862376	40	6	dry					3
F1616	90564306	BH5	28.186611	-25.860861	38	23	dry	6-23				4
F1616	90564306	BH6	28.18739	-25.862923	30	15	dry					3
F1616	90564306	G28	28.181897	-25.867502	29	11	dry	0-9				3
F1616	90564306	I24	28.182098	-25.866302	25	>25	dry	1-25				1
F1616	90564306	L28	28.183366	-25.867031	38	32	dry	9-32				2
F1616	90564306	S1	28.17484	-25.871035	22	>22	dry	9-22	5-9			2
F1616	90564306	S2	28.177899	-25.871949	40	1	dry	20-40				5
F1616	90564306	S3	28.177701	-25.872523	21	7	dry	11-13				3
F1616	90564306	S4	28.177486	-25.873071	20	2	dry	10-20				5
F1616	90564306	X37	28.187811	-25.868254	48	44	dry	20-44			14-15	1
F1619	90568737	1	28.203827	-25.853098	10	2	dry					5
F1619	90568737	2	28.204277	-25.853444	12	5	dry					5
F1619	90568737	3	28.203965	-25.853796	10	3	dry					5
F1619	90568737	4	28.20397	-25.853374	15	6	dry					3
F1619	90568737	5	28.203424	-25.853568	10	1	dry					5
F162	90126435	1	28.197848	-25.835886	25	>25	dry					4
F162	90126435	2	28.197619	-25.835577	25	>25	dry					4
F162	90126435	3	28.197974	-25.835545	25	>25	dry					4
F162	90126435	E/4-5	28.196137	-25.834313	30	>30	dry					4
F162	90126435	F-G/1	28.195611	-25.83478	30	>30	dry					4
F162	90126435	G-H/7	28.196758	-25.834529	35	>35	dry				28-29	4
F162	90126435	M-14/12-13	28.198235	-25.835059	30	>30	dry					4
F162	90126435	M5	28.196841	-25.835562	35	>35	dry					4
F1620	90230579	1	28.20166	-25.85688	25	8	dry					3
F1620	90230579	2	28.201281	-25.85676	30	>30	dry	17-30				2
F1620	90230579	3	28.201256	-25.856077	25	20	dry				10-20	6
F1620	90230579	4	28.200831	-25.856209	14	9	dry				7-9	3
F1620	90230579	5	28.200827	-25.85568	8	3	dry					5
F1620	90230579	6	28.201979	-25.856427	18	15	dry					3
F1620	90589048	BH1(HM&A)	28.201976	-25.856674	41	36	dry			22-27		8
F1620	90589048	BH126/1	28.2017	-25.857125	17	11	dry					3
F1620	90589048	BH126/2	28.201402	-25.856906	60	>60	dry	10-36				2
F1620	90589048	BH126/3	28.201614	-25.856664	27	21	dry					4
F1620	90589048	BH126/4	28.201922	-25.856819	30	17	dry					4
F1620	90589048	BH2(HM&A)	28.201598	-25.856369	24	10	dry				8-10	3
F1620	90589048	BH7(HM&A)	28.201492	-25.856173	14	8	dry				3-8	6
F1620	90589048	BH8(HM&A)	28.201856	-25.856553	27	21	dry					4
F1621	90562297	BH1	28.199064	-25.827957	13	4	dry					5
F1621	90562297	BH2	28.199104	-25.82779	24	18	dry					4
F163	90229627	BH1	28.194917	-25.84242	25	7	dry					3
F163	90229627	BH2	28.194892	-25.842908	25	10	dry					3
F163	90229627	BH3	28.194464	-25.843422	21	>21	dry					4
F163	90229627	BH4	28.194841	-25.842187	22	1	dry				12-14	5

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F163	90229627	BH5	28.194545	-25.842167	25	4	dry					5
F163	90229627	BH6	28.194342	-25.842604	8	1	dry					5
F163	90229627	BH7	28.193924	-25.842775	42	>42	dry	17-42			15-17	1
F163	90229627	BH8	28.194198	-25.843219	18	>18	dry	11-18			6-11	4
F163	90229627	BH9	28.19465	-25.843235	30	>30	dry	13-30	5-8		8-11	4
F163	90229850	BH10	28.194525	-25.843265	31	>31	dry	26-31				2
F163	90229850	BH11	28.194305	-25.843041	31	>31	dry	13-31			11-13	1
F163	90229850	BH12	28.194189	-25.842738	8	1	dry					5
F163	90229850	BH13	28.194066	-25.842498	31	>31	dry	24-31				2
F164	90124628	BG1	28.187418	-25.835554	11	4	dry					5
F164	90124628	BG2	28.186887	-25.835442	10	1	dry					5
F164	90124628	BG3	28.186943	-25.835974	17	13	dry					3
F164	90124628	BG4	28.186288	-25.836009	25	>25	dry					4
F164	90124628	BG5	28.186324	-25.83646	25	>25	dry					4
F164	90124628	BG6	28.186657	-25.836208	22	>22	dry	9-22				2
F164	90124628	BG7	28.186569	-25.835685	20	>20	dry	18-20	9-18			3
F164	90124628	BG8	28.185912	-25.836299	25	>25	dry					4
F164	90124628	BG9	28.187124	-25.835838	20	1	dry					5
F1642	90096937	1	28.189739	-25.864694	28	13	dry	22-28			8-13	3
F1642	90096937	10	28.189281	-25.865119	40	>30	dry	12-40				2
F1642	90096937	12	28.190182	-25.8665	30	25	dry			20-21	21-24	7
F1642	90096937	13	28.190442	-25.865351	37	27	dry	19-21		25-27		7
F1642	90096937	2	28.188829	-25.865796	20	>20	dry				6-8	4
F1642	90096937	3	28.189463	-25.867462	30	20	dry	2-19			19-20	4
F1642	90096937	4	28.19038	-25.866062	21	>21	dry					4
F1642	90096937	5	28.189157	-25.866471	30	>30	dry	9-30				2
F1642	90096937	6	28.188672	-25.867677	25	>25	dry	16-25				2
F1642	90096937	7	28.189012	-25.866132	30	>30	dry	20-30				2
F1642	90096937	8	28.189613	-25.866037	30	>30	dry	10-30				2
F1642	90096937	9	28.189678	-25.865442	29	5	dry	14-29				5
F1642	90564691	3A1	28.189803	-25.86588	42	36	dry	12-36			5-8;11-12	2
F1642	90564691	3A2	28.18978	-25.865706	42	36	dry	18-36			6-18	4
F1642	90564691	3A3	28.189792	-25.866051	41	35	dry	11-35			6-11	2
F1642	90564691	3A4	28.189794	-25.866237	40	34	dry	10-34			4-10	2
F1642	90564691	3A5	28.189772	-25.866442	41	35	dry	8-35			4-8	2
F1642	90564692	2A1	28.189261	-25.867499	32	24	dry	3-26				2
F1642	90564692	2A2	28.189289	-25.867447	44	38	dry	2-32			35-38	2
F1642	90564692	2A3	28.18931	-25.867385	47	31	dry	1-28				2
F1642	90564692	2A4	28.189162	-25.867658	33	27	dry	1-25			25-27	2
F1642	90564692	2A5	28.189242	-25.867596	32	26	dry	3-24				4
F1642	90564692	2A6	28.189338	-25.867533	42	35	dry	3-28			28-35	7
F1642	90564692	2B1	28.188939	-25.866726	16	>16	dry					6
F1642	90564692	2B2	28.189105	-25.866603	7	>7	dry					6
F1642	90564692	2B3	28.189041	-25.867022	8	>8	dry					2
F1642	90564692	BH125	28.188886	-25.866533	56	55	dry	23-47				2
F1642	90564692	BH128	28.188658	-25.866527	48	>48	dry	27-48				2
F1642	90564692	BH132	28.189108	-25.867256	40	34	dry	7-33				2
F1642	90564692	BH72	28.189775	-25.866117	39	34	dry	6-27				2
F1642	90564692	BH79	28.188973	-25.865684	54	48	dry	25-41		41-48	19-25	8
F1642	90564692	BH97	28.189766	-25.866553	43	37	dry	6-35				2
F1642	90564692	DB	28.189388	-25.867064	35	29	dry	2-28			28-29	2
F1642	90564692	DBX	28.189516	-25.867246	29	22	dry	1-22				4
F1642	90564692	DFX	28.190013	-25.867247	32	23	dry	1-23				4
F1642	90564692	DFY	28.1892	-25.867336	37	30	dry	10-30				2
F1642	90564692	DG	28.189719	-25.867575	27	19	dry	1-19				4
F1642	90564692	DHX	28.18937	-25.867782	27	21	dry	1-20			20-21	4
F1642	90564692	FC	28.188807	-25.866457	30	>30	dry	24-30			21-24	4
F1642	90564692	FD	28.188854	-25.866779	52	46	dry	23-44				2
F1642	90564692	FEX	28.188946	-25.867261	38	31	dry	12-31				4
F1642	90564692	FF	28.189196	-25.866842	47	42	dry	8-38			6-8	4
F1642	90564692	FIX	28.188885	-25.867565	45	38	dry	13-38			9-13	2
F1642	90564692	FJ	28.188806	-25.867147	45	>45	dry	19-45			11-19	2
F1642	90564692	HA	28.189259	-25.865302	30	>30	dry	12-30				2
F1642	90564692	HB	28.18961	-25.865598	35	>35	dry	12-35			6-12	2
F1642	90564692	HD	28.189425	-25.865787	37	>37	dry	11-37				2

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F1642	90564692	HE	28.189059	-25.865525	30	>30	dry	15-30				2
F1642	90564692	HM10	28.189329	-25.865549	39	38	dry	12-33	6-12			2
F1642	90564692	JA	28.189785	-25.866805	38	32	dry	6-32				2
F1642	90564692	JB	28.18996	-25.866558	35	31	dry	11-31				2
F1642	90564692	JBC	28.190073	-25.866638	18	12	dry				9-12	6
F1642	90564692	JC	28.190156	-25.866714	33	27	dry			24-27	10-24	7
F1642	90564692	JCD	28.19008	-25.866778	29	23	dry				10-23	7
F1642	90564692	JCS	28.190161	-25.866873	27	21	dry		13-17		9-13	7
F1642	90564692	JCW	28.189998	-25.866713	36	28	dry	9-16;19-28			16-19	4
F1642	90564692	JDC	28.190014	-25.866856	37	30	dry	5-29			30-31	2
F1642	90564692	JDX	28.189713	-25.867033	34	27	dry	1-26				2
F1642	90564692	JY	28.19009	-25.866894	37	31	dry	3-29			30-31	2
F1642	90564692	JZ	28.190008	-25.866598	32	27	dry					4
F1642	90564693	EAX	28.18877	-25.865792	47	41	dry	22-41			16-22	2
F1642	90564693	EAXX	28.188874	-25.865845	56	50	dry	23-50			7-23	2
F1642	90564693	ECX	28.189577	-25.866315	47	41	dry	9-36			6-9;39-41	2
F1642	90564693	EE	28.189286	-25.866734	41	36	dry	6-32				2
F1642	90564693	EEXX	28.189187	-25.866652	43	36	dry	14-36			3-14	4
F1642	90564693	EG	28.188675	-25.866283	57	51	dry	27-51			20-27	4
F1642	90564693	EH	28.18855	-25.866071	47	43	dry	28-43			14-20; 23-2	4
F1642	90564693	EZ	28.189648	-25.866443	34	>34	dry	13-34			10-13	4
F1642	90564693	FBX	28.188543	-25.866721	30	>30	dry	25-30			12-16; 22-2	4
F1642	90564693	GA	28.18949	-25.865991	50	46	dry	11-37			5-11	4
F1642	90564693	GB	28.189336	-25.865985	51	37	dry	10-37			7-10	4
F1642	90564693	GE	28.189331	-25.866251	45	38	dry	10-38			7-10	4
F1642	90564693	GW	28.189088	-25.865928	35	>35	dry	10-35			6-10	4
F1642	90589062	BH1	28.190012	-25.865626	27	20	dry				11-14	6
F1642	90589062	BH2	28.189859	-25.865499	15	9	dry				4-9	6
F1642	90589062	BH3	28.189782	-25.86536	29	23	dry	10-23			6-10	4
F1642	90589062	BH4	28.189808	-25.86544	29	23	dry	19-23				4
F1642	90589062	BH5	28.189944	-25.865567	25	19	dry				12-16	6
F1642	90589062	BH6	28.190155	-25.865622	26	20	dry				10-20	7
F1642	90589062	BH7	28.190074	-25.864895	30	24	dry			21-24		7
F1642	90589063	FS1	28.189812	-25.865082	?	>35	dry				7-35	8
F1642	90589063	FS2	28.189888	-25.865054	35	29	dry		23-25	25-29	8-11;14-23	7
F1642	90589063	FS3	28.189846	-25.864919	30	24	dry				13-18	7
F1642	90589063	FS4	28.189767	-25.864946	32	26	dry				9-24	7
F1647	90563184	BH1	28.172702	-25.856763	22	15	dry					3
F1647	90563184	BH2	28.172606	-25.856778	25	19	dry					4
F1649	90563186	10/3	28.183079	-25.854998	15	>15	dry					4
F1649	90563186	10/6	28.183513	-25.855348	25	>25	dry					4
F1649	90563186	3/2	28.183776	-25.854213	24	>23	dry					4
F1649	90563186	3/5-6	28.184168	-25.854544	13	8	dry					3
F1649	90563186	8/3	28.183335	-25.854729	25	19	dry					6
F1649	90563186	8/7	28.183936	-25.855181	30	26	dry					4
F1649	90563186	9/8	28.183986	-25.855452	10	>10	dry					3
F1649	90563186	BH1	28.183752	-25.855504	35	29	dry					7
F1649	90563186	BH2	28.183836	-25.855001	27	23	dry					7
F1649	90563186	BH3	28.183309	-25.855042	38	32	dry				7-32	7
F1649	90563186	BH4	28.183226	-25.854726	40	36	dry		19-22		13-19;22-3	8
F165	90117229	1	28.185921	-25.832846	25	>25	dry					4
F165	90117229	2	28.185872	-25.833074	25	>25	dry					4
F165	90117229	3	28.185239	-25.833183	25	>25	dry					4
F165	90117229	4	28.18527	-25.832806	10	1	dry					5
F1651	90562099	BH1	28.189056	-25.853816	41	37	dry				15-28	8
F1651	90562099	BH10	28.189527	-25.853239	19	>19	dry					4
F1651	90562099	BH11	28.189672	-25.853194	10	3	dry					5
F1651	90562099	BH12	28.189395	-25.853356	30	24	22m	12-20	2-12		20-24	5
F1651	90562099	BH14	28.189224	-25.853344	34	24	dry				7-14;17-24	7
F1651	90562099	BH15	28.189211	-25.852828	40	35	19m			9-10	6-9;10-20;3	7
F1651	90562099	BH2	28.18899	-25.853504	32	25	dry				11-25	7
F1651	90562099	BH3	28.189246	-25.853452	26	21	22m				11-21	7
F1651	90562099	BH4	28.189683	-25.853591	10	4	dry					5
F1651	90562099	BH5	28.189759	-25.853277	15	9	dry					3
F1651	90562099	BH6	28.189572	-25.853354	32	25	dry	13-25				4

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F1651	90562099	BH7	28.18942	-25.853634	32	22	dry					4
F1651	90562099	BH8	28.189337	-25.853232	32	26	dry	2-8				2
F1651	90562099	BH9	28.189259	-25.852852	17	>17	dry					4
F1658	90564322	42-43/02	28.181881	-25.857122	30	>30	dry	13-30				2
F1658	90564322	42-43/06	28.180918	-25.857785	22	12	dry	5-12				3
F1658	90564322	68-70/60	28.180766	-25.859164	30	>30	dry					3
F1658	90564322	72/100	28.181187	-25.859121	11	5	dry					5
F1658	90564322	CC/1	28.182907	-25.857806	13	7	dry					6
F1658	90564322	CC/10	28.181718	-25.859874	16	9	dry					3
F1658	90564322	CC/11	28.180297	-25.858248	34	6	dry	19-34				3
F1658	90564322	CC/12	28.180455	-25.857722	39	>39	dry	20-39				2
F1658	90564322	CC/13	28.181629	-25.857674	36	29	dry	10-28				2
F1658	90564322	CC/14	28.182192	-25.857232	46	39	dry	19-35			8-19	4
F1658	90564322	CC/15	28.181013	-25.85738	44	>44	dry	13-44			33-28	2
F1658	90564322	CC/16	28.180781	-25.858237	37	>37	dry	22-37				2
F1658	90564322	CC/17	28.181408	-25.856874	35	27	dry	6-27				2
F1658	90564322	CC/2	28.182497	-25.858253	23	>23	dry					6
F1658	90564322	CC/3	28.182444	-25.857843	32	>32	dry	26-32	10-16		4-10	6
F1658	90564322	CC/4	28.183323	-25.858143	33	>33	dry					6
F1658	90564322	CC/5	28.181508	-25.858558	20	14	dry					3
F1658	90564322	CC/6	28.182071	-25.858679	20	>20	dry					3
F1658	90564322	CC/7	28.182223	-25.859342	19	12	dry					3
F1658	90564322	CC/8	28.181702	-25.859095	20	16	dry	8-13				4
F1658	90564322	CC/9	28.181302	-25.859542	27	11	dry	15-27	11-15		3-11	3
F166	90373860	BH1	28.192855	-25.834361	30	>30	dry	25-30				4
F166	90373860	BH2	28.192727	-25.834886	21	14	dry	2-10				3
F166	90373860	BH3	28.192376	-25.834924	16	10	dry					3
F166	90373860	BH4	28.192162	-25.834603	15	8	dry					3
F166	90373860	BH5	28.192076	-25.835433	20	13	dry				8-12	6
F166	90373860	BH6	28.191509	-25.835424	18	12	dry				7-10	6
F1664	90563193	BH 1	28.197249	-25.851771	22	16	dry					6
F1664	90563193	BH 2	28.197743	-25.851434	22	15	dry					6
F1664	90563193	BH 2000/2001	28.196589	-25.851334	17	3	dry					5
F1664	90563193	BH 2105	28.197394	-25.851726	32	>32	dry					7
F1664	90563193	BH 2301	28.197068	-25.850955	35	22	dry					4
F1664	90563193	BH 2303	28.19736	-25.851168	9	2	dry					5
F1664	90563193	BH 2305	28.197628	-25.851486	20	13	dry					6
F1664	90563193	BH 3	28.197338	-25.851314	25	20	dry					6
F1664	90563193	BH 4	28.197662	-25.851599	24	18	dry					4
F1664	90575009	BH L1	28.196991	-25.851057	23	17	dry					4
F1664	90575009	BH L10	28.196875	-25.851119	17	11	dry					3
F1664	90575009	BH L2	28.197044	-25.851173	26	14	dry					3
F1664	90575009	BH L3	28.197176	-25.851293	22	15	dry					3
F1664	90575009	BH L4	28.197352	-25.851444	22	16	dry					4
F1664	90575009	BH L5	28.197448	-25.851314	24	21	dry					4
F1664	90575009	BH L6	28.197612	-25.851331	21	>21	dry					4
F1664	90575009	BH L7	28.197458	-25.851504	25	17	dry					4
F1664	90575009	BH L8	28.196883	-25.851287	23	17	dry					4
F1664	90575009	BH L9	28.19671	-25.85138	16	10	dry					3
F1666	90562936	RMS1	28.191704	-25.861467	25	>25	dry					4
F1666	90562936	RMS2	28.191899	-25.861536	25	>25	dry					4
F1666	90562936	RMS3	28.192131	-25.861909	25	>25	dry					4
F1666	90562936	RMS4	28.191664	-25.861877	25	>25	dry	8-9				4
F1666	90562936	RMS5	28.1918	-25.862027	23	18	dry					4
F1666	90562936	RMS6	28.191394	-25.861767	25	>25	dry					4
F1666	90563195	DT1	28.191686	-25.862538	41	35	27.2m				28-35	7
F1666	90563195	DT2	28.192145	-25.862463	31	25	24.9m					4
F1666	90563195	DT3	28.192429	-25.861816	26	20	22.2m				17-20	6
F1666	90563195	DT4	28.192084	-25.861357	33	27	dry				26-27	4
F1666	90563195	DT5	28.191202	-25.861495	29	23	dry				22-23	4
F167	90230743	BH1	28.190706	-25.837688	24	19	dry					4
F167	90230743	BH2	28.19086	-25.83702	48	43	dry				22-43	8
F167	90230743	BH3	28.191098	-25.836564	30	25	dry		15-18		18-25	7
F167	90230743	BH4	28.191601	-25.83691	18	13	dry		8-9		5-8	6
F167	90230743	BH5	28.191893	-25.836645	10	3	dry					5

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of: Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F167	90230743	BH6	28.191743	-25.836783	53	16-Feb	dry				40-47	8
F167	90230743	BH7	28.191231	-25.83645	23	17	dry		13-15		8-13;15-17	6
F167	90230743	BH8	28.190794	-25.837224	10	2	dry					5
F168	90079113	BH2	28.191428	-25.830737	15	5	dry					5
F1685	90584349	BH3102	28.180274	-25.839631	13	7	dry					3
F1685	90584349	BH3107	28.180341	-25.84001	10	0	dry					5
F1685	90584349	BH3201	28.180334	-25.839523	13	8	dry					3
F1685	90584349	BH3209	28.18045	-25.840137	40	3	dry					5
F1685	90584349	BH3408	28.18059	-25.84002	10	2	dry					5
F1685	90584349	BH3502-3401	28.180544	-25.839506	21	15	dry					3
F1685	90584349	BH3505	28.180632	-25.839777	34	28	dry					4
F1685	90584349	BH4005	28.181021	-25.83968	30	24	dry					4
F1685	90584349	BH4201	28.181113	-25.839337	16	9	dry					3
F1685	90584349	BH4401-4301	28.181233	-25.839302	26	4	dry					5
F1692	90564188	BH1106	28.197521	-25.841075	36	>36	dry					4
F1692	90564188	BH1207	28.197531	-25.841248	40	37	dry				19-38	8
F1692	90564188	BH1306/1407	28.197754	-25.841314	10	3	dry					5
F1692	90564188	BH1607/1706	28.198094	-25.841564	19	13	dry					3
F1692	90564188	BH1700/1801	28.198788	-25.841053	10	>10	dry					3
F1692	90564188	BH1701	28.19869	-25.841033	36	>36	dry	10-32				2
F1692	90564188	BH1702	28.198577	-25.841143	10	>10	dry					3
F1692	90564188	BH1703	28.198485	-25.841241	18	12	dry					3
F1692	90564188	BH1801/02	28.198768	-25.841178	29	8	dry					3
F1692	90564188	BH1807	28.198214	-25.841749	14	8	dry					3
F1692	90564188	BH1905	28.1986	-25.841662	16	10	dry					3
F1692	90564188	BH2002	28.198928	-25.841406	11	5	dry					5
F1692	90564188	BH2201/2202	28.199217	-25.841506	14	4	dry					5
F1692	90564188	BH2204	28.198982	-25.84176	24	9	dry					3
F1692	90564188	BH2206/2207	28.198712	-25.842023	13	4	dry					5
F172	90125996	1	28.202484	-25.848142	25	>25	dry	9-25				2
F172	90125996	2	28.202158	-25.848508	25	24	dry					4
F173	90125836	1	28.202328	-25.850143	25	>25	dry	3-9				4
F173	90125836	2	28.202445	-25.850017	18	12	dry	2-7				3
F1730	90079080	34/34	28.188285	-25.838274	24	9	dry	1-9				3
F1730	90079080	35/34	28.188027	-25.838509	14	7	dry					3
F1733	90127735	1008	28.17846	-25.846947	30	>30	dry					7
F1733	90127735	507	28.178436	-25.84603	30	>30	dry					4
F1733	90127735	610	28.179002	-25.846331	15	9	dry					3
F1746	90568799	BH3106	28.202173	-25.851932	51	>51	dry	23-51			38-39	1
F1746	90568799	BH3405	28.202435	-25.852302	18	12	dry				6-12	6
F1746	90568799	BH3602	28.20239	-25.852805	31	>31	dry	20-31			9-10	2
F175	90564662	BH1	28.204189	-25.831519	25	16	dry					4
F175	90564662	BH2	28.204117	-25.831546	26	20	dry				12-20	7
F175	90564662	BH3	28.203994	-25.831573	21	15	dry					3
F175	90564662	BH4	28.203881	-25.831644	21	15	dry					3
F175	90564662	BH5	28.203745	-25.831673	20	12	dry					3
F178	90564517	BH1/1525	28.195284	-25.82378	25	19	dry					4
F178	90564517	BH2/1525	28.195377	-25.823807	20	14	dry					3
F179	90564518	BH1/1532	28.194818	-25.822475	25	19	dry					4
F179	90564518	BH2/1532	28.194776	-25.8226	19	13	dry					3
F180	90584248	BH1	28.194836	-25.839831	32	27	dry	11-14	17-22		6-11;14-17	7
F180	90584248	BH2	28.194977	-25.839867	17	11	dry				5-11	6
F180	90584248	BH3	28.194772	-25.839792	24	18	dry				7-11;14-17	6
F180	90584248	BH4	28.194914	-25.839653	50	>50	dry				32-50	8
F180	90589067	BH1	28.195118	-25.84009	30	18	dry				10-18	6
F180	90589067	BH2	28.194974	-25.840052	15	3	dry					5
F181	90584351	BH1531-1	28.194579	-25.823094	24	18	dry					4
F181	90584351	BH1531-2	28.194618	-25.823202	22	16	dry					4
F1810	90229493	BH1	28.209054	-25.849029	25	>25	16.5	5-25				1
F1810	90229493	BH2	28.209207	-25.848988	15	>15	dry					1
F182	90374684	1	28.200099	-25.851217	23	16	dry					4
F182	90374684	2	28.19979	-25.850848	47	44	dry			31-44	23-31	8
F182	90374684	3	28.200199	-25.850826	27	22	dry	2-18				4
F182	90374684	4	28.200016	-25.850465	30	25	dry	1-19				4
F182	90374684	5	28.200545	-25.849934	40	>40	dry	4-37				2

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of: Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F182	90374684	6	28.201314	-25.849929	40	>40	dry					8
F182	90374684	7	28.201176	-25.850078	58	56	dry	15-45			49-56	4
F182	90374684	8	28.200704	-25.849627	31	>31	dry	16-31				2
F182	90374684	9	28.201135	-25.849724	30	>30	dry	19-30				2
F183	90374348	BH1	28.198941	-25.850355	19	12	dry					3
F183	90374348	BH2	28.199621	-25.850433	30	28	dry	2-19				4
F183	90374348	BH3	28.1993	-25.849966	20	14	dry	2-11			11-14	3
F183	90374348	BH4	28.200075	-25.849666	30	>30	dry	1-30				2
F183	90374348	BH5	28.200582	-25.849383	30	>30	dry	15-30				2
F183	90374348	BH6	28.199587	-25.849819	20	15	dry	2-14			14-15	3
F183	90374348	BH7	28.199412	-25.850275	22	17	dry	3-12				4
F183	90374348	BH8	28.199217	-25.850671	16	11	dry				10-11	3
F183	90374348	BH9	28.200024	-25.849278	34	29	dry	1-29				2
F1831	90564607	BH1072-1	28.217385	-25.860758	30	13	dry					3
F1831	90564607	BH1072-2	28.217401	-25.860613	30	9	dry					3
F1831	90564607	BH1073-1	28.217779	-25.860744	21	3	dry					5
F1831	90564607	BH1073-2	28.217781	-25.860519	28	9	dry					3
F1833	90564516	BH1042-1	28.211547	-25.861731	25	14	dry					3
F1833	90564516	BH1042-2	28.211358	-25.861772	20	10	dry					3
F184	90128270	DH1	28.203257	-25.83352	23	15	dry					3
F184	90128270	DH2	28.203481	-25.833528	22	18	dry		9-11	11-12		6
F184	90128270	DH3	28.203381	-25.833768	12	2	dry					5
F184	90128270	DH4	28.203602	-25.833773	9	2	dry					5
F185	90564542	BH1	28.201148	-25.831947	16	11	dry					3
F1855	90584294	BH7025/1	28.210511	-25.840249	29	23	dry					4
F1855	90584294	BH7025/2	28.210641	-25.84025	26	20	dry					4
F187	90574995	BH1-593	28.207559	-25.842001	28	21	dry				12-17	7
F187	90574995	BH2-593	28.207337	-25.842047	30	24	dry				12-23	7
F192	90564557	1	28.20228	-25.831136	13	7	dry					3
F192	90564557	2	28.202502	-25.831077	19	13	dry					6
F192	90564557	3	28.202685	-25.830972	11	5	dry					5
F2016	90584202	BH695-1	28.198443	-25.823864	11	4	dry					5
F2016	90584202	BH695-2	28.198472	-25.823964	13	7	dry					3
F2017	90584203	BH681-1	28.200562	-25.828154	38	9	dry					3
F2017	90584203	BH681-2	28.200487	-25.828125	24	13	dry					3
F2018	90584204	BH1038-1	28.209743	-25.861987	12	>12	dry	3-12				2
F2018	90584204	BH1038-2	28.209916	-25.862241	19	>19	dry	3-19				2
F2019	90584205	BH1039-1	28.210206	-25.862136	20	>20	dry	4-20				2
F2019	90584205	BH1039-2	28.210202	-25.861883	18	>18	dry	3-18				2
F2025	90584211	BH2289/1	28.213122	-25.845101	15	1	dry					5
F2036	90584270	BH7015/1	28.207542	-25.824781	35	>35	dry	3-35				1
F2036	90584270	BH7015/2	28.207503	-25.824573	29	>29	dry	5-29				1
F214	90589003	BH1034/1	28.215923	-25.859692	17	11	dry					3
F214	90589003	BH1034/2	28.216316	-25.859575	21	15	dry				5-15	6
F214	90589003	BH1034/3	28.216561	-25.859492	11	5	dry					5
F214	90589003	BH1034/4	28.216157	-25.859595	16	10	dry					3
F218	90588681	BH1890-1	28.211699	-25.844055	28	20	dry				16-20	6
F218	90588681	BH1890-2	28.21157	-25.844126	25	>25	dry	10-25				2
F218	90588681	BH1890-3	28.211646	-25.844057	18	>18	dry	6-18				2
F218	90588681	BH1890-4	28.21157	-25.843863	21	>21	dry	9-21				2
F218	90588681	BH1890-5	28.211682	-25.843934	13	7	dry					3
F2266	90584241	DG1	28.214968	-25.841585	27	19	dry				5-19	6
F2266	90584241	DG6	28.214977	-25.841478	16	0	dry					5
F2303	90588857	10/7	28.20284	-25.853818	15	5	dry					5
F2303	90588857	3100/3001	28.203207	-25.852575	20	13	dry					6
F2303	90588857	3203/3104	28.203495	-25.852775	13	0	dry					5
F2303	90588857	3602	28.202843	-25.85325	10	1	dry					5
F2303	90588857	3801	28.202613	-25.853375	10	1	dry					5
F233	90230600	BH3504	28.195385	-25.866683	10	0	dry					5
F233	90230600	BH4102	28.194338	-25.866773	35	29	dry				16-29	7
F233	90230600	BH4503	28.19379	-25.867194	31	25	dry					4
F235	90229327	BH1	28.186594	-25.85399	26	>26	dry					4
F235	90229327	BH2	28.186221	-25.85366	22	>22	dry					4
F235	90229327	BH3	28.186817	-25.85316	20	>20	dry			10-13		7
F236	90584201	BH2450/1	28.206569	-25.835443	14	8	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F236	90584201	BH2450/2	28.206438	-25.835441	17	11	dry					3
F2370	90584185	693/1	28.19856	-25.824199	30	14	dry					3
F2370	90584185	693/2	28.198531	-25.824154	28	9	dry					3
F2373	90589107	BH1815/1	28.207087	-25.845159	18	10	dry					3
F2373	90589107	BH1815/2	28.207206	-25.845232	30	20	dry					4
F2376	90065874	1/25	28.19967	-25.850963	26	13	dry					3
F2376	90065874	10/32	28.199546	-25.855617	30	>30	dry					1
F2376	90065874	10-11/46	28.187187	-25.846264	45	5	41,40m					5
F2376	90065874	12/34	28.182789	-25.843212	30	>30	dry					4
F2376	90065874	13/11	28.19152	-25.851066	35	14	dry					6
F2376	90065874	13/48	28.186995	-25.84749	31	1	26,30m					5
F2376	90065874	14/31	28.198108	-25.85649	20	8	dry					3
F2376	90065874	20/36	28.198115	-25.859772	25	>25	dry					7
F2376	90065874	23/36	28.197275	-25.860725	25	>25	dry					4
F2376	90065874	3/11	28.194285	-25.847731	15	4	dry					5
F2376	90065874	3/46	28.189478	-25.843962	30	>30	dry					1
F2376	90065874	32/35	28.205512	-25.851152	27	13	dry				1-8	6
F2376	90065874	36/27	28.185671	-25.836989	21	>21	dry					4
F2376	90065874	36/32	28.203056	-25.851395	45	>45	dry					4
F2376	90065874	37/26	28.200745	-25.850381	33	30	dry					1
F2376	90065874	37/7	28.194389	-25.845389	31	11	dry					3
F2376	90065874	38/18	28.197819	-25.848519	45	12	dry					3
F2376	90065874	39/36	28.203732	-25.853481	38	6	dry					3
F2376	90065874	39/48	28.190999	-25.843895	20	14	dry					3
F2376	90065874	4-5/12-13	28.19431	-25.84885	35	16	dry					4
F2376	90065874	5/23	28.197966	-25.851583	27	18	dry					4
F2376	90065874	5/42	28.187547	-25.843551	25	7	dry					3
F2376	90065874	7/48	28.188985	-25.845887	33	10	dry					6
F238	90083047	16-12/5	28.198785	-25.852879	10	5	dry					5
F238	90083047	16-16/13	28.199233	-25.853931	10	6	dry					3
F238	90083047	16-18/11	28.198875	-25.854081	20	>20	dry					4
F238	90083047	16-18/3	28.198139	-25.853453	10	6	dry	2.5-5.5				3
F238	90083047	16-21-22/3	28.197792	-25.853656	10	7	dry					3
F238	90083047	16-26/9	28.198169	-25.854523	10	8	dry					3
F238	90083047	16-3/11	28.200238	-25.852544	10	5	dry					5
F238	90083047	16-5/11	28.200088	-25.852771	15	12	dry					3
F238	90083047	16-6/6	28.199395	-25.852592	15	13	dry					3
F238	90083047	16-9/13	28.200059	-25.853274	10	7	dry					3
F238	90083047	24-25/7	28.198097	-25.854165	10	2	dry			8-9		5
F238	90083047	6/15	28.200423	-25.853088	20	19	dry					6
F239	90083097	1	28.199134	-25.856942	22	17	dry		5-9		9-17	6
F239	90083097	10	28.19914	-25.856157	25	3	dry					5
F239	90083097	2	28.19942	-25.856356	24	4	dry					5
F239	90083097	3	28.198836	-25.85601	25	6	dry					3
F239	90083097	4	28.198265	-25.856346	22	15	dry		6-11		11-13	6
F239	90083097	5	28.198465	-25.856094	25	0	dry					5
F239	90083097	6	28.198768	-25.85661	25	>24	dry					7
F239	90083097	7	28.199264	-25.856702	25	>24	dry		6-8			7
F239	90083097	8	28.198951	-25.856389	25	7	dry					3
F239	90083097	9	28.198759	-25.85576	25	4	dry					5
F240	90083090	1	28.190914	-25.854441	25	>25	dry					4
F240	90083090	10	28.190362	-25.854849	16	2	dry					5
F240	90083090	11	28.19078	-25.854822	24	>24	dry					4
F240	90083090	12	28.190673	-25.854501	25	18	dry					4
F240	90083090	2	28.190491	-25.854804	26	18	dry					6
F240	90083090	3	28.190185	-25.854998	25	>25	dry					7
F240	90083090	4	28.190498	-25.855444	39	33	dry					7
F240	90083090	5	28.190848	-25.855465	19	>18	dry					4
F240	90083090	6	28.191129	-25.85508	23	5	dry					5
F240	90083090	7	28.190835	-25.855566	13	3	dry					5
F240	90083090	8	28.190654	-25.855347	23	16	dry				8-10; 14-16	4
F240	90083090	9	28.1904	-25.85506	39	33	27m				20-27	7
F241	90083110	BH1	28.196365	-25.846278	15	10	dry					3
F241	90083110	BH151/1	28.196151	-25.846516	25	12	dry					3
F241	90083110	BH151/2	28.196639	-25.846656	25	10	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F241	90083110	BH151/3	28.196163	-25.846927	25	10	dry					3
F241	90083110	BH2	28.19656	-25.846428	17	12	dry					3
F242	90065548	D/3	28.190592	-25.85412	10	2	dry					5
F242	90065548	E-F/11	28.189946	-25.854632	20	13	dry					3
F242	90065548	F/14	28.189773	-25.854888	18	12	dry					3
F242	90065548	F/6-7	28.190306	-25.854323	10	4	dry					5
F242	90065548	I/2	28.190301	-25.853844	10	2	dry					5
F242	90065548	J/6	28.189985	-25.85406	12	3	dry					5
F242	90065548	K/11	28.189563	-25.85433	18	11	dry					3
F242	90065548	M/2	28.190027	-25.853648	27	21	dry					7
F242	90065548	N/5	28.189745	-25.853798	29	23	dry			17-23		7
F242	90065548	O/8	28.189496	-25.853929	30	26	dry	8-11				4
F242	90065548	P/11-12	28.189183	-25.854107	20	13	dry					3
F243	90100326	BG1	28.194695	-25.851884	25	>25	dry					4
F243	90100326	BG2	28.195091	-25.851441	25	10	dry					3
F243	90100326	BG3	28.195054	-25.852222	25	5	dry					5
F243	90100326	BG4	28.195241	-25.851768	25	4	dry					5
F245	90109044	BG1	28.202916	-25.855112	30	>30	dry	11-30				2
F245	90109044	BG2	28.202528	-25.855125	29	24	dry	1-17				4
F245	90109044	BG3	28.201828	-25.854506	30	17	dry	1-16				4
F245	90109044	BG4	28.202436	-25.854391	30	24	dry	1-21				4
F2456	90584263	BH1	28.205975	-25.83912	20	10	dry		4-5			3
F2456	90584263	BH2	28.206071	-25.839081	28	15	dry					3
F2458	90584274	BH1071-1	28.217008	-25.861002	24	10	dry					3
F2458	90584274	BH1071-2	28.217003	-25.860671	11	6	dry					3
F247	90230637	BH2	28.198154	-25.861022	20	14-Jan	dry					6
F247	90230637	BH3	28.198818	-25.860787	30	24	dry		14-18		6-14	4
F247	90230637	BH4	28.197772	-25.860571	14	8	dry				2-8	6
F247	90230637	BH5	28.197679	-25.860063	30	23	dry				11-23	7
F247	90230637	BH6	28.19723	-25.860665	24	18	dry		11-14	14-14.5		4
F247	90420472	A	28.197775	-25.861006	23	16	dry				8-16	6
F247	90420472	B	28.198464	-25.861238	31	26	dry				18-26	7
F247	90420472	BH1	28.198251	-25.861531	19	15	dry				7-15	6
F247	90420472	C	28.198204	-25.861013	28	23	dry		17-21	21-23		7
F247	90420472	D	28.197504	-25.861079	36	30	dry				14-20	7
F247	90420472	E	28.197768	-25.861326	36	30	dry		25-26		16-25; 26-3	7
F247	90420472	F	28.198024	-25.861493	36	30	dry		19-22; 27-2		12-19;22-2	7
F248	90575007	BH1	28.196246	-25.84357	50	6	dry	25-44				3
F248	90575007	BH10	28.195917	-25.843943	53	46	dry	1-45				1
F248	90575007	BH11	28.196051	-25.844133	40	32	dry	13-22	2-6;9-13			4
F248	90575007	BH12	28.196373	-25.844246	50	45	dry	12-45	6-12			2
F248	90575007	BH2	28.19658	-25.84377	14	3	dry					5
F248	90575007	BH3	28.196766	-25.843906	14	4	dry					5
F248	90575007	BH4	28.196432	-25.843601	28	7	dry					3
F248	90575007	BH5	28.196425	-25.843797	50	7	dry	24-42				3
F248	90575007	BH6	28.196177	-25.843797	60	50	dry	6-50	2-4			1
F248	90575007	BH7	28.196457	-25.84398	45	4	dry	23-40				5
F248	90575007	BH8	28.196629	-25.844153	20	7	dry					3
F248	90575007	BH9	28.196269	-25.844019	55	48	dry	2-48				1
F250	90127162	BH18/23	28.194173	-25.855627	27	>27	dry					4
F250	90127162	BH2/11	28.193136	-25.855268	30	26	dry					4
F250	90127162	BH2/5	28.193729	-25.85462	24	17	dry					4
F250	90127162	BH5/7	28.193907	-25.855114	30	>30	dry					4
F250	90127162	BH6-7/10-11	28.19375	-25.855632	30	>30	dry	10-20				4
F250	90127162	BH7/2-3	28.194603	-25.854817	30	>30	dry	9-20				2
F250	90562919	A	28.193485	-25.854879	31	28	dry					4
F250	90562919	B	28.19373	-25.855392	50	>50	dry					4
F250	90562919	C	28.194351	-25.855186	57	53	dry					4
F250	90562919	D	28.194212	-25.854508	42	37	dry					4
F250	90562919	E	28.193697	-25.855875	40	36	dry					4
F252	90474123	BG4	28.185201	-25.833524	30	>30	dry					4
F252	90474123	BG5	28.184515	-25.834012	30	>30	dry				13-17	7
F252	90474123	BH1	28.185498	-25.833911	30	>30	dry					4
F252	90474123	BH2	28.185057	-25.834058	39	>39	dry					4
F252	90474123	BH3	28.184871	-25.833786	30	>30	dry					4

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F252	90474123	BH4	28.184452	-25.833718	39	>39	dry					4
F252	90474123	BH5	28.185829	-25.833676	35	31	dry			22-23		7
F252	90474123	BH6	28.184772	-25.834139	47	>47	dry	32-47				2
F252	90474123	BH7	28.1847	-25.833707	15	6	dry					3
F253	90481947	BH1(3102)	28.19914	-25.860302	18	12	dry					3
F253	90481947	BH10(3604)	28.198547	-25.85949	28	22	dry	11-15				4
F253	90481947	BH11(3605)	28.19866	-25.859341	40	35	dry	1-7			26-35	7
F253	90481947	BH12(3703)	28.198267	-25.859536	35	29	dry				17-19	4
F253	90481947	BH13(3800)	28.197763	-25.859881	20	16	dry					4
F253	90481947	BH14(3804)	28.198216	-25.859288	25	19	dry				12-19	6
F253	90481947	BH15(3902)	28.197825	-25.859482	19	12	dry					3
F253	90481947	BH16(3303)	28.198925	-25.859947	35	30	dry			13-17	24-30	7
F253	90481947	7(3202/3303)	28.198953	-25.860073	35	31	dry			28-31	24-28	7
F253	90481947	BH18(3104)	28.199367	-25.860005	25	18	dry			11-15	15-18	6
F253	90481947	BH19(3502)	28.198482	-25.859891	30	25	dry			21-24		7
F253	90481947	2(3200/3201)	28.198807	-25.860421	30	25	dry	14-17		21-23	23-25	7
F253	90481947	BH20(3404)	28.198875	-25.859695	18	12	dry					3
F253	90481947	BH21(3504)	28.198709	-25.859593	15	9	dry					3
F253	90481947	2(3602/3803)	28.198047	-25.85951	35	28	dry					4
F253	90481947	BH23(3704)	28.198382	-25.859386	23	17	dry	7-12				4
F253	90481947	4(3904/3905)	28.19811	-25.859109	35	28	dry				27-28	4
F253	90481947	5(3000/3101)	28.199057	-25.860577	35	31	dry				25-18	4
F253	90481947	BH26(3103)	28.199254	-25.860153	30	28	dry				22-28	7
F253	90481947	7(3104/3205)	28.19934	-25.859879	9	4	dry					5
F253	90481947	8(3804/3805)	28.198275	-25.859211	36	28	dry					4
F253	90481947	9(3604/3505)	28.198685	-25.859467	40	34	dry				20-30	7
F253	90481947	BH3(3203)	28.19909	-25.86005	35	30	dry			24-27	23-30	7
F253	90481947	0(3700/3801)	28.197902	-25.859856	22	16	dry					4
F253	90481947	1(3203/3104)	28.199228	-25.86003	14	8	dry					3
F253	90481947	BH4(3204)	28.199203	-25.859903	12	7	dry					3
F253	90481947	BH5(3403)	28.198759	-25.859844	45	37	dry	2-10;18-23				4
F253	90481947	BH6(3401)	28.198535	-25.860143	22	15	dry	12-13				3
F253	90481947	7(3404/3505)	28.198849	-25.85957	22	16	dry					4
F253	90481947	BH8(3503)	28.198595	-25.859742	40	37	dry					4
F253	90481947	9(3600/3601)	28.198148	-25.86001	25	19	dry					4
F255	90065608	3/8	28.198538	-25.84947	12	6	dry					3
F255	90065608	5/10	28.198818	-25.849444	13	9	dry					3
F255	90065608	5/4	28.19844	-25.849861	8	4	dry					5
F255	90065608	6-7/8	28.198807	-25.84967	12	9	dry					3
F255	90065608	9/6	28.198873	-25.849952	16	11	dry					3
F255	90474669	3101	28.198904	-25.849077	17	11	dry	2-10				3
F255	90474669	3105	28.199411	-25.848521	30	27	dry	1-27				2
F255	90474669	3205	28.199573	-25.848643	30	>30	dry	1-30				2
F255	90474669	3301	28.199227	-25.849323	18	11	dry	3-11				3
F255	90474669	3303/3403	28.199565	-25.849099	29	23	dry	2-21				2
F255	90474669	3405	28.199896	-25.848886	30	>30	dry	1-30				2
F256	90474771	3000/3101	28.188875	-25.84222	15	9	dry					3
F256	90474771	3104	28.189421	-25.842607	18	11	dry					3
F256	90474771	3302	28.189423	-25.84211	23	17	dry					4
F256	90474771	3304/3405	28.189816	-25.842357	46	45	dry			29-43	5-45	8
F256	90474771	3504	28.189974	-25.842128	13	6	dry					3
F256	90474771	3601	28.189702	-25.841623	20	15	dry				8-15	6
F256	90474771	3802	28.190114	-25.841513	12	5	dry					5
F256	90474771	3804	28.190388	-25.841771	15	9	dry					3
F256	90474771	4001	28.190253	-25.841147	35	24	dry	3-24				2
F256	90474771	4004	28.190663	-25.841531	20	11	dry					3
F256	90482092	3103/3202	28.189287	-25.842353	14	8	dry					3
F256	90482092	3403	28.189697	-25.842119	13	7	dry					3
F256	90482092	3801/3900	28.189978	-25.841261	7	2	dry					5
F256	90482092	3902/4002	28.19032	-25.841333	21	15	dry					6
F256	90562920	3401/3501	28.189496	-25.841802	13	6	dry					3
F256	90562920	3502/3503	28.189768	-25.841935	11	5	dry					5
F256	90562920	3603/3703	28.190044	-25.84182	13	7	dry					3
F256	90562920	3903/3904	28.190459	-25.841586	14	8	dry					3
F256	90562920	4004/4103	28.190508	-25.841296	18	12	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F256	90564499	3701	28.189846	-25.841499	14	8	dry					3
F256	90564499	3802/3901	28.190114	-25.841389	12	6	dry					3
F256	90584383	BH1	28.189491	-25.842576	15	11	dry					3
F256	90584383	BH2	28.189891	-25.842242	13	2	dry					5
F257	90574997	BH1901-1	28.211765	-25.846438	23	3	dry					5
F257	90574997	BH1901-2	28.211815	-25.846528	20	3	dry					5
F2589	90588901	MTD165	28.199164	-25.864855	33	>33	dry				20-26;28-3	7
F259	90564536	BH1	28.202705	-25.835	27	21	dry					4
F259	90564536	BH2	28.202613	-25.834971	23	17	dry					4
F2609	90588723	BH1	28.184033	-25.871666	50	44	15	1-44				1
F2609	90588723	BH2	28.183713	-25.871818	50	41	16	3-41				1
F2609	90588723	BH3	28.183282	-25.872041	50	32	13	0-32				1
F2609	90588723	BH4	28.183162	-25.872221	50	29	14	1-29				1
F261	90474357	3001/3100	28.194135	-25.847486	24	9	dry	1-9				3
F261	90474357	3001/3102	28.194288	-25.847598	20	14	dry	2-5				3
F261	90474357	3002/3103	28.194444	-25.847708	10	4	dry					5
F261	90474357	3004/3104	28.194681	-25.847879	8	3	dry					5
F261	90474357	3100/3201	28.193999	-25.847636	40	34	dry	13-19		28-34		7
F261	90474357	3101/3202	28.194151	-25.847753	15	5	dry					5
F261	90474357	3103	28.194452	-25.847845	11	5	dry					5
F261	90474357	3104/3204	28.194543	-25.848031	8	2	dry					5
F261	90474357	3105	28.194765	-25.848072	8	2	dry					5
F261	90474357	3202	28.194161	-25.847885	14	8	dry	2-5				3
F261	90474357	3203	28.194318	-25.847995	14	8	dry					3
F261	90474357	3204/3305	28.194481	-25.848242	15	9	dry	1-5				3
F261	90474357	3205	28.194629	-25.848222	7	1	dry					5
F261	90474357	3300/3201	28.193858	-25.847793	12	6	dry					3
F261	90474357	3301	28.193868	-25.847925	13	8	dry	3-5				3
F261	90474357	3302	28.194023	-25.848037	32	27	dry			21-23	16-21;23-2	7
F261	90474357	3303/3402	28.194033	-25.848168	16	10	dry					3
F261	90474357	3304	28.194336	-25.848262	13	6	dry					3
F261	90474357	3305	28.194491	-25.848375	18	12	dry					3
F261	90474357	3401	28.193732	-25.848076	7	1	dry					5
F261	90474357	3402	28.193885	-25.848188	24	18	dry				12-14	4
F261	90474357	3402/3501	28.19374	-25.84821	14	8	dry	0-2				3
F261	90474357	3403/3404	28.194115	-25.848359	10	4	dry					5
F261	90474357	3403/3502	28.193895	-25.848322	19	13	dry				6-12	6
F261	90474357	3404/3504	28.194129	-25.848489	13	6	dry					3
F261	90474357	3405/3505	28.194283	-25.848602	15	9	dry					3
F261	90474357	3501/3502	28.193672	-25.848284	14	7	dry					3
F261	90474357	3501/3601	28.193527	-25.848306	12	6	dry					3
F261	90474357	3503	28.193904	-25.848455	15	9	dry					3
F261	90474357	3504	28.19406	-25.848567	30	25	dry	8-15;19-25			15-19	4
F261	90474357	3505/3605	28.194146	-25.848756	13	7	dry					3
F261	90474357	3600/3601	28.19338	-25.848325	15	9	dry					3
F261	90474357	3602	28.19361	-25.848495	8	2	dry					5
F261	90474357	3604	28.19392	-25.848718	10	3	dry					5
F261	90474357	3605	28.194078	-25.848832	8	2	dry					5
F261	90474357	3605/3704	28.193931	-25.848852	14	8	dry					3
F261	90474357	3701	28.193318	-25.848535	15	9	dry					3
F261	90474357	3702	28.193471	-25.848646	7	1	dry					5
F261	90474357	3703	28.193629	-25.848758	10	4	dry					5
F261	90474357	3704	28.193784	-25.848872	9	3	dry					5
F261	90474357	3704/3705	28.193861	-25.848929	30	25	dry				16-25	7
F261	90474357	3704/3804	28.193715	-25.848949	7	1	dry					5
F261	90474357	3705/3706	28.194017	-25.849041	10	4	dry					5
F261	90474357	3705/3805	28.193882	-25.849033	9	3	dry					5
F261	90474357	3800/3801	28.193102	-25.848631	12	6	dry					3
F261	90474357	3802	28.193335	-25.8488	13	7	dry					3
F261	90474357	3803/3804	28.193567	-25.848967	12	6	dry					3
F261	90474357	3805	28.193802	-25.849137	10	4	dry					5
F262	90474362	1	28.194699	-25.837167	35	20	dry	3-25				2
F262	90474362	10	28.194415	-25.837538	15	8	dry	2-8				3
F262	90474362	11	28.194421	-25.838346	14	8	dry					3
F262	90474362	12	28.194625	-25.838173	15	9	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F262	90474362	13	28.194803	-25.838021	15	9	dry					3
F262	90474362	14	28.195153	-25.837598	25	17	dry	2-17				4
F262	90474362	15	28.194522	-25.837319	20	17	dry	5-8				4
F262	90474362	16	28.194232	-25.837562	21	16	dry					4
F262	90474362	2	28.194881	-25.837881	23	17	dry					4
F262	90474362	3	28.194566	-25.837645	15	8	dry					3
F262	90474362	4	28.194304	-25.838131	22	15	dry					3
F262	90474362	5	28.193887	-25.837852	35	34	dry	9-34				2
F262	90474362	6	28.194669	-25.837398	13	7	dry					3
F262	90474362	8	28.19452	-25.837942	21	15	dry					3
F262	90474362	9	28.194252	-25.837806	20	18	dry	3-13;15-18				4
F263	90564305	3106	28.194698	-25.844973	25	19	dry	1-14			14-19	4
F263	90564305	3203	28.194267	-25.844798	24	18	dry	2-9			9-10;12-14	4
F263	90564305	3401	28.193857	-25.844808	40	38	dry	14-38				2
F263	90564305	3406	28.194402	-25.845261	46	40	dry	2-20		26-34	20-26;34-4	8
F263	90564305	3605	28.194045	-25.845321	34	25	dry	2-15			15-25	6
F263	90564305	3606	28.194205	-25.84546	10	4	dry					5
F263	90564305	3801	28.193468	-25.845192	30	24	dry	2-24				2
F263	90564305	3805	28.193954	-25.845628	15	8	dry	2-4			4-8	6
F263	90584305	L1	28.193781	-25.845207	70	66	dry	22-43			43-66	8
F263	90584305	L10	28.194476	-25.844785	69	>69	dry	3-27				4
F263	90584305	L3	28.193625	-25.845117	30	25	dry	19-25				4
F263	90584305	L5	28.194467	-25.845051	57	53	dry	4-34			43-53	2
F263	90584305	L6	28.194277	-25.845027	40	34	dry	3-28			28-34	2
F263	90584305	L7	28.194091	-25.844971	36	30	dry	2-25			25-30	2
F263	90584305	L8	28.194001	-25.844744	48	41	dry	17-38			5-9;38-41	4
F263	90584305	L9	28.194071	-25.844824	32	26	dry	4-25			25-26	4
F264	90420677	BH3108	28.187232	-25.844331	16	10	dry					3
F264	90420677	BH3407	28.186663	-25.844585	14	8	dry				3-9	6
F264	90420677	BH3501	28.185702	-25.843938	62	56	dry		25-27		14-25;27-5	8
F264	90420677	BH3605	28.186112	-25.844582	35	33	dry	6-23				2
F264	90420677	BH3901.5	28.185199	-25.84451	52	46	dry	7-23				2
F264	90420677	BH4107.5	28.185531	-25.845436	57	51	dry	1-21			35-51	2
F264	90420677	BH4203	28.184971	-25.845081	19	13	dry				5-13	6
F264	90420677	LAH-C-11/42	28.185644	-25.84522	30	>30	dry	4-30				2
F264	90421075	BH3202	28.186234	-25.843741	10	1	dry					5
F264	90421075	BH3205	28.186666	-25.844144	21	1	dry			14-15		5
F264	90421075	BH3403	28.186078	-25.844146	13	6	dry					3
F264	90421075	BH3701	28.185337	-25.844259	37	31	dry			26-27	14-26; 27-3	7
F264	90421075	BH3708	28.186356	-25.84522	25	18	dry	11-18			3-11	6
F264	90421075	BH4101	28.184741	-25.844777	25	15	dry				9-15	6
F264	90421219	BH1	28.186958	-25.844073	5	2	dry					5
F264	90421219	BH10	28.18667	-25.84432	5	1	dry					5
F264	90421219	BH11	28.18663	-25.844845	6	2	dry					5
F264	90421219	BH12	28.1864	-25.844062	12	8	dry	2-3				3
F264	90421219	BH13	28.186109	-25.843862	16	13	dry					3
F264	90421219	BH14	28.186142	-25.843545	6	3	dry					5
F264	90421219	BH15	28.186186	-25.844422	10	7	dry					3
F264	90421219	BH16	28.186943	-25.844575	6	3	dry					5
F264	90421219	BH2	28.186954	-25.844324	5	2	dry					5
F264	90421219	BH3	28.186801	-25.844699	6	2	dry					5
F264	90421219	BH4	28.186386	-25.844375	8	5	dry					5
F264	90421219	BH5	28.186386	-25.844921	5	1	dry					5
F264	90421219	BH6	28.186553	-25.843687	5	2	dry					5
F264	90421219	BH7	28.186287	-25.843425	8	5	dry					5
F264	90421219	BH8	28.185963	-25.843723	23	18	dry					4
F264	90421219	BH9	28.186364	-25.844655	16	13	dry					3
F264	90474038	BH3400/3401	28.185785	-25.843734	16	13	dry					3
F264	90474038	BH3502/3402	28.185902	-25.843993	19	14	dry	1-9				3
F264	90474038	BH3504	28.186113	-25.84432	20	>20	dry	6-20				2
F264	90474038	BH3601/3602	28.185628	-25.844124	22	17	dry	6-15				4
F264	90474038	BH3606	28.186244	-25.84471	20	>20	dry	2-20				2
F264	90474038	BH3707	28.186237	-25.844961	25	20	dry	2-15				4
F264	90474038	BH3801/3802	28.185341	-25.844379	20	15	dry	0-11				3
F264	90474038	BH4000/4102	28.184846	-25.844572	30	26	dry			17-21	15-17;21-2	7

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F264	90474038	BH4001	28.184977	-25.844553	20	>20	dry	9-20				4
F264	90474038	BH4102	28.184969	-25.844812	22	17	dry	7-17				4
F264	90474038	BH4104	28.185242	-25.845067	25	20	dry	12-20				4
F264	90474038	BH4205	28.185235	-25.845329	25	20	dry	9-13				4
F264	90562952	91-1	28.186098	-25.843457	10	7	dry					3
F264	90562952	91-10	28.186555	-25.844097	10	6	dry					3
F264	90562952	91-11	28.186251	-25.844385	10	7	dry					3
F264	90562952	91-12	28.186523	-25.844264	11	9	dry					3
F264	90562952	91-14	28.186955	-25.844207	11	9	dry					3
F264	90562952	91-15	28.18713	-25.844187	13	11	dry				6-11	6
F264	90562952	91-16	28.187344	-25.844467	10	8	dry				0-8	6
F264	90562952	91-17	28.187176	-25.844497	10	4	dry					5
F264	90562952	91-18	28.186966	-25.844538	10	2	dry					5
F264	90562952	91-19	28.186798	-25.844568	30	25	dry					4
F264	90562952	91-2	28.186269	-25.843423	18	>18	dry				5-9; 11-18	6
F264	90562952	91-20	28.185789	-25.844396	30	>30	dry	10-30				2
F264	90562952	91-21	28.185811	-25.844707	30	>30	dry	10-30				2
F264	90562952	91-22	28.185851	-25.844893	30	>30	dry	4-24				2
F264	90562952	91-23	28.18594	-25.845079	30	>30	dry	2-30				2
F264	90562952	91-24	28.186101	-25.845006	30	>30	dry	1-17				2
F264	90562952	91-25	28.186267	-25.84496	30	>30	dry	20-23	23-26		28-30	7
F264	90562952	91-26	28.186437	-25.844929	21	19	dry				9-12	6
F264	90562952	91-27	28.185981	-25.845239	30	>30	dry	2-27				2
F264	90562952	91-28	28.186306	-25.845178	27	26	dry	13-20				4
F264	90562952	91-3	28.186081	-25.843815	16	14	dry					3
F264	90562952	91-4	28.186394	-25.843764	13	11	dry				2-7	6
F264	90562952	91-5	28.186599	-25.843727	10	2	dry					5
F264	90562952	91-6	28.185918	-25.844173	30	>30	dry	4-25			25-30	2
F264	90562952	91-7	28.186186	-25.844094	11	4	dry					5
F264	90562952	91-8	28.18691	-25.84401	10	8	dry				6-8	3
F264	90562952	91-9	28.186727	-25.844067	11	11	dry					3
F264	90562952	95-01	28.187541	-25.844647	10	0	dry					5
F264	90562952	95-02	28.187766	-25.844833	10	6	dry					3
F264	90562952	95-04	28.187301	-25.844827	9	7	dry					3
F264	90562952	95-05	28.187551	-25.845029	11	9	dry					3
F264	90562952	95-06	28.187734	-25.845225	10	9	dry					3
F264	90562952	95-07	28.187166	-25.844949	10	5	dry					5
F264	90562952	95-08	28.187409	-25.845176	10	2	dry					5
F264	90562952	95-09	28.187604	-25.845323	9	7	dry					3
F264	90562952	95-10	28.18692	-25.845143	9	0	dry					5
F264	90562952	95-11	28.187152	-25.84532	9	1	dry					5
F264	90562952	95-12	28.186974	-25.845404	10	2	dry					5
F264	90562952	95-13	28.1872	-25.845682	13	11	dry				7-11	6
F264	90562952	95-14	28.186569	-25.845486	15	12	dry		8-10		10-12	3
F264	90562952	95-15	28.186815	-25.845711	14	12	dry		3-5		8-12	6
F264	90562952	95-16	28.187024	-25.845898	10	1	dry				5-6	5
F264	90562952	95-17	28.186433	-25.845592	10	8	dry					3
F264	90562952	95-18	28.186854	-25.845964	9	4	dry					5
F264	90562952	95-19	28.186247	-25.845854	30	>30	dry					4
F264	90562952	95-20	28.186694	-25.846182	12	10	dry					3
F264	90562952	95-21	28.186433	-25.8462	30	>30	dry	2-28				2
F265	90482320	BH2	28.191814	-25.853231	37	30	dry					4
F265	90482320	MM/1	28.192299	-25.853399	15	8	dry				6-8	6
F265	90482320	MM/10	28.191278	-25.852328	16	10	dry				4-10	6
F265	90482320	MM/11	28.191067	-25.852616	40	>40	dry					4
F265	90482320	MM/12	28.19088	-25.852308	16	10	dry				6-10	6
F265	90482320	MM/13	28.190881	-25.852046	19	13	dry				7-13	6
F265	90482320	MM/14	28.190778	-25.852533	40	>40	dry				34-40	8
F265	90482320	MM/15	28.19062	-25.852361	30	25	dry				11-15	7
F265	90482320	MM/2	28.1921	-25.853254	32	>32	dry		21-23		6-21;23-27	7
F265	90482320	MM/3	28.191915	-25.853147	46	40	41m					4
F265	90482320	MM/4	28.19165	-25.853405	17	10	dry				5-7	3
F265	90482320	MM/5	28.191869	-25.853559	34	26	dry		13-16		5-9;16-20	7
F265	90482320	MM/6	28.192027	-25.853696	21	15	dry		7-11		11-15	6
F265	90482320	MM/7	28.191675	-25.852701	34	32	dry		7-12	12-15	15-32	7

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F265	90482320	MM/8	28.191524	-25.852889	25	25	dry				14-19	7
F265	90482320	MM/9	28.1914	-25.852635	29	28	dry		14-18;20-2		12-14;18-2	7
F265	90585107	BH11	28.193587	-25.853211	32	25	dry		11-13		17-25	7
F265	90585107	BH12	28.193798	-25.853108	12	7	dry					3
F265	90585107	BH13	28.194127	-25.852777	23	17	dry					4
F265	90585107	BH14	28.194325	-25.852316	37	24	dry	15-18				4
F265	90585107	BH15	28.194592	-25.852885	39	32	dry		22-24		17-22;24-3	7
F265	90585107	BH16	28.194114	-25.853486	20	13	dry		7-12			3
F265	90585107	BH17	28.193851	-25.8538	47	44	dry				29-44	8
F265	90585107	BH18	28.193507	-25.853502	17	10	dry					3
F265	90585107	BH19	28.194346	-25.852638	33	28	dry					4
F265	90585107	BH20	28.194894	-25.852639	44	38	dry					4
F265	90589056	1	28.193696	-25.853683	37	31	dry				23-30	7
F265	90589056	10	28.194289	-25.85214	34	24	dry					4
F265	90589056	2	28.193996	-25.853323	13	7	dry					3
F265	90589056	3	28.194174	-25.853147	33	27	dry				11-27	7
F265	90589056	4	28.194346	-25.852967	19	13	dry	5-11			11-13	3
F265	90589056	5	28.194652	-25.852623	49	43	17	24-32			33-43	8
F265	90589056	6	28.193238	-25.85331	42	37	dry			25-33	23-25;33-3	8
F265	90589056	7	28.19351	-25.852996	25	19	dry			11-13	5-11;13-16	6
F265	90589056	8	28.193821	-25.852631	49	43	dry				7-20	8
F265	90589056	9	28.19399	-25.852412	29	23	dry				11-17	7
F266	90474949	1	28.195066	-25.838949	21	15	dry					3
F266	90474949	10	28.196104	-25.837361	21	>21	dry	16-21				4
F266	90474949	11	28.194677	-25.838425	21	13	dry	1-6				3
F266	90474949	12	28.194905	-25.838236	29	23	dry	2-16				4
F266	90474949	13	28.195266	-25.838069	29	16	dry	2-6				4
F266	90474949	14	28.195401	-25.837798	24	12	dry	2-9;18-24				3
F266	90474949	15	28.19568	-25.837942	25	>25	dry	3-10;20-25	17-19			4
F266	90474949	2	28.194846	-25.83866	25	20	dry	1-16				4
F266	90474949	3	28.195271	-25.838545	29	26	dry					4
F266	90474949	4	28.195108	-25.838307	35	33	dry	21-33				4
F266	90474949	5	28.195116	-25.83805	29	26-Jan	dry				13-17;22-2	7
F266	90474949	6	28.195622	-25.838496	30	25	dry	8-24				4
F266	90474949	7	28.195561	-25.838052	21	15	dry	3-7				3
F266	90474949	8	28.195964	-25.838196	35	>35	dry	25-35				4
F266	90474949	9	28.196148	-25.83809	30	>30	dry	24-30				4
F268	90482150	BG1	28.186323	-25.834137	30	>30	dry	3-7			17-21	7
F268	90482150	BG2	28.185705	-25.834603	30	26	dry				16-20	7
F268	90482150	BG3	28.184949	-25.835564	30	>30	dry	8-30				2
F268	90482150	BG6	28.185121	-25.834451	30	>30	dry					4
F268	90482150	DT1	28.185435	-25.834895	30	>30	dry				18-25	7
F268	90482150	DT10	28.185612	-25.834643	12	6	dry					3
F268	90482150	DT11	28.185697	-25.834511	19	13	dry					3
F268	90482150	DT2	28.185892	-25.83458	30	>30	dry	1-18				4
F268	90482150	DT3	28.185742	-25.834424	45	>45	dry				23-33;36-4	8
F268	90482150	DT4	28.185613	-25.834198	30	>30	dry					4
F268	90482150	DT5	28.185399	-25.834407	34	>34	dry			26-28	28-34	8
F268	90482150	DT6	28.184788	-25.835086	30	>30	dry	18-30				2
F268	90482150	DT7	28.18597	-25.834283	15	9	dry				5-9	6
F268	90482150	DT8	28.184694	-25.834787	30	>30	dry	14-30				2
F268	90482150	DT9	28.184926	-25.834627	40	>40	dry	28-40				2
F269	90564307	BH104/1	28.192178	-25.847342	10	3	dry					5
F269	90564307	BH104/2	28.19185	-25.847521	10	1	dry					5
F269	90564307	BH104/3	28.192019	-25.847639	30	26	dry					7
F269	90564307	BH104/4	28.192058	-25.847712	25	22	dry					7
F269	90564307	BH104/5	28.192089	-25.847486	10	2	dry					5
F269	90564307	BH2/06	28.191961	-25.847287	11	4.5	dry					5
F269	90564307	BH2/07	28.191802	-25.847205	10	4	dry					5
F269	90564307	BH2/08	28.191953	-25.847061	10	4	dry					5
F269	90564307	BH2/09	28.192211	-25.847216	15	9	dry					3
F269	90564307	BH2/10	28.192521	-25.847037	18	12	dry					3
F269	90564307	BH2/11	28.192403	-25.846901	19	11	dry					3
F269	90564307	BH2/12	28.192243	-25.846864	16	9	dry					3
F269	90564307	BH2/13	28.192114	-25.846746	18	11	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F269	90564307	BH3102	28.191939	-25.847728	17	11	dry					3
F269	90564307	BH3206	28.191566	-25.847271	10	1	dry					5
F269	90564307	BH3302	28.192113	-25.847512	12	6	dry					3
F269	90564307	BH3501/3400	28.192433	-25.847484	14	8	dry					3
F269	90564307	BH3502	28.192325	-25.847304	12	6	dry					3
F269	90564307	BH3504	28.192095	-25.847134	12	9	dry					3
F269	90564307	BH3506	28.191845	-25.846965	12	9	dry					3
F269	90564307	BH3703	28.192375	-25.847018	18	15	dry	3-5			9-12	6
F269	90564307	BH3800	28.192817	-25.847166	22	16	dry					4
F269	90564307	BH3805/06	28.192182	-25.846695	19	13	dry	5-8	8-11		11-13	3
F269	90564307	BH4002/03	28.192731	-25.846746	16	15	dry					6
F269	90564307	BH4201	28.193066	-25.846679	10	5	dry					5
F270	90564310	BH3114	28.187338	-25.841364	10	3	dry					5
F270	90564310	BH3501	28.187648	-25.841926	23	17	dry					4
F270	90564310	BH3613	28.18719	-25.841565	30	26	dry					7
F270	90564310	BH3909	28.187215	-25.841783	10	0	dry					5
F270	90564310	BH4305	28.187215	-25.84204	16	10	dry					3
F270	90564310	BH4313	28.186916	-25.841771	17	12	dry					3
F270	90564310	BH5108	28.186816	-25.842194	19	14	dry	17-19			10-14	6
F270	90564310	BH5314	28.186513	-25.842054	16	14	dry					6
F270	90564310	BH5504	28.186825	-25.842451	12	9	dry					3
F270	90564310	BH5912	28.186373	-25.84233	30	27	dry					4
F270	90564310	BH6106	28.186537	-25.842579	20	14	dry					3
F270	90564310	BH6514	28.18609	-25.842455	22	16	dry					4
F270	90564310	BH6708	28.186251	-25.842706	14	8	dry					3
F273	90420476	BH1(4403)	28.186285	-25.846077	30	>30	dry	2-22				2
F273	90420476	BH10(3301)	28.187321	-25.844807	9	3	dry					5
F273	90420476	BH2(4505)	28.18659	-25.846274	30	24	dry					4
F273	90420476	BH3(4205)	28.186815	-25.845993	13	7	dry					3
F273	90420476	BH5(3901)	28.18667	-25.845367	10	4	dry					5
F273	90420476	BH6(3503)	28.187255	-25.845123	9	4	dry					5
F273	90420476	BH7(3406)	28.187699	-25.845344	13	7	dry					3
F273	90420476	BH8(3205)	28.187844	-25.84511	26	20	dry					6
F273	90420476	BH9(3203)	28.187639	-25.844914	10	4	dry					5
F274	90575034	BH1	28.190503	-25.838895	48	41	dry	1-31			35-38	2
F274	90575034	BH10	28.190723	-25.839191	34	28	dry	1-27				2
F274	90575034	BH11	28.190201	-25.839082	50	43	dry	1-30				1
F274	90575034	BH12	28.190094	-25.838877	35	29	dry	1-23				2
F274	90575034	BH13	28.190271	-25.838903	38	31	dry	1-26				2
F274	90575034	BH14	28.190218	-25.838682	40	35	dry	1-27				2
F274	90575034	BH2	28.190414	-25.838588	45	39	dry	2-33				2
F274	90575034	BH3	28.191021	-25.838627	40	34	dry	17-30				2
F274	90575034	BH4	28.190625	-25.838297	31	25	dry	14-23				4
F274	90575034	BH5	28.190487	-25.839196	33	27	dry	0-24				2
F274	90575034	BH6	28.190712	-25.838442	32	26	dry	14-25				4
F274	90575034	BH7	28.190718	-25.838708	40	39	dry	8-22;30-37				2
F274	90575034	BH8	28.190736	-25.838922	53	47	dry	3-39				1
F274	90575034	BH9	28.191055	-25.83889	54	48	dry	6-9;16-41				1
F275	90482551	14	28.192879	-25.838839	30	>30	dry				16-26	7
F275	90482551	3107	28.192649	-25.839691	23	18	dry				4-11	6
F275	90482551	3306/3406	28.192784	-25.839451	11	4	dry					5
F275	90482551	3403	28.192603	-25.839228	30	28	dry	14-28	1-9		9-14	4
F275	90482551	3408	28.192952	-25.839557	10	4	dry					5
F275	90482551	3602	28.192687	-25.839029	10	1	dry					5
F275	90482551	3607	28.193033	-25.839359	12	6	dry					3
F275	90482551	3701	28.19269	-25.838897	10	4	dry					5
F275	90482551	3707/3807	28.193198	-25.839153	30	>30	dry					4
F275	90482551	3708	28.193256	-25.839248	10	2	dry					5
F275	90482551	3908/3909	28.193378	-25.839066	11	5	dry					5
F275	90482551	4102/6	28.192944	-25.838617	30	>30	dry	2-30				2
F275	90482551	4102-4202	28.193068	-25.838566	30	>30	dry				10-22	7
F275	90482551	4303	28.193259	-25.838515	22	17	dry				4-15	6
F275	90482551	4306	28.193434	-25.838706	30	>30	dry				10-19	7
F275	90482551	BH1	28.19259	-25.839014	10	4	dry					5
F275	90482551	BH2	28.192586	-25.839496	50	>50	dry	33-50				2

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F275	90482551	BH3	28.19237	-25.839427	30	>30	dry					4
F275	90482551	BH4	28.192383	-25.839168	30	>30	dry					4
F275	90584923	BH259(1)	28.193247	-25.838638	60	>60	dry		16-18; 24-2		13-15; 23-2	7
F275	90584923	BH259(2)	28.192844	-25.839223	36	30	dry		5-8; 10-13		15-17; 26-2	7
F275	90584923	BH259(3)	28.192995	-25.838917	43	37	dry					2
F275	90584923	BH259(4)	28.193073	-25.839188	16	10	dry					3
F277	90482559	BH1	28.201535	-25.844964	30	>30	dry	11-25				4
F277	90482559	BH2	28.201412	-25.844737	30	>30	dry	20-26				4
F277	90482559	BH3	28.201608	-25.844519	30	>30	dry					4
F278	90065596	1	28.187871	-25.840858	30	6	dry					3
F278	90065596	2	28.188592	-25.840726	30	2	dry					5
F278	90065596	3	28.188744	-25.840417	30	15	dry					6
F278	90065596	4	28.18924	-25.840166	30	1	dry					5
F278	90065596	5	28.188483	-25.840315	24	>24	dry					7
F278	90065596	6	28.189047	-25.840515	20	6	dry					3
F278	90065596	7	28.188826	-25.83996	25	14	dry					6
F278	90065596	8	28.18835	-25.840428	25	>25	dry					4
F278	90065596	9	28.188622	-25.840159	25	>25	dry					4
F279	90562922	1	28.200376	-25.846502	37	31	dry					4
F279	90562922	2	28.200001	-25.846206	11	5	dry					5
F279	90562922	3	28.199735	-25.846499	18	12	dry					3
F279	90562922	4	28.20002	-25.846705	41	>41	dry					4
F279	90562922	5	28.200185	-25.846356	27	21	dry		4-8			4
F279	90562922	6	28.200038	-25.846505	40	>40	dry					2
F280	90065606	BH205/A	28.188192	-25.831206	18	16	dry					4
F280	90065606	BH205/B	28.188323	-25.831328	15	>15	dry					4
F280	90081881	BG1	28.188571	-25.831212	25	10	dry					3
F280	90081881	BG2	28.188462	-25.831409	25	12	dry					3
F280	90081881	BG3	28.188093	-25.83143	25	14	dry					3
F280	90081881	BG4	28.188104	-25.831223	25	11	dry					3
F280	90081881	BG5	28.18826	-25.831277	25	14	dry					3
F284	90374539	BH1	28.192421	-25.842414	38	>38	dry	1-19;26-31				2
F284	90374539	BH3	28.192642	-25.841608	50	>50	dry	4-47				1
F284	90374539	BH4	28.19247	-25.842009	46	41	dry	1-19				2
F287	90420932	1	28.191327	-25.848478	7	1	dry					5
F287	90420932	2	28.191233	-25.848516	17	12	dry					3
F287	90420932	3	28.191109	-25.848546	8	2	dry					5
F287	90420932	4	28.191031	-25.848574	16	10	dry					3
F287	90420932	5	28.191269	-25.848593	10	4	dry					5
F287	90421084	BG1	28.190948	-25.84903	25	>25	dry		3-16	16-20		7
F287	90421084	BG2	28.190384	-25.848656	14	8	dry					3
F287	90421084	BG3	28.190688	-25.848471	10	2	dry					5
F287	90421084	BG4	28.191144	-25.848416	25	11	dry					3
F287	90421084	BG5	28.191257	-25.8477	14	1	dry					5
F287	90421084	BG6	28.190994	-25.848848	25	>25	dry				14-25	7
F287	90421084	BG7	28.190728	-25.848735	15	9	dry					3
F287	90421084	BG8	28.190957	-25.847896	10	3	dry					5
F287	90421084	BG9	28.191556	-25.848132	19	11	dry					3
F288	90115441	B1	28.1927	-25.843265	30	>30	dry	4-25				2
F288	90115441	B2	28.192028	-25.843898	30	>30	dry	5-22				2
F288	90115441	B3	28.191235	-25.84404	30	>30	dry					4
F288	90115441	B4	28.191983	-25.843376	30	22	dry					4
F289	90115426	BH3/2	28.192591	-25.837024	15	9	dry					3
F289	90115426	BH3/9	28.191536	-25.837941	11	5	dry					5
F289	90115426	BH7/10	28.192006	-25.83854	30	>30	dry					4
F291	90116177	1	28.191215	-25.841427	17	9	dry	4-8				3
F291	90116177	1a	28.1917	-25.841766	30	>30	dry	5-30				2
F291	90116177	2	28.191446	-25.841465	17	8	dry					3
F291	90116177	2a	28.191877	-25.841612	20	12	dry	4-10				3
F291	90116177	3a	28.192129	-25.841406	16	10	dry	4-10				3
F292	90374687	BH1	28.19735	-25.847162	20	15	dry	1-12				3
F292	90374687	BH3	28.197835	-25.847538	20	14	dry	2-11				3
F292	90374687	BH7	28.197518	-25.84761	11	>11	dry	3-8				3
F292	90374687	BH8	28.197868	-25.848013	16	11	dry	4-9				3
F292	90374687	BH9	28.198429	-25.847591	10	>10	dry	3-10				3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F293	90125819	1	28.1917	-25.831	13	8	dry					3
F293	90125819	2	28.191313	-25.830815	22	11	dry					3
F293	90125819	3	28.191859	-25.83122	15	>15	dry					4
F293	90125819	4	28.191361	-25.831159	25	>25	dry					4
F294	90126127	1	28.190873	-25.833571	25	>25	dry					4
F294	90126127	2	28.190298	-25.83404	10	3	dry					5
F294	90126127	3	28.191856	-25.833891	13	7	dry	3-6				3
F295	90126714	BH1	28.197204	-25.861457	25	>25	dry					4
F295	90126714	BH2	28.196982	-25.861297	25	14	dry					3
F295	90126714	BH3	28.196538	-25.861273	17	>17	dry					4
F295	90126714	BH4	28.196828	-25.861638	17	>17	dry				10-17	7
F295	90126714	BHA	28.19795	-25.861932	27	21	dry					4
F295	90126714	BHB	28.197121	-25.862096	18	12	dry					3
F295	90126714	BHC	28.196412	-25.861603	19	15	dry					3
F295	90562923	BHD	28.197158	-25.86226	23	18	dry				12-13;15-1	6
F295	90562923	BHE	28.196662	-25.861943	24	20	dry				14-18	6
F295	90562923	BHF	28.196989	-25.861743	12	5	dry					5
F295	90562923	BHG	28.197244	-25.861453	22	16	dry				9-12	4
F295	90562923	BHH	28.197156	-25.861521	21	15	dry		4-7		9-15	6
F295	90562923	BHI	28.196462	-25.861771	28	22	dry				13-15;20-2	7
F295	90562923	BHJ	28.196904	-25.86201	14	9	dry					3
F296	90230172	3105	28.186795	-25.83399	10	4	dry					5
F296	90230172	3404	28.187361	-25.83374	14	8	dry				2-8	6
F296	90230172	4002	28.18851	-25.833268	19	3	dry					5
F296	90374457	3101	28.187353	-25.834522	8	2	dry					5
F296	90374457	3401	28.187765	-25.834154	25	>25	dry				14-25	7
F296	90374665	2505.5	28.188197	-25.833306	20	11	dry				4-8	6
F296	90374665	2803.2	28.188123	-25.833429	24	18	dry				10-18	6
F296	90374665	2902.2	28.188075	-25.833531	12	5	dry					5
F296	90374665	A	28.188276	-25.833358	66	60	dry					8
F297	90575081	BH735-1	28.215196	-25.852445	12	5	dry					5
F297	90575081	BH735-2	28.21525	-25.852518	12	6	dry					3
F298	90575082	983/1	28.2036	-25.825608	10	1	dry					5
F298	90575082	983/2	28.203639	-25.825757	29	23	dry				8-23	7
F298	90575082	983/3	28.203628	-25.825709	10	4	dry					5
F298	90575082	983/4	28.2035	-25.82567	10	3	dry					5
F298	90575082	983/5	28.203427	-25.825666	13	4	dry					5
F298	90575082	983/6	28.203596	-25.825664	9	3	dry					5
F298	90588669	983/10	28.203505	-25.825846	14	2	dry					5
F298	90588669	983/11	28.203326	-25.825817	8	2	dry					5
F298	90588669	983/12	28.203304	-25.825763	9	6	dry					3
F298	90588669	983/13	28.203364	-25.82577	9	6	dry					3
F298	90588669	983/14	28.203443	-25.825772	10	1	dry					5
F298	90588669	983/15	28.203554	-25.825778	13	7	dry					3
F298	90588669	983/16	28.203411	-25.825854	16	12	dry				4-6;7-12	6
F298	90588669	983/17	28.20331	-25.825709	17	11	dry				6-11	6
F298	90588669	983/18	28.203382	-25.825724	15	10	dry				7-10	6
F298	90588669	983/19	28.203484	-25.825745	9	2	dry					5
F298	90588669	983/7	28.203331	-25.825786	37	>37	dry			29-33	12-29;33-3	8
F298	90588669	983/8	28.203241	-25.825749	10	0	dry					5
F298	90588669	983/9	28.203272	-25.825917	8	2	dry					5
F299	90474052	BH1	28.186326	-25.839664	25	>25	dry	4-9				4
F299	90474052	BH1A	28.187636	-25.838852	13	5	dry					5
F299	90474052	BH2	28.186861	-25.839794	25	>25	dry	5-25				2
F299	90474052	BH2508	28.186676	-25.840126	11	3	dry				5-6	5
F299	90474052	BH2702	28.186362	-25.839628	32	26	dry	2-22			22-25	4
F299	90474052	BH2805	28.186705	-25.839725	52	46	dry	3-19			30-45	8
F299	90474052	BH2807.5	28.186929	-25.839859	26	20	dry					4
F299	90474052	BH2A	28.187255	-25.839246	41	35	dry	16-20			7-16;20-35	7
F299	90474052	BH3	28.186815	-25.839233	25	>25	dry	13-25				2
F299	90474052	BH3100.2	28.186531	-25.839282	40	32	dry	27-30			16-27;30-3	7
F299	90474052	BH3211	28.186985	-25.838958	32	26	dry				5-23	7
F299	90474052	BH3310.2	28.186994	-25.839039	23	18	dry				6-18	6
F299	90474052	BH3629	28.187817	-25.838508	13	7	dry					3
F299	90474052	BH3702.3	28.186845	-25.839423	26	20	dry					4

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of: Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F299	90474052	BH3709	28.18708	-25.839205	25	20	dry	17-18			8-17	6
F299	90474052	BH3821	28.187495	-25.838785	17	11	dry	3-4			4-10	6
F299	90474052	BH3917	28.187439	-25.839011	37	32	dry				20-32	7
F299	90474052	BH4	28.187474	-25.839247	25	>25	dry	16-22				4
F299	90474052	BH4002	28.186926	-25.839531	15	10	dry				7-10	6
F299	90474052	BH4006	28.187066	-25.8394	29	19	dry				15-18	6
F299	90474052	BH4009	28.187179	-25.839309	12	7	dry					3
F299	90474052	BH4227	28.187922	-25.838786	10	4	dry					5
F299	90474052	BH4310	28.187326	-25.839366	22	16	dry				13-16	6
F299	90474052	BH4523	28.187883	-25.839015	8	2	dry					5
F299	90474052	BH4618	28.187725	-25.83921	36	30	dry			22-24;25-3		7
F299	90474052	BH5	28.187842	-25.838885	25	4	dry					5
F299	90474052	BH6	28.187304	-25.838742	25	>25	dry	8-12				4
F299	90584858	DMT1	28.187359	-25.839048	21	15	dry					3
F299	90584858	DMT2	28.18745	-25.838904	30	>30	dry				18-30	7
F299	90584858	DMT3	28.187581	-25.83867	18	12	dry				9-12	3
F299	90584858	DMT4	28.186546	-25.839747	40	>40	dry				25-40	8
F299	90584858	DMT5	28.186886	-25.839623	13	7	dry					3
F299	90584858	DMT6	28.186509	-25.839404	20	14	dry					3
F299	90584858	DMT7	28.186705	-25.83991	24	18	dry					4
F299	90584858	DMT8	28.187155	-25.83966	34	28	dry					4
F300	90562924	BH145/1	28.197325	-25.860864	32	26	dry		17-22		5-17;22-26	7
F300	90562924	BH145/2	28.197259	-25.86096	32	25	dry				9-25	7
F300	90562924	BH145/3	28.19718	-25.860773	30	24	dry					4
F300	90562924	BH145/4	28.197219	-25.860867	30	23	dry		19-21		5-19;21-23	7
F300	90562924	BH145/5	28.197095	-25.860893	22	16	dry		1-9		9-13	6
F300	90562924	BH145/6	28.197353	-25.860753	25	19	dry				6-19	6
F301	90374367	BH3006.5	28.190583	-25.839573	23	18	dry	8-16				4
F301	90374367	BH3101	28.189976	-25.84021	9	3	dry					5
F301	90374367	BH3103	28.190271	-25.839957	23	18	dry	4-7			9-17	6
F301	90374367	BH3204	28.190548	-25.83996	23	18	dry	1-8	10-11		8-10;14-18	6
F301	90374367	BH3302	28.190403	-25.840339	11	5	dry					5
F301	90374367	BH3404	28.190821	-25.840214	28	23	dry	2-17			17-21	4
F301	90374367	BH3408	28.191373	-25.839829	30	>30	dry	1-30				1
F303	90420614	1	28.184421	-25.847473	39	34	dry				21-23	4
F303	90420614	2	28.184277	-25.847986	26	>26	dry					4
F303	90420614	3	28.183671	-25.847566	37	31	dry					4
F303	90420614	3/10	28.183228	-25.84674	16	10	dry					3
F303	90420614	4/12	28.183134	-25.847037	20	>20	dry					4
F303	90420614	4/16	28.182704	-25.847403	20	>20	dry			9-14		7
F303	90420614	5/8	28.183665	-25.846769	17	11	dry					6
F303	90420614	7/9	28.18378	-25.84707	17	10	dry					6
F303	90420614	C/13	28.185645	-25.84768	18	12	dry				10-12	6
F303	90420614	D/10	28.185233	-25.847471	22	>22	dry					4
F303	90420614	E/12-13	28.185371	-25.847821	22	>22	dry					4
F303	90420614	F/9-10	28.184929	-25.847606	20	>23	dry				10-11	4
F303	90420614	F-G/11	28.185056	-25.847789	25	>25	dry					4
F3034	90564025	2102	28.186593	-25.860911	28	21	dry					4
F3034	90564025	2104	28.186227	-25.861346	42	>42	dry					2
F3034	90564025	2107	28.1857	-25.861944	21	16-Jan	dry					4
F3034	90564025	21-2203	28.186319	-25.861002	39	36	dry					8
F3034	90564025	2302	28.186213	-25.860665	38	33	dry					2
F3034	90564025	2304	28.185848	-25.861051	25	>25	dry					4
F3034	90564025	2308	28.185152	-25.861888	18	>18	dry					7
F3034	90564025	2501	28.186009	-25.860187	31	>31	dry					4
F3034	90564025	2503	28.185665	-25.860594	28	>28	dry					2
F3034	90564025	2505	28.185299	-25.861002	25	8	dry					3
F3034	90564025	2510	28.184435	-25.862042	25	6	dry					3
F3034	90564025	2706	28.184765	-25.860974	25	7	dry					3
F3034	90564025	2710/11	28.183894	-25.861944	25	6	dry					3
F3034	90564025	27-2809	28.184131	-25.861446	19	10	dry					3
F3034	90564025	2803	28.185096	-25.860229	24	12-Jan	dry					3
F3034	90564025	29-3006	28.184266	-25.860552	16	7	dry					3
F3034	90564025	29-3009	28.183739	-25.861171	22	13	dry					6
F3034	90564025	29-3011	28.183387	-25.861571	19	6	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F3034	90564025	3001	28.185081	-25.85954	30	24	dry					7
F3034	90564025	3004	28.184554	-25.860165	25	15	dry					6
F3034	90564025	31-3208	28.183549	-25.860714	25	19	dry					6
F3034	90564025	3303	28.183985	-25.859779	25	3	dry					5
F3034	90564025	3305	28.183816	-25.85999	25	20	dry					4
F3034	90564025	3311	28.182738	-25.861234	25	4	dry					5
F3034	90564025	3409	28.182902	-25.860693	25	8	dry					3
F3034	90564025	42-4302	28.182678	-25.858071	30	>30	dry					2
F3034	90564025	42-4306	28.181827	-25.858731	22	12	dry					3
F3034	90568864	2206/2105	28.185813	-25.861649	30	14	dry					3
F3034	90568864	2310	28.184814	-25.862288	18	5	dry					5
F3034	90568864	2406	28.18532	-25.861346	25	9	dry					3
F3034	90568864	2604	28.185299	-25.860665	26	10	dry					3
F3034	90568864	2608	28.184596	-25.861515	17	9	dry					3
F3034	90568864	2701	28.185644	-25.859926	30	15	dry					3
F3034	90568864	2907	28.18421	-25.860925	25	18	dry					4
F3034	90568864	3201	28.184695	-25.859301	36	30	dry					4
F3034	90568864	3204/3103	28.184379	-25.859863	22	9	dry					3
F3034	90568864	3206/3105	28.184013	-25.86025	25	19	dry					4
F3034	90568864	3210	28.183113	-25.86115	30	23	dry					4
F3034	90568864	3501	28.184133	-25.858914	18	17	dry					6
F3034	90568864	3503	28.183781	-25.859315	28	21	dry					4
F3034	90568864	3507	28.183064	-25.86013	19	14	dry					3
F3034	90568864	3510	28.182551	-25.86077	30	7	dry					3
F3034	90568864	3600	28.184126	-25.858563	21	>21	dry					4
F3034	90568864	3605	28.183254	-25.859589	20	12	dry					3
F3034	90568864	3608/3709	28.18253	-25.860222	26	4	dry					5
F3034	90568864	3702	28.183605	-25.858858	30	24	dry					4
F3034	90568864	3801	28.18357	-25.858514	38	32	dry					4
F3034	90568864	3804	28.183043	-25.859132	30	16	dry					4
F3034	90568864	3807	28.182488	-25.859751	24	22	dry					7
F3034	90568864	3810	28.181953	-25.860369	25	21	dry					4
F3034	90568864	4003	28.182952	-25.858753	25	19	dry					4
F3034	90568864	4006/4106	28.182171	-25.859174	24	9	dry					3
F3034	90568864	S1	28.183444	-25.859884	35	10	dry					3
F3034	90568864	S10	28.18537	-25.860243	27	12	dry					3
F3034	90568864	S11	28.18511	-25.860538	35	7	dry					3
F3034	90568864	S12	28.18506	-25.861649	20	18	dry					4
F3034	90568864	S13	28.184793	-25.861993	28	4	dry					5
F3034	90568864	S14	28.185419	-25.861909	30	10	dry					3
F3034	90568864	S15	28.185243	-25.862091	30	8	dry					3
F3034	90568864	S2	28.183275	-25.860264	33	14	dry					3
F3034	90568864	S3	28.183655	-25.860362	35	5	dry					5
F3034	90568864	S4	28.183268	-25.860587	32	11	dry					3
F3034	90568864	S5	28.183922	-25.860875	30	7	dry					3
F3034	90568864	S6	28.183486	-25.861058	30	6	dry					3
F3034	90568864	S7	28.184034	-25.861135	30	10	dry					3
F3034	90568864	S8	28.184175	-25.859413	25	3	dry					5
F3034	90568864	S9	28.184723	-25.859765	28	6	dry					3
F3037	90564321	1	28.190666	-25.849657	15	9	dry					3
F3037	90564321	10	28.191122	-25.850377	15	1	dry					5
F3037	90564321	11	28.191301	-25.84998	20	13	dry					3
F3037	90564321	12	28.191225	-25.850086	17	11	dry					3
F3037	90564321	13	28.191237	-25.850255	18	11	dry					3
F3037	90564321	2	28.190422	-25.850012	23	3	dry					5
F3037	90564321	3	28.190639	-25.850077	18	12	dry					3
F3037	90564321	4	28.190911	-25.850175	15	9	dry					3
F3037	90564321	5	28.19105	-25.850448	31	25	dry					7
F3037	90564321	6	28.191098	-25.850138	11	5	dry					5
F3037	90564321	7	28.191356	-25.850137	23	17-Jan	dry					4
F3037	90564321	8	28.191183	-25.84984	25	19	dry					4
F3037	90564321	9	28.190974	-25.850381	24	6	dry					3
F3039	90564141	1101	28.198383	-25.850722	12	6	dry					3
F3039	90564141	1105	28.198044	-25.851091	15	9	dry					3
F3039	90564141	1207	28.197705	-25.851255	25	>25	dry					4

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F3039	90564141	1305	28.197794	-25.850956	14	8	dry					3
F3039	90564141	1401	28.198047	-25.850456	50	>50	dry					8
F3039	90564141	1407	28.197504	-25.851089	18	13	dry					3
F3039	90564141	1503/1605	28.197708	-25.85062	21	11-Jan	dry					3
F3039	90564141	1602	28.197711	-25.850396	45	22	dry					7
F3039	90564141	1606/1706	28.197347	-25.850805	28	22	dry					4
F3039	90564141	BH1	28.198273	-25.851004	38	33	dry					7
F3039	90564141	BH10	28.198278	-25.850832	13	7	dry					3
F3039	90564141	BH11	28.198364	-25.85092	22	11	dry					3
F3039	90564141	BH12	28.198186	-25.850931	21	15	dry					6
F3039	90564141	BH13	28.198061	-25.850969	37	32	dry					7
F3039	90564141	BH14	28.198201	-25.851087	17	11	dry					3
F3039	90564141	BH2	28.198461	-25.850629	23	18	dry					4
F3039	90564141	BH3	28.198176	-25.850764	12	6	dry					6
F3039	90564141	BH4	28.197902	-25.851064	10	1	dry					5
F3039	90564141	BH5	28.197834	-25.851368	27	21	dry					4
F3039	90564141	BH6	28.197312	-25.850986	12	6	dry					3
F3039	90564141	BH7	28.197491	-25.850739	14	7	dry					3
F3039	90564141	BH8	28.198485	-25.850797	21	16	dry					4
F3039	90564141	BH9	28.198291	-25.850645	22	11	dry					3
F304	90374765	10-11/11-12	28.194819	-25.845669	20	>20	dry					4
F304	90374765	8/12	28.195151	-25.845836	20	>20	dry			9-10		4
F304	90374765	9-10/12-13	28.195034	-25.845658	20	>20	dry	4-10				4
F304	90374765	BH1	28.195049	-25.845343	15	>15	dry	2-15				4
F304	90374765	BH2	28.194823	-25.845295	16	>16	dry	4-8				4
F304	90374765	BH3	28.194671	-25.845447	17	11	dry					3
F304	90374765	BH4	28.195279	-25.845497	30	>30	dry	3-16			20-26;27-3	7
F305	90374101	1	28.191965	-25.850655	25	3	dry					5
F305	90374101	10	28.191459	-25.851447	25	15	dry					3
F305	90374101	11	28.190956	-25.851574	25	7	dry					3
F305	90374101	2	28.191394	-25.850583	25	12	dry					3
F305	90374101	3	28.191765	-25.851238	25	14	dry					3
F305	90374101	4	28.191235	-25.851116	25	6	dry					3
F305	90374101	5	28.190903	-25.851263	25	13	dry				9-11	3
F305	90374101	6	28.191277	-25.851724	24	>24	dry					4
F305	90374101	7	28.191643	-25.850912	25	18	dry					4
F305	90374101	8	28.190948	-25.851051	25	6	dry					3
F305	90374101	9	28.191123	-25.851402	25	14	dry				11-13	3
F305	90420889	BH1	28.191646	-25.850249	57	51	dry				19-51	8
F305	90420889	BH11	28.19142	-25.850435	28	22	dry				8-17	7
F305	90420889	BH2	28.191658	-25.85042	51	50	dry				13-50	8
F305	90420889	BH3	28.191457	-25.85082	28	23	dry				11-23	7
F305	90420889	BH4	28.191991	-25.850875	10	1	dry					5
F305	90420889	BH5	28.192	-25.851182	16	10	dry					3
F305	90420889	BH6	28.191797	-25.851086	23	17	dry				11-17	6
F305	90420889	BH7	28.191094	-25.850907	20	10	dry					3
F305	90420889	BH8	28.190754	-25.85158	10	2	dry					5
F305	90421122	D12	28.191498	-25.850843	8	5	dry					5
F305	90421122	D9	28.191427	-25.85069	5	1	dry					5
F305	90421122	E10	28.191218	-25.851714	10	7	dry					3
F305	90421122	G5	28.191745	-25.851138	10	7	dry					3
F305	90421122	H1	28.191546	-25.850885	8	5	dry					5
F305	90421122	H22	28.191839	-25.850932	11	8	dry					3
F305	90421122	H6	28.191598	-25.850699	8	1	dry					5
F305	90421122	I1	28.191791	-25.850428	15	12	dry					3
F305	90421122	I2	28.191865	-25.85034	18	15	dry					3
F305	90421122	I3	28.191983	-25.850364	7	3	dry					5
F306	90575078	BH1	28.20361	-25.854553	25	19	dry	13-19			6-13	4
F306	90575078	BH2	28.203857	-25.854006	7	1	dry					5
F306	90575078	BH3	28.203512	-25.853993	15	8	dry					3
F306	90575078	BH4	28.203127	-25.854271	16	10	dry					3
F306	90575078	BH5	28.203519	-25.854456	34	27	dry				10-27	7
F306	90575078	BH6	28.203713	-25.854317	8	2	dry					5
F306	90575078	BH7	28.203469	-25.854282	10	4	dry					5
F306	90575078	BH8	28.203187	-25.854072	14	8	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F306	90575078	FP1	28.203379	-25.853768	30	20	dry		1-4			4
F306	90575078	FP10	28.203641	-25.854242	15	1	dry					5
F306	90575078	FP11	28.203797	-25.854411	15	1	dry					5
F306	90575078	FP12	28.203375	-25.854246	14	2	dry					5
F306	90575078	FP13	28.203147	-25.854157	30	28	dry		4-6	20-22	6-20;22-24	7
F306	90575078	FP14	28.203453	-25.853843	20	14	dry				7-8;10-14	3
F306	90575078	FP15	28.203667	-25.853929	10	3	dry					5
F306	90575078	FP16	28.203472	-25.85399	10	1	dry					5
F306	90575078	FP17	28.203198	-25.854178	30	18	dry				4-18	6
F306	90575078	FP18	28.203588	-25.853887	7	1	dry					5
F306	90575078	FP19	28.203423	-25.853805	11	1	dry					5
F306	90575078	FP2	28.203784	-25.853917	20	2	dry					5
F306	90575078	FP20	28.203386	-25.853871	12	6	dry					3
F306	90575078	FP21	28.203348	-25.854132	12	1	dry					5
F306	90575078	FP22	28.203305	-25.854218	35	30	dry					4
F306	90575078	FP3	28.203994	-25.854106	20	4	dry					5
F306	90575078	FP4	28.203527	-25.85391	25	17	dry					4
F306	90575078	FP5	28.203324	-25.853933	20	5	dry					5
F306	90575078	FP6	28.203724	-25.854072	15	5	dry					5
F306	90575078	FP7	28.203899	-25.854259	20	2	dry					5
F306	90575078	FP8	28.203443	-25.854079	20	3	dry					5
F306	90575078	FP9	28.203237	-25.854092	12	1	dry					5
F3069	90564324	3206	28.199448	-25.858827	20	14	dry				9-11	6
F3069	90564324	3502/3401	28.199809	-25.859442	20	16	dry				12-16	6
F3069	90564324	3606/3707	28.199003	-25.859265	39	33	dry				28-33	7
F3069	90564601	4/9	28.19886	-25.858494	20	16	dry		3-5		12-16	6
F3069	90564601	5/10	28.199	-25.858469	16	>16	dry		6-8			4
F3069	90564601	6/5	28.198799	-25.858898	9	3	dry					5
F3069	90564601	6/7	28.198913	-25.858747	12	6	dry					3
F3069	90564601	7/5	28.19888	-25.858954	20	14	dry				8-12	6
F3069	90564601	7/9	28.199111	-25.858646	8	2	dry					5
F307	90108523	10/3	28.201112	-25.853199	22	17	dry		6-9			4
F307	90108523	12-13/3	28.20135	-25.852936	13	7	dry					3
F307	90108523	2/2-3	28.200291	-25.85399	17	11	dry					3
F307	90108523	2/5	28.200584	-25.854203	18	12	dry					3
F307	90108523	2/9	28.201046	-25.85455	13	7	dry					3
F307	90108523	4/9	28.201233	-25.854343	14	8	dry					3
F307	90108523	6-7/3-4	28.200836	-25.853604	12	7	dry					3
F307	90108523	LAH-D-4/33	28.201612	-25.854044	31	29	dry					2
F307	90482191	BH1	28.201892	-25.853618	39	32	dry					1
F307	90482191	BH2	28.201556	-25.853452	45	38	dry					2
F307	90482191	BH3	28.201755	-25.853317	38	32	dry					2
F3072	90564163	BH1	28.216053	-25.856915	21	15	dry					3
F3072	90564163	BH10	28.217738	-25.858249	16	10	dry		1-5;6-8		8-10	3
F3072	90564163	BH11	28.218594	-25.858202	10	3	dry					5
F3072	90564163	BH12	28.218189	-25.857791	13	7	dry					3
F3072	90564163	BH13	28.218437	-25.858132	18	12	dry		5-9		9-12	6
F3072	90564163	BH14	28.218437	-25.857749	21	15	dry		6-9		9-15	6
F3072	90564163	BH15	28.218427	-25.857447	14	8	dry				2-8	6
F3072	90564163	BH16	28.218019	-25.856881	16	10	dry			6-10	5-6	6
F3072	90564163	BH2	28.215947	-25.856438	10	3	dry				1-3	5
F3072	90564163	BH3	28.216023	-25.857328	19	13	dry		6-7		7-13	6
F3072	90564163	BH4	28.215443	-25.857099	11	5	dry					5
F3072	90564163	BH5	28.215917	-25.857944	28	20	dry				4-20	7
F3072	90564163	BH6	28.216295	-25.85766	18	12	dry		7-9		3-7; 9-11	6
F3072	90564163	BH7	28.216849	-25.857372	16	10	dry		4-5			3
F3072	90564163	BH8	28.21632	-25.858149	11	5	dry					5
F3072	90564163	BH9	28.217798	-25.857457	10	3	dry					5
F3073	90568802	BH1	28.198735	-25.863139	20	>20	dry					4
F3073	90568802	BH2	28.199251	-25.863046	30	>30	dry				27-30	7
F3073	90568802	BH3	28.200958	-25.863016	20	>20	dry					4
F3073	90568802	BH4	28.20176	-25.862907	20	>20	dry	10-17			5-9;17-20	6
F3074	90564164	BH1137/1	28.206155	-25.822137	32	26	dry	6-20				2
F3074	90564164	BH1137/2	28.206276	-25.822212	33	27	dry	6-24				2
F3076	90584433	BH1	28.187562	-25.850159	30	24	dry				9-17	7

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F3076	90584433	BH2	28.187139	-25.850452	32	24	dry				23-25	4
F3076	90584433	BH3	28.186608	-25.849793	30	27	dry				14-27	7
F3076	90584433	BH4	28.187264	-25.850506	10	3	dry					5
F3076	90584433	BHA1	28.187313	-25.85026	19	13	dry					3
F3076	90584433	BHA2	28.187177	-25.85004	15	9	dry					3
F3076	90584433	BHA3	28.186963	-25.849685	27	20	dry				13-20	6
F308	90083087	BH1	28.191818	-25.855102	15	10	dry					3
F308	90083087	BH2	28.19228	-25.855396	25	>25	dry					4
F308	90083087	BH3	28.191915	-25.855549	20	15	dry					3
F308	90083087	BH4	28.191647	-25.855506	17	13	dry					3
F308	90083087	BH5	28.191263	-25.855578	25	22	dry			19-22		7
F308	90083087	BH6	28.191346	-25.856067	29	>29	dry				25-29	7
F308	90083087	BH7	28.19142	-25.855662	26	19	dry					4
F308	90083087	BH8	28.191753	-25.855895	30	>30	dry				23-30	7
F309	90083129	10/3	28.200303	-25.857556	10	4	dry					5
F309	90083129	11-12/8-9	28.200752	-25.857198	6	1	dry					5
F309	90083129	3/2	28.199677	-25.857283	20	>20	dry				12-20	7
F309	90083129	4/10	28.200236	-25.8567	20	>20	dry	8-15		17-20		7
F309	90083129	4/6	28.199996	-25.857017	15	10	dry					3
F309	90083129	4/8	28.200119	-25.856857	14	8	dry	3-7				3
F309	90083129	6/4	28.200041	-25.857275	20	>20	dry				15-20	7
F309	90083129	6-7/6	28.200197	-25.85714	20	8	dry					3
F309	90083129	9-10/7	28.200504	-25.857216	18	12	dry	4-11				3
F3093	90568885	1	28.190657	-25.846622	11	5	dry					5
F3093	90568885	10	28.190748	-25.8469	9	4	dry					5
F3093	90568885	11	28.190758	-25.847083	9	2	dry					5
F3093	90568885	12	28.190887	-25.847024	13	6	dry					3
F3093	90568885	13	28.191018	-25.846878	17	>17	dry					7
F3093	90568885	14	28.190946	-25.846909	17	14	dry					3
F3093	90568885	16	28.190753	-25.846786	18	13	dry					3
F3093	90568885	17	28.190458	-25.846569	8	1	dry					5
F3093	90568885	18	28.190434	-25.846289	9	2	dry					5
F3093	90568885	19	28.19025	-25.846289	19	14	dry					6
F3093	90568885	2	28.190235	-25.846401	16	10	dry					3
F3093	90568885	20	28.19007	-25.846316	9	3	dry					5
F3093	90568885	21	28.190114	-25.846409	9	1	dry					5
F3093	90568885	22	28.1906	-25.8469	9	2	dry					5
F3093	90568885	23	28.190745	-25.846644	15	9	dry					3
F3093	90568885	24	28.190704	-25.846559	20	>20	dry					8
F3093	90568885	25	28.190682	-25.846598	10	4	dry					5
F3093	90568885	26	28.190628	-25.846521	14	9	dry					3
F3093	90568885	27	28.190586	-25.846608	19	13	dry					3
F3093	90568885	28	28.190637	-25.846591	37	>37	dry					8
F3093	90568885	29	28.190618	-25.846622	25	19-Jan	dry					4
F3093	90568885	3	28.190328	-25.846131	13	7	dry					3
F3093	90568885	30	28.190681	-25.846689	11	5	dry					5
F3093	90568885	31	28.190796	-25.846674	21	15	dry					3
F3093	90568885	32	28.190777	-25.846723	7	1	dry					5
F3093	90568885	33	28.190816	-25.84684	18	12	dry					6
F3093	90568885	34	28.190907	-25.846797	22	15	dry					3
F3093	90568885	35	28.190817	-25.846791	9	3	dry					5
F3093	90568885	36	28.190983	-25.846838	21	>21	dry					7
F3093	90568885	37	28.190816	-25.847047	9	2	dry					5
F3093	90568885	38	28.190823	-25.846963	11	5	dry					5
F3093	90568885	39	28.190689	-25.846978	12	3	dry					5
F3093	90568885	4	28.190585	-25.846369	21	17-Jan	dry					4
F3093	90568885	40	28.190681	-25.846838	16	11	dry					6
F3093	90568885	41	28.190579	-25.846745	16	10	dry					6
F3093	90568885	42	28.190554	-25.846784	7	2	dry					5
F3093	90568885	43	28.190478	-25.846672	15	9	dry					3
F3093	90568885	44	28.190363	-25.846548	10	3	dry					5
F3093	90568885	45	28.19026	-25.846531	15	8	dry					6
F3093	90568885	46	28.190173	-25.846348	18	13	dry					6
F3093	90568885	47	28.190318	-25.846198	10	1	dry					5
F3093	90568885	48	28.190352	-25.846304	7	1	dry					5

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F3093	90568885	49	28.190333	-25.846385	18	12	dry					3
F3093	90568885	5	28.19033	-25.846654	14	7	dry					3
F3093	90568885	50	28.190249	-25.846353	19	15	dry					3
F3093	90568885	51	28.190159	-25.846304	15	12	dry					6
F3093	90568885	52	28.190124	-25.846315	17	11	dry					6
F3093	90568885	53	28.190495	-25.846431	15	10	dry					6
F3093	90568885	54	28.190505	-25.846323	15	9	dry					6
F3093	90568885	55	28.190453	-25.846372	18	14	dry					6
F3093	90568885	6	28.190473	-25.846762	15	8	dry					3
F3093	90568885	7	28.190406	-25.846411	9	3	dry					5
F3093	90568885	8	28.190726	-25.846509	33	28	dry					7
F3093	90568885	9	28.190848	-25.846738	9	1	dry					5
F3096	90568804	BH1-628	28.205439	-25.837254	21	15	dry					3
F3096	90568804	BH2-628	28.205378	-25.837307	16	10	dry					3
F310	90083060	1	28.197898	-25.854976	24	16	dry					4
F310	90083060	10	28.198109	-25.85554	25	>25	dry				13-16	4
F310	90083060	11	28.197405	-25.85568	25	>25	dry					4
F310	90083060	12	28.197493	-25.855375	25	13	dry					3
F310	90083060	13	28.198002	-25.855451	25	13	dry					3
F310	90083060	14	28.197601	-25.855526	25	6	dry					3
F310	90083060	15	28.19787	-25.855723	25	5	dry					5
F310	90083060	2	28.197862	-25.855471	30	3	dry					5
F310	90083060	3	28.19753	-25.856007	30	3	dry					5
F310	90083060	4	28.197139	-25.856076	30	>30	dry					4
F310	90083060	5	28.197777	-25.855186	25	5	dry					5
F310	90083060	6	28.198285	-25.855404	25	13	dry					3
F310	90083060	7	28.198123	-25.855753	25	9	dry					3
F310	90083060	8	28.197968	-25.855926	25	22	dry		5-12			4
F310	90083060	9	28.197788	-25.85613	25	16	dry					4
F310	90374542	16	28.197305	-25.855888	25	7	dry					3
F310	90374542	17	28.197165	-25.855719	25	6	dry					3
F310	90374542	18	28.197031	-25.855904	25	14	dry					3
F310	90374542	19	28.196878	-25.856037	25	21	dry					7
F310	90374542	20	28.19712	-25.856236	25	16	dry					4
F310	90374542	21	28.197509	-25.856179	25	6	dry					3
F310	90374542	22	28.197337	-25.856329	25	15	dry					3
F310	90374542	23	28.197532	-25.856488	25	2	dry					5
F3102	90584236	3203	28.192111	-25.839749	40	>40	dry	16-40				2
F3102	90584236	3401/3501	28.192073	-25.840164	40	36	dry	6-29			29-36	4
F3102	90584236	3504	28.1917	-25.839929	31	25	dry	2-23				2
F3102	90584236	3804	28.191395	-25.840198	40	04-Feb	dry	3-17			20-35	7
F3102	90584236	4204	28.190981	-25.840558	40	35	dry			25-32;33-3	32-33	7
F3102	90584236	BH1	28.192411	-25.839845	44	>44	dry	16-44				2
F3102	90584236	BH2	28.191704	-25.840206	35	29	dry	2-18				4
F3102	90584236	BH3	28.19169	-25.840483	30	19	dry	1-7				4
F3102	90584236	BH4	28.191201	-25.840657	30	25	dry	2-20				4
F3102	90584236	BH5	28.191062	-25.841067	37	>37	dry	1-37				1
F3102	90584236	BH6	28.191134	-25.840329	23	17	dry	2-10				4
F3102	90584236	BH7	28.190881	-25.840758	22	1	dry					5
F312	90230204	BH1	28.201026	-25.857214	25	>25	dry	12-20				4
F312	90230204	BH10	28.200855	-25.857754	32	26	dry	6-26				2
F312	90230204	BH2	28.201338	-25.857392	25	>25	dry	1-23				2
F312	90230204	BH3	28.201199	-25.857756	25	>25	dry				15-25	7
F312	90230204	BH4	28.200665	-25.857795	25	3	dry	19-25				5
F312	90230204	BH5	28.200993	-25.857998	23	>23	dry	8-23				4
F312	90230204	BH6	28.201295	-25.857678	25	>25	dry	18-25			12-18	4
F312	90230204	BH7	28.20145	-25.857552	25	>25	dry	4-25				2
F312	90230204	BH8	28.201026	-25.857508	25	>25	dry	14-25				4
F312	90230204	BH9	28.200943	-25.857313	30	20	dry	8-20				4
F312	90575035	BH11	28.201292	-25.857611	55	46	dry	33-46				4
F312	90575035	BH12	28.201133	-25.857555	47	39	dry	19-39				2
F312	90575035	BH13	28.201079	-25.857675	32	25-Jan	dry	6-16			16-25	7
F312	90575035	BH14	28.201109	-25.857795	30	23	dry	5-9;12-23	9-12			4
F312	90575035	BH15	28.201185	-25.857904	43	37	dry	10-28			28-37	8
F312	90575035	BH16	28.200708	-25.85753	18	12	dry	3-8				3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F312	90575035	BH17	28.200611	-25.857661	13	7	dry					3
F312	90575035	BH18	28.200748	-25.857747	18	12	dry	6-12				3
F312	90575035	BH19	28.200504	-25.85781	14	8	dry	3-5				3
F312	90575035	BH20	28.200672	-25.857941	15	9	dry	3-9				3
F312	90575035	BH21	28.2009	-25.858112	25	19	dry	7-15				4
F312	90575035	BH22	28.200794	-25.857893	45	30	dry	6-15				4
F312	90575035	BH23	28.200969	-25.857856	30	22	dry	17-22	9-17			4
F312	90575035	BH24	28.201267	-25.857506	60	>60	dry					4
F312	90575035	BH25	28.201111	-25.857404	45	41	dry					4
F312	90575035	BH26	28.201153	-25.857189	51	41	dry					4
F3122	90589066	BH1591/1	28.172435	-25.875292	10	1	dry					5
F3140	90575046	1	28.185677	-25.863282	25	8	dry	19-25				3
F3140	90575046	10	28.185307	-25.863388	25	19	dry				15-19	6
F3140	90575046	11	28.185716	-25.86348	24	>24	dry	18-24				4
F3140	90575046	2	28.186243	-25.86361	30	>30	dry	24-30			11-17	7
F3140	90575046	3	28.185413	-25.863912	25	>25	dry	20-25				4
F3140	90575046	4	28.185197	-25.863523	24	>24	dry	4-24				2
F3140	90575046	5	28.186064	-25.863591	21	15	dry					3
F3140	90575046	6	28.185763	-25.86386	16	10	dry					3
F3140	90575046	7	28.185392	-25.864065	14	8	dry					3
F3140	90575046	8	28.185715	-25.863625	25	18	dry					4
F3140	90575046	9	28.185006	-25.86372	22	>22	dry	17-22			10-15	6
F3140	90584427	BH12	28.185402	-25.863204	60	45	dry	18-45	10-18			2
F3140	90584427	BH13	28.185237	-25.863347	34	>34	dry	17-34	9-17			2
F3140	90584427	BH14	28.185353	-25.863677	33	>33	dry	15-33	7-15			2
F3140	90584427	BH15	28.185141	-25.86395	32	>32	dry	14-32			10-14	7
F3140	90584427	BH16	28.185632	-25.864022	40	>40	dry	20-40			12-20	7
F3140	90584427	BH17	28.186043	-25.86378	40	>40	dry	22-40	10-11		11-20	7
F3140	90584427	BH18	28.186291	-25.863583	43	>18	dry	28-43			12-18	7
F3140	90584427	BH19	28.185995	-25.863365	60	50	dry	21-50	10-21			2
F3149	90584911	BH1	28.196034	-25.851151	15	7	dry					3
F3149	90584911	BH2	28.195705	-25.851501	20	6	dry					3
F3149	90584911	BH3	28.195351	-25.851076	30	12	dry					3
F3149	90584911	BH4	28.195619	-25.850923	16	11	dry					3
F3149	90584911	BH5	28.195636	-25.85109	25	17	dry					4
F3149	90584911	BH6	28.195814	-25.851277	12	4	dry					5
F3149	90584911	BH7	28.195837	-25.851073	30	4	dry					5
F3149	90584911	BH8	28.195469	-25.851318	30	7	dry					3
F3149	90584911	BH9	28.195414	-25.850893	20	12	dry					3
F316	90568827	CPA13	28.166237	-25.87708	16	10	10.2	1-9				3
F316	90568827	CPA9	28.165784	-25.877565	15	9	11.2				1-3	3
F316	90584336	BH11	28.168716	-25.873735	10	1	dry	8-10				5
F316	90584336	BH15	28.168713	-25.874105	11	5	dry					5
F316	90588671	BH10	28.16815	-25.874126	13	2	dry					5
F316	90588671	BH12	28.168194	-25.873665	10	0	dry					5
F316	90588671	BH17	28.167765	-25.874694	10	3	dry					5
F316	90588671	BH18	28.168118	-25.874919	11	9	dry	5-9				3
F316	90588671	BH19	28.167693	-25.875416	15	9	dry	1-8				3
F316	90588671	BH20	28.167242	-25.875925	11	9	dry	4-9			3-5	3
F316	90588671	BH21	28.166748	-25.876387	13	7	dry	9-12			3-4	3
F316	90588671	BH23	28.166754	-25.875847	10	0	dry	9-10				5
F316	90588671	BH24	28.167083	-25.875453	10	1	dry	6-10				5
F316	90588671	BH25	28.167352	-25.875142	13	11	dry	7-11			6-7	3
F316	90588671	BH7	28.166429	-25.876113	21	8	dry	2-7				3
F3166	90575222	BH1	28.208766	-25.849723	24	>24	dry	2-24				2
F3169	90081882	BG1	28.204301	-25.836266	38	33	dry			12-13	7-12;13-33	7
F3169	90081882	BG10	28.204088	-25.835604	25	>25	dry				15-25	7
F3169	90081882	BG11	28.204124	-25.835312	16	>16	dry				11-16	6
F3169	90081882	BG2	28.20424	-25.835736	28	24	dry				6-24	7
F3169	90081882	BG3	28.204192	-25.835383	11	7	dry					3
F3169	90081882	BG4	28.204463	-25.834683	11	7	dry					3
F3169	90081882	BG5	28.20419	-25.834727	14	8	dry				3-8	6
F3169	90081882	BG6	28.204547	-25.835111	9	5	dry					5
F3169	90081882	BG7	28.204021	-25.835463	31	28	dry				5-23	7
F3169	90081882	BG8	28.204256	-25.836278	19	>19	dry				8-19	6

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F3169	90081882	BG9	28.204169	-25.835724	20	>20	dry				11-20	6
F3170	90574994	BH1	28.20354	-25.840435	58	>58	dry	55-58				4
F3170	90574994	BH2	28.203493	-25.840266	57	>57	dry	30-57				2
F3185	90108856	G/VP5	28.198864	-25.839026	45	>45	dry	8-32				2
F3185	90108856	G/VP6	28.199241	-25.837727	45	>45	dry	37-45				4
F3185	90108856	G/VP7	28.198265	-25.83776	45	>45	dry	40-45				4
F3185	90124775	3/02-03	28.198131	-25.838151	35	>35	dry					4
F3185	90124775	3-4/01	28.198306	-25.838332	35	>35	dry					4
F3185	90124775	3-4/01	28.198306	-25.838332	35	>35	dry					4
F3185	90124775	5/03	28.19846	-25.837907	35	>35	dry					4
F3185	90124775	7/02	28.198886	-25.837939	30	>30	dry					4
F3185	90124775	BW1	28.199525	-25.837373	30	>30	dry					4
F3185	90124775	BW2	28.198998	-25.83734	30	>30	dry					4
F3185	90124775	BW3	28.199246	-25.837663	30	>30	dry					4
F3191	90564342	DT1	28.17466	-25.874695	10	2	dry					5
F3191	90564342	DT2	28.174638	-25.874542	8	2	dry	4-8				5
F3191	90564342	DT3	28.174765	-25.874514	10	2	dry					5
F3216	90568825	BH01	28.179883	-25.863214	44	38	dry	5-13;19-38				2
F3216	90568825	BH02	28.180013	-25.863382	44	38	dry	6-11;15-36				2
F3221	90564360	BH1811/1	28.207941	-25.845219	41	>41	dry	17-41				2
F3221	90564360	BH1811/2	28.207867	-25.845129	29	>29	dry	17-29				2
F3224	90564363	BH2019	28.186047	-25.840509	28	19	dry					4
F3224	90564363	BH2110/2111	28.185349	-25.841295	31	25	dry					4
F3224	90564363	BH2115	28.185773	-25.840934	29	22	dry					4
F3224	90564363	BH2212	28.185591	-25.841277	12	2	dry					5
F3224	90564363	BH2320	28.186439	-25.840729	15	3	dry					5
F3224	90564363	BH2411	28.185702	-25.841556	40	6	dry					3
F3224	90564363	BH2415	28.186073	-25.841232	40	>40	dry					8
F3224	90564363	BH2417	28.18626	-25.841074	13	7	dry					3
F3224	90564363	BH2419	28.18645	-25.840908	27	21	dry					7
F3224	90564363	BH2613	28.186086	-25.841598	17	1	dry					5
F3224	90564363	BH2710	28.185913	-25.84194	17	10	dry					6
F3224	90564363	BH2716	28.186471	-25.84145	10	2	dry					5
F3224	90564363	BH2719	28.186742	-25.841211	32	19	dry					6
F3224	90574951	BH1	28.185889	-25.841682	30	25	dry					4
F3224	90574951	BH2	28.186287	-25.841693	30	24	dry					4
F3224	90574951	BH3	28.185939	-25.841414	25	20	dry					4
F3224	90574951	BH4	28.185675	-25.84114	28	22	dry					4
F3224	90574951	BH5	28.185454	-25.840987	16	10	dry					3
F325	90562928	3206	28.168233	-25.873999	11	2	dry	7-11				5
F325	90562928	3505/3506	28.167608	-25.874668	10	4	dry					5
F325	90562928	3507/3508	28.168194	-25.874789	11	4	dry					5
F325	90562928	3805	28.166956	-25.875329	10	1	dry					5
F325	90562928	4205/4206	28.16645	-25.876308	15	8	dry	1-7			7-8	3
F325	90562928	4806	28.165623	-25.877754	13	3	dry					5
F3252	90564375	BH1	28.194772	-25.859403	33	27	dry					7
F3252	90564375	BH19	28.194971	-25.860373	15	>15	dry					4
F3252	90564375	BH2	28.194703	-25.859629	49	45	dry					1
F3252	90564375	BH3	28.194604	-25.859826	24	>24	dry					4
F3252	90564375	BH4	28.19467	-25.860239	40	>40	34m					2
F3252	90564375	BH41	28.194632	-25.859547	25	>25	dry					4
F3252	90564375	BH5	28.194604	-25.860042	21	>21	dry					2
F3252	90564375	BH6	28.194794	-25.860509	20	>20	dry					1
F3252	90584851	1	28.195417	-25.858851	16	>16	dry					4
F3252	90584851	10	28.196127	-25.85906	6	>6	dry					3
F3252	90584851	11	28.196556	-25.859328	7	2	dry					5
F3252	90584851	12	28.195558	-25.859223	8	>8	dry					3
F3252	90584851	13	28.196028	-25.859377	10	>10	dry					6
F3252	90584851	14	28.196461	-25.859606	5	>5	dry					3
F3252	90584851	15	28.195477	-25.859482	5	>5	dry					3
F3252	90584851	16	28.195912	-25.859714	6	>6	dry					3
F3252	90584851	17	28.196388	-25.859919	4	>4	dry					3
F3252	90584851	18	28.196087	-25.859982	5	>5	dry					3
F3252	90584851	2	28.195932	-25.858839	18	>18	dry					4
F3252	90584851	20	28.195873	-25.860635	15	>15	dry					4

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F3252	90584851	3	28.19638	-25.859101	11	>11	dry					4
F3252	90584851	38	28.194841	-25.859213	8	2	dry					5
F3252	90584851	39	28.195086	-25.859054	25	>25	dry					4
F3252	90584851	4	28.195322	-25.859158	12	>12	dry					4
F3252	90584851	40	28.195064	-25.859332	25	>25	dry					4
F3252	90584851	42	28.195695	-25.858747	25	>25	dry					4
F3252	90584851	43	28.195904	-25.859008	25	>25	dry	9-25				2
F3252	90584851	44	28.196148	-25.858906	25	>25	dry					4
F3252	90584851	45	28.196286	-25.859248	21	>21	dry					4
F3252	90584851	46	28.196538	-25.859519	25	>25	dry					4
F3252	90584851	47	28.195362	-25.859681	15	>15	dry					4
F3252	90584851	48	28.195743	-25.860061	15	>15	dry					4
F3252	90584851	49	28.19531	-25.859421	15	>15	dry					4
F3252	90584851	5	28.195844	-25.859161	17	>17	dry					4
F3252	90584851	50	28.195672	-25.859773	15	>15	dry					4
F3252	90584851	51	28.196026	-25.860126	15	>15	dry					4
F3252	90584851	52	28.195634	-25.859444	29	22	dry				10-22	7
F3252	90584851	53	28.195826	-25.859626	15	>15	dry				10-15	7
F3252	90584851	54	28.196028	-25.859827	15	>15	dry					4
F3252	90584851	55	28.195988	-25.859493	15	>15	dry	0-5				4
F3252	90584851	56	28.194954	-25.860787	30	>30	dry					4
F3252	90584851	57	28.195911	-25.860935	30	>30	dry					4
F3252	90584851	58	28.195472	-25.858688	14	10	dry					4
F3252	90584851	59	28.195989	-25.858736	13	7	dry					3
F3252	90584851	6	28.196275	-25.859393	14	>14	dry					4
F3252	90584851	60	28.195143	-25.858931	28	>28	dry					4
F3252	90584851	61	28.195196	-25.858952	17	11	dry					3
F3252	90584851	62	28.196303	-25.859164	20	13	dry					3
F3252	90584851	63	28.196367	-25.859167	17	11	dry					3
F3252	90584851	7	28.195751	-25.859448	14	>14	dry					4
F3252	90584851	8	28.19618	-25.859695	15	9	dry					3
F3252	90584851	9	28.19564	-25.858952	4	>4	dry					3
F3252	90588814	SP137	28.196108	-25.860725	29	18						4
F3252	90588814	SP138	28.195562	-25.860945	28	>28	9					4
F3252	90588814	SP139	28.195993	-25.860609	27	21	11					4
F3252	90588814	SP140	28.195622	-25.860718	28	22	9					7
F3252	90588814	SP141	28.195818	-25.860824	33	27	10					4
F3252	90588814	SP142	28.195766	-25.860641	23	17	8					4
F3252	90588814	SP143	28.19539	-25.860752	23	17	8					4
F3252	90588814	SP144	28.19512	-25.860733	31	18	9					4
F3252	90588814	SP145	28.195166	-25.860634	27	21	8					4
F3252	90588814	SP146	28.195026	-25.860663	57	51	8					8
F3255	90564377	BH1756/1	28.205464	-25.846835	13	7	dry					3
F3255	90564377	BH1756/2	28.205473	-25.846729	17	11	dry					3
F3259	90564379	25	28.18507	-25.840229	14	8	dry					3
F3259	90564379	28	28.185184	-25.84065	31	25	34					4
F3259	90564379	3301	28.184053	-25.840664	22	17	6m,9-10m,17-18					6
F3259	90564379	3602	28.184417	-25.840125	10	1	dry					5
F3259	90564379	4101/4201	28.185366	-25.839554	28	22	dry					4
F3259	90564379	4104	28.185056	-25.839311	21	15	0-9m					3
F3259	90564379	44	28.184841	-25.841157	31	26	dry					4
F3259	90564379	58	28.184281	-25.841175	17	4	dry					5
F3259	90564379	68	28.184213	-25.841706	11	1	dry					5
F3259	90564379	7	28.18568	-25.839961	23	6	dry					3
F3259	90564379	86	28.183606	-25.842213	24	18	0-1m, 14-19m					4
F3259	90564379	94	28.183142	-25.842631	40	>40	30m					8
F3259	90564539	BH14/17	28.185322	-25.840237	37	10	dry					3
F3259	90564539	BH19	28.18551	-25.840566	30	22	dry					4
F3259	90564539	BH3501	28.184311	-25.840427	20	0	dry					5
F3259	90564539	BH3802	28.184604	-25.839921	31	6	dry					3
F3259	90564539	BH39	28.18468	-25.840788	30	6	dry					3
F3259	90564539	BH3902/4002	28.184834	-25.839754	48	42	dry					4
F3259	90564539	BH4000	28.185143	-25.839932	38	24	dry					4
F3259	90564539	BH4200	28.185434	-25.839675	30	23	dry					4
F3259	90564539	BH48	28.184309	-25.840692	34	10	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F3259	90564539	BH60	28.184014	-25.84094	30	12	dry					3
F3259	90564539	BH70	28.183959	-25.841405	30	18	dry					4
F3259	90564539	BH77/79	28.184047	-25.841893	34	4	dry					5
F3259	90564539	BH80	28.18381	-25.841794	60	42	dry					2
F3259	90564539	BH9	28.185822	-25.840291	30	5	dry					5
F3280	90564600	BH1254/1	28.207948	-25.847898	15	6	dry					3
F3280	90564600	BH1254/2	28.207836	-25.847866	21	12	dry					3
F3285	90568859	BHA/2179	28.206278	-25.850573	19	13	dry		6-9			3
F3285	90568859	BHB/2179	28.206113	-25.850334	19	13	dry					3
F3293	90564383	1/341	28.208949	-25.837844	40	>40	dry				21-26	7
F3293	90564383	2/341	28.208836	-25.837719	40	>40	dry					4
F3296	90589038	2012	28.209059	-25.834762	11	4	dry					5
F3296	90589038	2312	28.20934	-25.834653	17	6	dry				2-6;9-11	6
F3296	90589038	2511	28.209529	-25.834678	11	4	dry					5
F3309	90589065	BH1590/1	28.173005	-25.875169	13	0	dry					5
F3309	90589065	BH1590/2	28.172845	-25.875222	12	2	dry					5
F3317	90574941	BH1	28.186017	-25.843306	50	>50	dry					8
F3317	90574941	BH10	28.185305	-25.84317	39	33	dry					4
F3317	90574941	BH11	28.185513	-25.843467	30	23	dry					4
F3317	90574941	BH12	28.185738	-25.843443	45	>45	dry					8
F3317	90574941	BH12/06	28.185459	-25.843241	20	>20	dry					4
F3317	90574941	BH13	28.185819	-25.843152	25	20	dry					4
F3317	90574941	BH2	28.185722	-25.842893	50	46	dry					1
F3317	90574941	BH3	28.185358	-25.842891	32	>32	dry					8
F3317	90574941	BH4	28.18607	-25.8433	27	21-Jan	dry					4
F3317	90574941	BH5	28.185663	-25.843277	40	>40	dry					8
F3317	90574941	BH6	28.185165	-25.843217	40	05-Feb	dry					4
F3317	90574941	BH7	28.185908	-25.842986	46	39	dry					8
F3317	90574941	BH8	28.185495	-25.84284	12	6	dry					3
F3317	90574941	BH9	28.185497	-25.843	24	19	dry					4
F3326	90575229	BH1	28.208697	-25.842053	23	>23	dry	1-23				2
F3326	90575229	BH2	28.208947	-25.841993	21	15	dry					3
F3335	90564411	BH1	28.196348	-25.841565	11	3	dry					3
F3335	90564411	BH2	28.196175	-25.841417	13	7	dry					3
F3335	90564411	BH3	28.196043	-25.841525	10	1	dry					5
F3335	90564411	BH4	28.19572	-25.841711	13	3	dry					5
F3335	90564411	BH5	28.196051	-25.841855	20	4	dry					5
F335	90562093	1(3004/3103)	28.197916	-25.844678	25	17	dry					4
F335	90562093	BH11	28.197572	-25.84487	12	6	dry					3
F335	90562093	BH12	28.197865	-25.845155	17	11	dry					3
F335	90562093	BH13	28.19813	-25.845195	14	8	dry					3
F335	90562093	BH14	28.197658	-25.845251	25	20	dry					4
F335	90562093	BH15	28.197276	-25.845205	33	27	dry	7-27	3-6			2
F335	90562093	BH16	28.197632	-25.845587	44	38	dry	7-34				2
F335	90562093	BH17	28.197539	-25.845873	36	30	dry	1-29				2
F335	90562093	BH18	28.196999	-25.845669	20?	>20	dry	1-20				2
F335	90562093	BH19	28.197108	-25.84588	30	24	dry	1-24				2
F335	90562093	2(3101/3200)	28.198115	-25.845011	22	16	dry				9-12	6
F335	90562093	BH20	28.196869	-25.84591	25	19	dry	2-19				2
F335	90562093	BH21	28.197236	-25.846236	30	23	dry	1-21				2
F335	90562093	BH22	28.198351	-25.844967	15	4	dry					5
F335	90562093	BH23	28.198038	-25.84537	21	10	dry					3
F335	90562093	BH24	28.197736	-25.845252	42	36	dry	18-35	12-17			4
F335	90562093	BH26	28.197585	-25.845263	48	43	dry	13-36	10-13			2
F335	90562093	BH27	28.197675	-25.845164	39	33	dry	4-9;13-33				2
F335	90562093	BH28	28.197376	-25.845019	40	35	dry	13-34			6-8;12-13	2
F335	90562093	BH3(3303)	28.197686	-25.845062	40	34	dry	20-34				4
F335	90562093	BH30	28.197504	-25.845536	40	33	dry	7-33				2
F335	90562093	BH31	28.197664	-25.845792	38	33	dry	8-28;32-33	3-8			2
F335	90562093	BH4(3401)	28.197871	-25.845424	50	45	dry	15-45	9-15			2
F335	90562093	BH5(3404)	28.197418	-25.845085	45	42	dry	8-42				1
F335	90562093	BH6(3603)	28.197306	-25.845484	35	31	dry	4-23;28-31				2
F335	90562093	BH7(4002)	28.196956	-25.846143	40	35	dry	2-27				2
F335	90562093	BH8(4004)	28.196655	-25.845916	27	21	dry	1-20				2
F335	90562093	BH9	28.198213	-25.844803	41	35	dry	32-35				4

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F3404	90589047	BH913/1	28.185567	-25.869184	25	11	dry	2-11				3
F3433	90584311	BHR/2179	28.205885	-25.850207	11	1	dry					5
F346	90562101	1	28.18561	-25.830558	40	>40	dry	20-40				2
F346	90562101	1	28.186203	-25.831213	35	29	dry					4
F346	90562101	1	28.184871	-25.831041	20	14	dry		8-11			3
F346	90562101	10	28.1858	-25.830713	22	14	dry					3
F346	90562101	11	28.185959	-25.830724	13	7	dry					3
F346	90562101	12	28.18593	-25.830918	25	19	dry					4
F346	90562101	2	28.185357	-25.831399	30	25	dry				7-10;13-16	7
F346	90562101	2	28.184405	-25.831112	11	5	dry					5
F346	90562101	2	28.184741	-25.830544	30	24	dry				19-24	7
F346	90562101	3	28.184132	-25.83068	12	6	dry					3
F346	90562101	3	28.185225	-25.831117	18	12	dry					3
F346	90562101	3	28.184676	-25.8313	17	11	dry					3
F346	90562101	4	28.1862	-25.830673	26	20	dry	4-13				4
F346	90562101	4	28.185088	-25.831612	35	28	dry				9-22	7
F346	90562101	4	28.184222	-25.831393	26	20	dry		14-16		16-20	6
F346	90562101	5	28.185864	-25.830822	10	4	dry					5
F346	90562101	5	28.184658	-25.831496	50	>50	dry			34-36	36-50	8
F346	90562101	6	28.185411	-25.830488	30	24	dry		6-10			4
F346	90562101	7	28.18505	-25.830712	20	14	dry				9-14	6
F346	90562101	8	28.184486	-25.830715	25	19	dry				13-19	6
F346	90562101	9	28.184505	-25.830432	20	14	dry					3
F3461	90584363	1158/1	28.204042	-25.831275	12	5	dry					5
F3461	90584363	1158/2	28.204081	-25.831384	12	3	dry					3
F3463	90584366	BH1683-1	28.203346	-25.843775	32	24	dry					4
F3463	90584366	BH1683-2	28.203308	-25.84345	32	8	dry					3
F3468	90584376	BH1578/1	28.194523	-25.825576	22	8	dry					3
F3468	90584376	BH1578/2	28.194676	-25.825766	12	3	dry					5
F3476	90584395	1/1668	28.204412	-25.842454	51	41	dry					4
F3489	90589130	BH1/1830	28.207472	-25.842823	43	21	dry	37-43				4
F3489	90589130	BH2/1830	28.207552	-25.842733	36	24	dry	36-42				4
F3591	90588707	BH7152/1	28.205491	-25.819814	13	7	dry					3
F3591	90588707	BH7152/2	28.205492	-25.819634	10	3	dry					5
F3615	90588751	709-01	28.197449	-25.821936	28	20	dry					4
F3615	90588751	709-02	28.197448	-25.822036	32	13	dry					3
F3647	90588770	BH361-1	28.209367	-25.841281	24	18	dry					4
F3672	90588818	BH261/1	28.207635	-25.830341	24	9	dry					3
F3672	90588818	BH261/2	28.207546	-25.830142	25	6	dry					3
F3685	90588867	1	28.197008	-25.844436	17	11	dry					3
F3685	90588867	2	28.197395	-25.844717	18	12	dry				4-10	6
F3685	90588867	3	28.197244	-25.844888	48	42	dry	16-42	9-11			2
F3685	90588867	4	28.196696	-25.844786	46	>46	dry	8-46				1
F3686	90588868	1	28.2007	-25.821846	10	1	dry					5
F3686	90588868	2	28.20057	-25.821999	23	17	dry				12-15	6
F3686	90588868	3	28.200548	-25.822197	17	4	dry					5
F3686	90588868	4	28.200757	-25.822261	13	7	dry					3
F3686	90588868	5	28.201027	-25.8222	23	17	dry					4
F3686	90588868	6	28.200622	-25.821629	27	21	dry				16-19	7
F3687	90588869	1	28.207328	-25.837416	29	23	dry					4
F3687	90588869	2	28.207508	-25.837318	29	>29	dry					4
F3692	90588877	BH3	28.205971	-25.862952	47	41	dry	9-36				2
F3692	90588877	BH4	28.206599	-25.862955	38	32	dry	4-10	14-18		12-14;25-3	7
F3692	90588877	BH5	28.20616	-25.863007	36	>36	dry	15-29				4
F3692	90589025	BH64	28.202214	-25.864126	30	25	dry	6-13				4
F3692	90589025	BH67	28.202856	-25.863882	25	20	dry			16-18	18-20	6
F3692	90589026	1	28.204391	-25.863449	18	10	dry					3
F3692	90589026	4	28.203832	-25.8635	12	6	dry					3
F3692	90589026	7	28.203692	-25.863625	27	13	13					3
F3692	90589026	8	28.204003	-25.863311	15	8	dry					3
F3692	90589026	9	28.204151	-25.863628	20	15	dry				10-15	6
F3697	90588882	BH1	28.208601	-25.839427	19	6	dry					3
F3697	90588882	BH2	28.208411	-25.839516	23	10	dry				14-17	6
F3719	90588986	BH60/1	28.187772	-25.860399	47	25	33	7-25;43-47				2
F3719	90588986	BH60/2	28.18807	-25.860275	43	26	30	9-26				4

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F3721	90589052	MTD6	28.223592	-25.859454	15	9	dry					3
F3721	90589052	MTD66	28.223828	-25.858346	17	11	dry				8-11	6
F3721	90589052	MTD69	28.223279	-25.859995	6	0	dry					5
F3721	90589052	MTD7	28.223832	-25.858836	6	0	dry					5
F3721	90589052	MTD8	28.223289	-25.858201	7	1	dry					5
F3745	90588963	BH1133/1	28.206449	-25.822699	36	30	dry	5-30				2
F3745	90588963	BH1133/2	28.206398	-25.822816	29	>29	dry	3-29				2
F375	90474772	BH3101	28.174376	-25.854904	15	5	dry	3-5				5
F375	90474772	BH3401	28.174169	-25.854758	42	35	dry	14-28				2
F375	90474772	BH3701	28.173961	-25.854611	33	27	dry	5-27				2
F376	90564681	BH3	28.174836	-25.85381	40	30	dry	11-28	3-9			4
F376	90564681	BH3001/3101	28.174532	-25.85395	33	23	dry	6-23				4
F376	90564681	BH3301	28.174691	-25.85377	36	27	dry	6-27				2
F376	90564681	BH4	28.174732	-25.85395	40	27	dry	6-27				2
F3768	90589023	BH1	28.208479	-25.854779	40	>40	dry	6-40				1
F3768	90589023	BH2	28.20831	-25.854751	29	>29	dry	9-29				1
F377	90482010	BH ecsoft	28.177204	-25.863947	30	4	dry					5
F377	90482010	BH2	28.177237	-25.863918	10	>10	dry	5-10				3
F3770	90589034	BH1/1671	28.17755	-25.865765	24	>24	dry	1-24				1
F378	90474283	BH1	28.181189	-25.849934	24	19	dry					4
F378	90474283	BH2	28.180159	-25.849837	18	12	dry					3
F378	90474283	BH3	28.181421	-25.850163	24	18	dry					4
F378	90474283	BH4	28.181555	-25.849872	29	23	dry					4
F378	90474283	BH5	28.180958	-25.849705	20	14	dry					3
F378	90474283	BH6	28.180312	-25.849522	20	14	dry					3
F378	90474283	BH7	28.180691	-25.850029	23	17	dry					4
F3789	90589079	BH7380(1)	28.211031	-25.832526	15	9	dry					3
F380	90474270	3207	28.181818	-25.85182	57	51	dry					4
F380	90474270	3402	28.182855	-25.852037	37	31	dry					4
F380	90474270	3406	28.182225	-25.85164	47	43	dry				31-43	8
F380	90474270	3603	28.182946	-25.851671	34	30	dry					4
F380	90474270	3610	28.181846	-25.85097	11	6	dry					3
F380	90474270	3705	28.182757	-25.851332	23	17	dry					4
F380	90589242	BH1	28.181758	-25.851409	32	26	dry				22-26	7
F380	90589242	BH2	28.181508	-25.851493	39	32	dry				19-26	7
F380	90589242	G01	28.181775	-25.850416	45	16	16					4
F380	90589242	G02	28.182104	-25.850481	50	>50	16		37-46		18-37;46-5	8
F380	90589242	G03	28.182253	-25.850572	32	26	16				20-26	7
F380	90589242	G04	28.181904	-25.850543	46	39	16				6-39	8
F380	90589242	G05	28.181694	-25.850623	50	33	16				11-33	7
F380	90589242	G06	28.182043	-25.850652	22	15	16				9-15	6
F380	90589242	G07	28.182342	-25.850681	46	36	30		20-30		5-16;30-36	8
F380	90589242	G08	28.182182	-25.85077	48	41	16		23-33;38-4		10-13;14-2	8
F380	90589242	G09	28.181833	-25.850732	17	10	16				6-10	6
F380	90589242	G10	28.181623	-25.850812	22	3	16					5
F380	90589242	G11	28.181972	-25.85085	11	4	dry					5
F380	90589242	G12	28.182281	-25.85087	45	30	16		7-13;18-20		14-18;20-3	7
F380	90589242	G13	28.181762	-25.850921	39	33	16		19-25	31-33	5-19;25-31	7
F380	90589242	G14	28.181552	-25.85101	42	32	16		22-24		7-22;24-32	7
F380	90589242	G15	28.181901	-25.851039	20	14	16-Jan		5-11		11-13	3
F380	90589242	G16	28.1822	-25.851059	40	34	16		10-12;20-3		6-10;12-20	7
F380	90589242	G18	28.181701	-25.851101	43	31	16		14-17	18-20;22-2	3-14;17-18	7
F380	90589242	G19	28.182119	-25.851185	56	47	16		14-17;20-2	17-20	28-29;32-3	8
F380	90589242	G20	28.1816	-25.851281	60	55	18		39-44		13-28;33-3	8
F380	90589242	G21	28.18143	-25.851362	57	51	18				31-51	8
F380	90589242	G22	28.181609	-25.851381	50	33	18				15-24;30-3	7
F380	90589242	G23	28.181778	-25.851418	56	44	18				29-33	4
F380	90589242	G24	28.181439	-25.851461	48	16	18					4
F380	90589242	G25	28.181608	-25.851489	60	38	18				18-38	8
F380	90589242	G26	28.181788	-25.851517	45	38	18				17-22;27-3	8
F380	90589242	G27	28.181957	-25.851545	46	36	18				17-36	8
F380	90589242	G28	28.181617	-25.851597	52	45	18				37-45	8
F380	90589242	G29	28.181797	-25.851625	49	32	18				20-26	7
F380	90589242	G30	28.181796	-25.851725	57	51	18				23-26;31-4	8
F3819	90589228	D1	28.180283	-25.848431	30	18	dry					4

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F3819	90589228	D11	28.181569	-25.845622	30	6	dry					3
F3819	90589228	D15	28.184067	-25.839083	17	12	dry					3
F3819	90589228	D2	28.180661	-25.848586	30	>30	dry					4
F3819	90589228	D3	28.180414	-25.848251	20	>20	dry					4
F3819	90589228	D4	28.180624	-25.848117	30	28	dry				23-25	4
F3819	90589228	D5	28.180884	-25.847974	26	21	dry					4
F3819	90589228	D6	28.1818	-25.845352	30	8	dry					3
F3819	90589228	D7	28.181982	-25.845074	30	>30	dry					4
F3819	90589228	P76-1	28.184092	-25.838322	26	7	dry					3
F3819	90589228	P76-2	28.184083	-25.838262	30	7	dry					3
F3819	90589228	P76-3	28.184151	-25.838315	24	5	dry					5
F3819	90589228	P76-4	28.184143	-25.838253	31	13	dry					3
F3819	90589228	P77-5	28.184161	-25.838321	15	4	dry					5
F3820	90589230	BH V1	28.193286	-25.843115	60	>60	dry	33-60				2
F3820	90589230	BH V2	28.193427	-25.842926	60	>60	dry	40-60				2
F3820	90589230	BH V3	28.193495	-25.843152	60	>60	dry	52-60				4
F3820	90589230	BH V5	28.193814	-25.843272	60	>60	dry	51-60				4
F3820	90589230	BH V6	28.193654	-25.843352	60	>60	dry	48-60				4
F3820	90589230	BH V7	28.193832	-25.843479	60	>60	dry	40-60				2
F3824	90589269	1	28.195911	-25.845874	25	14	dry	3-11				3
F3824	90589269	1101	28.196239	-25.846011	17	10	dry	3-10				3
F3824	90589269	1107	28.195837	-25.846415	28	12	dry				2-7	6
F3824	90589269	16-17/01	28.195802	-25.845683	16	9	dry	1-9				3
F3824	90589269	1706	28.195451	-25.846006	17	14	dry				9-11	6
F3824	90589269	2	28.196099	-25.8461	24	18	dry	2-9				4
F3824	90589269	3	28.195721	-25.845963	21	15	dry	5-9				3
F3824	90589269	4	28.195839	-25.846081	21	15	dry	3-8				3
F3824	90589269	5	28.19555	-25.84616	20	14	dry				9-14	6
F3824	90589269	6	28.19535	-25.846123	16	10	dry					3
F3824	90589269	7	28.195608	-25.846314	17	11	dry					3
F383	90481728	BH1	28.178616	-25.862209	30	>30	dry	5-8;18-30				1
F3846	90584862	BH1	28.204489	-25.850889	38	32	dry	12-16				4
F3846	90584862	BH2	28.204345	-25.850987	25	19	dry					4
F3853	90589288	BH1726/1	28.205467	-25.848942	35	3	dry					5
F3862	90589299	BH1	28.205271	-25.848652	14	4	dry					5
F3865	90589303	537/1	28.202135	-25.835501	40	32	dry					4
F3867	90589305	376/1	28.206158	-25.834918	41	25	dry					4
F3867	90589305	376/2	28.206277	-25.834982	29	7	dry					3
F3873	90589317	105	28.194726	-25.864894	19	13	dry					3
F3873	90589317	117	28.195125	-25.865237	28	22	dry					4
F3873	90589317	26	28.193368	-25.864878	27	15	dry					3
F3873	90589317	33	28.193174	-25.865581	28	21	dry				15-21	4
F3873	90589317	57	28.193967	-25.864177	36	30	dry					4
F3873	90589317	65	28.194154	-25.864344	23	17	dry					4
F3873	90589317	70	28.194153	-25.865245	28	22	dry					4
F3874	90589317	BH1	28.206209	-25.839343	12	6	dry					3
F3874	90589317	BH2	28.206128	-25.839403	17	11	dry					3
F3878	90584838	BH01	28.211365	-25.843291	21	>21	dry	4-21				1
F3878	90584838	BH02	28.211243	-25.843089	23	>23	dry	4-23				1
F3878	90584838	BH03	28.211099	-25.843392	25	18	dry				13-18	6
F3878	90584838	BH04	28.210884	-25.843234	31	25	dry		15-19		9-15;19-25	7
F3878	90584846	BH05	28.211265	-25.843313	23	17	dry	3-12				4
F3878	90584846	BH06	28.211136	-25.843196	28	23	dry					4
F3890	90584857	BH450/1	28.196736	-25.823144	21	9	dry					3
F3890	90584857	BH450/2	28.19662	-25.823115	10	2	dry					5
F3917	90584909	BH964/1	28.201437	-25.820585	60	>60	dry					4
F3951	90584972	7691	28.208282	-25.84243	27	>27	dry	7-27				1
F3952	90584973	BH69/1	28.178232	-25.860848	39	33	dry	25-33				4
F3952	90584973	BH69/2	28.17835	-25.861101	46	40	dry	28-40				4
F3958	90585039	BH7707(1)	28.202446	-25.845522	60	>60	dry	34-60				2
F3958	90585039	BH7707(2)	28.202607	-25.845387	60	>60	dry	32-42			49-60	8
F3959	90585040	BH1	28.195374	-25.827864	13	7	dry					3
F3964	90585059	1814/1	28.207595	-25.845324	40	22	dry	8-22				4
F3971	90585081	BH1/1032	28.217008	-25.859302	19	7	dry					3
F3971	90585081	BH2/1032	28.216749	-25.859328	25	7	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F3975	90585088	BH1	28.217309	-25.859126	12	6	dry					3
F3975	90585088	BH2	28.217109	-25.859203	14	8	dry					3
F3985	90585101	1	28.188882	-25.852386	28	21	dry		14-15		8-14;15-21	7
F3985	90585101	2	28.189046	-25.852661	33	26	dry				14-26	7
F3985	90585101	3	28.18891	-25.85257	31	24	dry				15-24	4
F3985	90585101	4	28.188775	-25.852448	29	21	dry				9-21	7
F3985	90585101	5	28.18885	-25.85266	27	2	dry				17-20	6
F3985	90585101	6	28.188909	-25.852756	23	16	dry				12-16	6
F3985	90585101	7	28.188601	-25.852538	20	13	17				8-13	3
F3985	90585101	8	28.188729	-25.852767	24	16	20				7-13	6
F3985	90585101	BH1&1A	28.188702	-25.852683	50	>50	9.5				24-50	8
F3985	90585101	BH2	28.18862	-25.852619	45	>45	10.1		15-20			4
F3985	90585101	BH3	28.188732	-25.852611	45	>45	12.3					4
F3985	90585101	P2	28.188918	-25.852318	11	7	dry				5-7	3
F3985	90585101	P3	28.189109	-25.852611	16	>16	dry				15-16	6
F3985	90585101	P4	28.189265	-25.852523	20	>2	dry				18-20	7
F3985	90585101	P5	28.189143	-25.852412	16	>16	dry				15-16	6
F3986	90585102	BH314/1	28.206867	-25.858685	24	10	dry					3
F4000	90585139	1574/1	28.195255	-25.826837	26	12	dry					3
F4000	90585139	1574/2	28.194927	-25.82688	26	12	dry					3
F4006	90585146	BH1	28.18924	-25.864484	41	>41	dry	15-41				2
F4006	90585146	BH2	28.1891	-25.864591	41	>41	dry	16-41				2
F420	90563939	BH5804	28.177418	-25.875773	10	4	dry					5
F420	90563939	BH5805	28.176104	-25.875495	10	4	dry					5
F420	90563939	BH5807	28.175087	-25.875967	10	3	dry					5
F420	90563939	BH5808	28.174339	-25.876347	10	2	dry					5
F420	90563939	BH5809	28.174905	-25.876598	10	0	dry					5
F420	90563939	BH5814	28.17382	-25.876624	10	2	dry					5
F420	90563939	BH5815	28.173391	-25.87728	13	7	dry	0-7;11-13				3
F420	90563939	BH5816	28.173416	-25.877987	13	>13	dry	7-13				2
F420	90563939	BH5817	28.173515	-25.876958	10	1	dry					5
F420	90563939	BH5818	28.172759	-25.877107	12	6	dry					3
F421	90564629	BH1/293	28.204616	-25.855894	10	4	dry					5
F421	90564629	BH2/293	28.204759	-25.855796	16	7	dry					3
F422	90562094	EP5901	28.172236	-25.879134	13	2	dry	10-13				5
F422	90562094	EP5902	28.171686	-25.878794	13	8	dry	4-8				3
F422	90562094	EP5903	28.171132	-25.879414	10	3	dry					5
F422	90562094	EP5904	28.170637	-25.879982	14	2	dry	9-14				5
F422	90562094	EP5905	28.171292	-25.880353	18	3	dry					5
F422	90562094	EP5906	28.170757	-25.881042	10	3	dry	6-10				5
F422	90562094	EP5907	28.169739	-25.881201	10	>10	dry	0-10				2
F456	90589104	BH1530(1)	28.194606	-25.823527	17	10	dry					3
F498	90083263	H7-L8	28.169707	-25.871313	30	15	9	25-30				3
F520	90589011	6819	28.222904	-25.853061	15	3	dry					5
F520	90589011	6917	28.223278	-25.852413	10	3	dry					5
F520	90589011	7023	28.22341	-25.853921	18	12	dry		7-9		4-7;9-12	6
F520	90589011	7127/11	28.223389	-25.854945	10	1	dry					5
F520	90589011	7229	28.223618	-25.855432	18	12	dry				5-12	6
F520	90589011	BH19(7021)	28.223438	-25.853384	10	3	dry					5
F520	90589011	BH21(7025)	28.223306	-25.85439	21	15	dry				5-15	6
F528	90229599	BH10/6-7	28.196428	-25.857622	18	12	dry				11-12	3
F528	90229599	BH12/2	28.195697	-25.857359	30	26	dry				16-23	7
F528	90229599	BH14/7	28.196068	-25.858099	17	14	dry					3
F528	90229599	BH2/5	28.197022	-25.856568	24	20	dry			12-16	8-19	6
F528	90229599	BH3/3-4	28.196746	-25.856525	30	>30	dry				14-30	7
F528	90229599	BH3/6	28.197037	-25.856788	15	11	dry					3
F528	90229599	BH4/7	28.197049	-25.856999	19	>19	dry		10-16		16-19	7
F528	90229599	BH4-5/6	28.19689	-25.856942	30	>30	dry				15-30	7
F528	90229599	BH6-7/3	28.196355	-25.856854	19	13	dry				11-13	3
F529	90574969	3036/3135	28.200247	-25.854933	13	6	dry					3
F529	90574969	3132/3231	28.199869	-25.854481	10	4	dry					5
F529	90574969	3138	28.200589	-25.855125	13	12	dry				8-12	6
F529	90574969	3332/3431	28.200066	-25.854274	17	8	dry					3
F529	90574969	3337/3237	28.20057	-25.854819	11	5	dry					3
F529	90574969	3434/3335	28.200424	-25.854517	23	10	dry					3

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Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F529	90574969	3438/3539	28.200986	-25.854776	33	>33	dry		6-9;14-19		9-13;19-33	7
F530	90564634	1	28.185926	-25.842085	17	6	dry					3
F530	90564634	10	28.18489	-25.841631	17	2	dry					5
F530	90564634	11	28.18522	-25.841607	18	11	dry					3
F530	90564634	2	28.185826	-25.842008	10	2	dry					5
F530	90564634	3	28.185497	-25.841776	23	11	dry					3
F530	90564634	4	28.185458	-25.842184	22	14	dry				7-14	3
F530	90564634	5	28.185263	-25.842424	17	6	dry	14-17				3
F530	90564634	6	28.185173	-25.842653	15	0	dry	11-15				5
F530	90564634	7	28.184907	-25.842728	23	16	dry	11-16				4
F530	90564634	8	28.184829	-25.842283	19	11	dry	13-19				3
F530	90564634	9	28.184807	-25.841929	24	4	dry	19-24				5
F541	90092902	G/VWD/12	28.192805	-25.869372	62	55	dry		28-31		12-24	8
F543	90564577	BH1	28.185714	-25.852957	30	18	22m					6
F543	90564577	BH2	28.18585	-25.853122	20	>20	dry					4
F543	90564577	BH3	28.185524	-25.85337	28	22	dry				18-22	7
F543	90564577	BH4	28.185369	-25.853203	23	12	dry					3
F543	90564577	BH5	28.185092	-25.852986	28	22	dry					4
F543	90564577	BH6	28.185335	-25.852886	30	22	dry					4
F543	90564577	CDH1	28.185459	-25.853054	18	16	dry					4
F544	90108434	2-3/3	28.204039	-25.827568	17	9	dry					3
F544	90108434	2-3/8-9	28.204304	-25.827451	15	4	dry					5
F544	90108434	3/6	28.204197	-25.827528	17	6	dry					3
F544	90108434	4-5/4-5	28.20416	-25.827622	23	11	dry					3
F544	90108434	6/3	28.204125	-25.827714	15	4	dry					5
F544	90108434	6/7	28.204311	-25.827635	11	0	dry					5
F544	90108434	8-9/3-4	28.204224	-25.827818	17	3	dry					5
F552	90092912	BH1	28.175915	-25.861394	22	>22	dry	3-22				1
F554	90096957	11/9	28.177264	-25.862373	25	>25	dry	12-25				2
F554	90096957	14/14	28.178673	-25.863199	35	>35	dry	15-35	6-15			2
F554	90096957	7/7	28.176684	-25.861291	45	>45	dry	9-45	4-9			2
F555	90092956	10/13	28.192708	-25.864668	25	22	15.80m					7
F555	90092956	12/16	28.193761	-25.864828	10	>10	dry					3
F555	90092956	13/10	28.192278	-25.865785	10	>10	dry					3
F555	90092956	13/14	28.19335	-25.865309	32	>32	dry				13-20	7
F555	90092956	15/20	28.195232	-25.865088	31	27	dry					4
F555	90092956	16/12	28.193204	-25.86628	35	28	dry					4
F555	90092956	16/5	28.191311	-25.867108	20	>20	9.9m					2
F555	90092956	6/17	28.193235	-25.863245	30	>30	dry					4
F555	90092956	8/14	28.192699	-25.864086	10	>10	dry					3
F555	90092956	8/7	28.190808	-25.864918	20	>20	dry				11-20	7
F563	90092968	I/4	28.173962	-25.860569	30	5	dry	1-5				5
F563	90092968	L/5	28.174413	-25.860124	23	13	dry	1-12				3
F563	90092968	L/8	28.174107	-25.859682	30	28	dry	1-16		24-28		7
F563	90092968	N/2	28.175022	-25.860453	30	26	dry	1-26				2
F565	90116014	Z1	28.172519	-25.866536	13	4	dry					5
F565	90116014	Z2	28.173101	-25.867561	11	1	dry					5
F565	90116014	Z3	28.173647	-25.868554	18	1	dry					5
F565	90116014	Z4	28.17251	-25.868635	26	>26	dry	7-26				2
F565	90116014	Z5	28.173927	-25.866348	14	8	dry					3
F567	90126369	BH1	28.173579	-25.864097	30	>30	sry	1-30				2
F567	90126369	BH2	28.17455	-25.862953	30	>30	dry	1-30				2
F568	90373884	BH1	28.203503	-25.852096	31	26	dry			16-23	23-26	7
F568	90373884	BH2	28.203832	-25.85199	45	>45	dry	2-18				4
F568	90373884	BH3	28.204253	-25.852076	30	24	dry					4
F568	90373884	BH4	28.204179	-25.852489	10	4	dry					5
F568	90373884	BH5	28.203669	-25.852575	14	8	dry					3
F647	90421315	3101	28.189149	-25.843266	16	10	dry		1-6			3
F647	90421315	3104	28.189563	-25.843663	30	24	dry	17-24				4
F647	90421315	3301	28.188852	-25.84351	7	4	dry					5
F647	90421315	3302	28.189002	-25.843654	21	15	dry	8-15			5-8	3
F647	90421315	3304	28.189275	-25.843911	24	18	dry	8-14		16-18	14-16	7
F647	90421315	3500	28.188469	-25.843652	34	28	dry	4-11			24-28	4
F647	90421315	3503	28.188858	-25.84404	26	20	dry	1-12				4
F647	90421315	3601	28.188414	-25.843911	15	10	dry	2-6				3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of Syenite	Dolomite floater	Cavity	Wad	Inherent Hazard Class
F647	90421315	3602	28.188659	-25.844107	17	4	dry					5
F647	90421315	3604	28.188858	-25.844291	16	7	dry					3
F647	90421315	3703	28.188552	-25.844294	23	17	dry			5-17		7
F647	90421315	3802	28.188256	-25.844182	10	4	dry					5
F647	90421315	3804	28.188538	-25.844559	10	1	dry					5
F647	90421315	3901	28.188011	-25.844288	25	19	dry			14-19	7-14	7
F647	90421315	4003	28.188115	-25.84468	20	12	dry			5-12	2-5	7
F647	90421315	BH1	28.189097	-25.843585	14	11	dry					3
F647	90421315	BH10	28.188417	-25.844426	6	3	dry					5
F647	90421315	BH12	28.18827	-25.844285	15	12	dry				6-12	6
F647	90421315	BH13	28.18855	-25.843963	9	5	dry	1-5				5
F647	90421315	BH14	28.188429	-25.844176	7	4	dry					5
F647	90421315	BH15	28.188702	-25.844441	7	4	dry					5
F647	90421315	BH16	28.188688	-25.844303	9	6	dry					3
F647	90421315	BH17	28.188544	-25.844196	6	3	dry					5
F647	90421315	BH18	28.188164	-25.844268	5	2	dry					5
F647	90421315	BH19	28.188273	-25.844421	7	4	dry					5
F647	90421315	BH2	28.189336	-25.843441	5	2	dry					5
F647	90421315	BH20	28.188388	-25.844565	7	4	dry					5
F647	90421315	BH21	28.188863	-25.844164	9	6	dry	2-6				3
F647	90421315	BH22	28.188719	-25.844046	9	6	dry	1-5				3
F647	90421315	BH23	28.188002	-25.844159	7	4	dry					5
F647	90421315	BH24	28.18899	-25.844055	10	7	dry	2-7				3
F647	90421315	BH25	28.189134	-25.843925	7	4	dry					5
F647	90421315	BH26	28.189275	-25.843801	16	15	dry	8-15				3
F647	90421315	BH27	28.189474	-25.843833	7	4	dry					5
F647	90421315	BH28	28.188987	-25.843796	8	5	dry					5
F647	90421315	BH29	28.188547	-25.844418	11	9	dry				4-9	6
F647	90421315	BH3	28.189405	-25.843387	5	2	dry					5
F647	90421315	BH30	28.189146	-25.843531	7	4	dry					5
F647	90421315	BH31	28.188388	-25.844665	8	5	dry					5
F647	90421315	BH32	28.188256	-25.844553	8	5	dry					5
F647	90421315	BH33	28.188123	-25.844412	16	13	dry					3
F647	90421315	BH34	28.188668	-25.844559	17	14	dry				6-14	6
F647	90421315	BH35	28.189172	-25.843139	5	1	dry					5
F647	90421315	BH36	28.188043	-25.844078	7	4	dry					5
F647	90421315	BH37	28.188322	-25.844032	6	3	dry					5
F647	90421315	BH38	28.189131	-25.844161	7	4	dry					5
F647	90421315	BH39	28.189278	-25.844038	8	5	dry					5
F647	90421315	BH4	28.189316	-25.843289	7	4	dry					5
F647	90421315	BH40	28.188794	-25.843447	9	6	dry					3
F647	90421315	BH41	28.188996	-25.843914	20	15	dry	4-15				3
F647	90421315	BH42	28.189137	-25.84404	17	14	dry	3-7				3
F647	90421315	BH43	28.188699	-25.844202	11	9	dry					3
F647	90421315	BH44	28.188296	-25.843891	11	8	dry	1-4				3
F647	90421315	BH45	28.188406	-25.844277	7	4	dry					5
F647	90421315	BH46	28.188895	-25.843294	7	4	dry					5
F647	90421315	BH47	28.189036	-25.843173	6	3	dry					5
F647	90421315	BH48	28.18927	-25.843502	5	2	dry					5
F647	90421315	BH49	28.189137	-25.843799	8	5	dry					5
F647	90421315	BH5	28.189166	-25.84341	5	2	dry					5
F647	90421315	BH50	28.188999	-25.844274	9	6	dry	2-6				3
F647	90421315	BH51	28.188826	-25.844418	7	4	dry					5
F647	90421315	BH52	28.188233	-25.843951	6	3	dry					5
F647	90421315	BH53	28.188149	-25.844176	7	4	dry					5
F647	90421315	BH54	28.188472	-25.844055	6	3	dry					5
F647	90421315	BH6	28.189025	-25.84328	6	3	dry					5
F647	90421315	BH7	28.188901	-25.843392	7	4	dry					5
F647	90421315	BH8	28.189013	-25.84351	5	2	dry					5
F647	90421315	BH9	28.188624	-25.844487	8	18	dry				8-18	6
F744	90082163	10	28.214291	-25.84714	15	5	dry					5
F744	90082163	11	28.214236	-25.847212	15	7	dry					3
F744	90082163	12	28.213804	-25.846793	15	4	dry					5
F744	90082163	13	28.213689	-25.846875	15	3	dry					5
F744	90082163	14	28.213308	-25.845353	15	8	dry					3

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F744	90082163	15	28.213031	-25.845305	15	6	dry					3
F744	90082163	16	28.212845	-25.84911	15	6	dry				11-14	6
F744	90082163	LM9	28.213843	-25.848476	5	>5	dry			>5		6
F744	90082163	LM9A	28.213889	-25.848471	5	>5	dry			>5		6
F744	90082163	LM9B	28.213878	-25.848498	3	>3	dry			>3		6
F744	90082163	LM9C	28.213833	-25.848512	5	>5	dry			>5		6
F744	90082163	LM9D	28.213803	-25.848489	3	>3	dry			>3		6
F744	90082163	LM9E	28.213833	-25.848442	15	10	dry				2-4	3
F744	90082164	B9	28.213504	-25.847816	13	8	dry					3
F744	90082164	C1.22	28.213715	-25.84942	7	2	dry					5
F744	90082164	C4.17	28.213726	-25.848787	10	5	dry					5
F744	90082164	C5.23	28.213728	-25.848523	14	9	dry				8-9	3
F744	90082164	C5/D5	28.213926	-25.848502	16	11	dry		6-7		8-11	6
F744	90082164	C7.04	28.213725	-25.848235	16	11	dry				5-7;8-11	6
F744	90082164	E3.02	28.214208	-25.849161	16	10	dry					3
F744	90082164	E3.20	28.214207	-25.848971	17	12	dry					3
F744	90082164	E4.15	28.214212	-25.848786	10	8	dry					3
F744	90082164	E6.05	28.214216	-25.848442	12	4	dry					5
F745	90474703	BH1	28.214537	-25.849688	11	5	dry				3-5	5
F745	90474703	BH2	28.214544	-25.849547	14	7	dry				3-7	6
F747	90474354	BH1	28.212578	-25.847359	10	3	dry					5
F747	90474354	BH2	28.212668	-25.847432	10	3	dry					5
F747	90474354	BH3	28.212653	-25.847527	10	2	dry					5
F749	90421252	1	28.214754	-25.846958	13	2	dry				6-7	5
F749	90421252	2	28.214696	-25.846763	13	2	dry				4-6	5
F749	90421252	3	28.214489	-25.846554	11	0	dry					5
F750	90420683	1	28.213026	-25.846498	14	9	dry	2-9				3
F750	90420683	2	28.213557	-25.846533	6	3	dry					5
F750	90420683	3	28.213298	-25.846335	12	11	dry					3
F750	90420683	4	28.212979	-25.846252	6	3	dry					3
F750	90420683	5	28.213843	-25.84636	3	1	dry					5
F756	90421187	1	28.214488	-25.848188	17	>17	dry					2
F756	90421187	2	28.214286	-25.848118	10	5	dry					5
F756	90421187	3	28.214611	-25.848065	19	6	dry					3
F760	90474164	1	28.214061	-25.845481	10	1	dry					5
F760	90474164	2	28.213811	-25.845562	18	3.5	dry				11-12	5
F765	90564562	BH608/1	28.20684	-25.840039	25	18	dry					4
F765	90564562	BH608/2	28.206764	-25.84013	24	18	dry					4
F78	90584271	BH1704/1	28.203013	-25.845741	15	9	dry					3
F78	90584271	BH1704/2	28.202924	-25.845741	10	3	dry					5
F828	90474857	BH1	28.208422	-25.839894	15	8	dry					3
F828	90474857	BH2	28.208369	-25.840068	25	>25	dry	1-25				2
F828	90474857	BH3	28.208408	-25.839927	28	>28	dry	1-16;25-28			21-25	4
F830	90474762	BH1	28.197336	-25.82449	22	8	dry					6
F830	90474762	BH2	28.197224	-25.824321	16	10	dry					6
F831	90482488	BH1	28.207433	-25.841428	40	>40	dry		28-32			4
F836	90481922	1	28.20503	-25.837516	13	7	dry					3
F838	90474434	BH1	28.197712	-25.822607	6	0	dry					5
F838	90474434	BH2	28.197839	-25.822561	14	8	dry					3
F838	90474434	BH3	28.197793	-25.8227	11	5	dry					5
F838	90474434	BH4	28.197788	-25.82277	10	4	dry					5
F839	90474065	BH1	28.196786	-25.820615	12	5	dry					5
F841	90482095	BH893/1	28.198931	-25.819316	43	37	dry					4
F841	90482095	BH893/2	28.199077	-25.819519	50	>50	dry					4
F841	90482095	BH893/3	28.198919	-25.819586	50	>50	dry				39-41	4
F852	90481987	BH1	28.203382	-25.840094	30	>30	dry					4
F854	90482127	BH1	28.207645	-25.843306	30	26	dry					4
F855	90481986	BH1	28.212336	-25.84125	11	4	dry					5
F855	90481986	BH2	28.212427	-25.841432	18	14	dry			9-10;11-12	2-9;10-11	6
F856	90482432	BH1	28.211801	-25.84592	11	6	dry				2-5	6
F857	90128069	BH1	28.210294	-25.843208	17	10	dry		4-7			3
F857	90128069	BH2	28.210232	-25.843083	17	11	dry		2-7			3
F857	90128069	BH3	28.210159	-25.842936	25	18	dry			11-13;16-1	9-11;13-16	6
F857	90128069	BH4	28.210105	-25.842932	17	11	dry				4-11	6
F857	90128069	BH5	28.210216	-25.842936	19	13	dry				6-10	6

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F858	90420540	BH1	28.209629	-25.843572	13	3	dry					5
F858	90420540	BH2	28.209856	-25.843571	18	10	dry		1-3			3
F858	90420540	BH3	28.210031	-25.843668	16	10	dry		3-5		5-10	6
F858	90420540	BH4	28.209818	-25.843774	30	27	dry		6-14	20-21;26-2	14-20;21-2	7
F858	90584368	02A	28.209777	-25.843775	28	>28	dry				6-28	7
F858	90584368	03	28.209857	-25.843853	12	6	dry				4-6	3
F858	90584368	04A	28.209837	-25.843758	28	>28	dry				13-28	7
F858	90584368	05	28.209916	-25.843737	22	17	dry					4
F858	90584368	06	28.209714	-25.84381	24	>24	dry		21-23		13-21;23-2	7
F858	90584368	N11	28.209427	-25.843572	16	11	dry		5-9			3
F858	90584368	N14	28.209764	-25.843496	14	9	dry				6-9	6
F858	90584368	N15	28.20988	-25.843514	14	9	dry				5-9	6
F858	90584368	N18	28.210059	-25.84368	16	10	dry		7-8			3
F858	90584368	N2	28.209916	-25.843806	15	10	dry					3
F858	90584368	N3	28.209793	-25.843844	11	6	dry					3
F858	90584368	N5	28.209597	-25.843766	15	10	dry		5-7			3
F858	90584368	N6	28.209743	-25.843725	12	7	dry					3
F858	90584368	N7	28.209915	-25.843676	13	8	dry					3
F858	90584368	N9	28.209501	-25.84361	11	6	dry				3-6	6
F889	90482495	BH10	28.207208	-25.860353	30	>30	dry	7-30				2
F889	90482495	BH11	28.207115	-25.859979	34	>34	dry	10-34				2
F890	90482655	BH1	28.202757	-25.858715	32	>32	dry	4-16			17-26	7
F891	90482392	BH1	28.207436	-25.849202	18	12	dry					3
F892	90229852	2/6	28.210381	-25.851825	29	23	dry	7-21				4
F892	90229852	3/10	28.209776	-25.851954	30	26	dry	2-13				4
F892	90229852	6/7	28.21022	-25.852353	30	27	dry	3-25				2
F892	90230281	3/3	28.210879	-25.852022	32	>32	dry	21-32	6-8;19-21			2
F892	90230281	5/4	28.211077	-25.852382	17	11	dry					3
F892	90230281	8/1-2	28.21057	-25.852924	23	19	dry	1-19				2
F892	90230281	8-9/5	28.211287	-25.852997	16	10	dry				5-6	3
F892	90230281	9/7	28.211665	-25.853097	10	4	dry					5
F90	90589096	1	28.202356	-25.845594	52	45	dry	27-42			42-45	4
F90	90589096	2	28.202243	-25.84569	32	26	dry	14-23	7-12			4
F90	90589096	3	28.20212	-25.845513	26	22	dry	13-22	6-8			4
F916	90588833	BH911/1	28.209087	-25.85944	13	>13	dry	4-13				2
F916	90588833	BH911/2	28.209157	-25.859332	14	>14	7	2-14				2
F947	90564035	66	28.191315	-25.859947	11	>11	dry					3
F947	90564035	67	28.190761	-25.860072	12	>12	dry					3
F947	90564035	68	28.190511	-25.860092	19	>19	dry					4
F947	90564035	69	28.191057	-25.860312	37	27	13m					4
F947	90564035	70	28.190887	-25.859581	40	31	15m					4
F947	90564035	71	28.191587	-25.860484	15	>15	dry					4
F947	90564062	1	28.191336	-25.859456	35	30	10m		24-26		21-24;26-3	7
F947	90564062	2	28.191133	-25.859869	24	18	16.5m					4
F947	90564062	3	28.191137	-25.859685	37	31	18.2m				20-31	7
F947	90564062	4	28.190866	-25.860609	29	23	dry				17-18	4
F947	90564062	5	28.191542	-25.860796	30	28	14m		21-25		24-28	7
F947	90564062	6	28.190679	-25.861262	29	23	15m					4
F947	90564062	7	28.191351	-25.861033	40	35	19m					4
F947	90588859	A1	28.190329	-25.859914	26	20	dry					4
F947	90588859	A10	28.192097	-25.861034	21	15	dry				13-15	6
F947	90588859	A11	28.191225	-25.860172	28	23	dry				10-11;13-2	7
F947	90588859	A5	28.191384	-25.860326	31	25	dry				11-12;18-2	7
F947	90588859	A6	28.191674	-25.860219	16	>16	dry					4
F947	90588859	A8	28.191382	-25.860597	33	28	dry				17-28	7
F947	90588859	A9	28.191199	-25.861038	20	>20	dry					4
F947	90588859	B1	28.190118	-25.860093	26	20	dry				13-20	6
F947	90588859	B10	28.190879	-25.859673	36	30	dry					4
F947	90588859	B11	28.190971	-25.859349	38	33	dry				13-27	7
F947	90588859	B12	28.190494	-25.860628	30	24	dry					4
F947	90588859	B2	28.190336	-25.860275	28	22	dry		13-14			4
F947	90588859	B3	28.190497	-25.860077	31	25	dry				13-16	7
F947	90588859	B4	28.19079	-25.860991	31	25	dry					4
F947	90588859	B5	28.191029	-25.861154	31	25	dry				23-24	4
F947	90588859	B6	28.191667	-25.86114	40	29	dry					4

Reference F No.	Reference Sageolit No.	Borehole No.	X coord	Y coord	Borehole length (m)	Bedrock Depth (m)	Groundwater level (m)	Depth from and to of				Inherent Hazard Class
								Syenite	Dolomite floater	Cavity	Wad	
F947	90588859	B7	28.191828	-25.860933	41	35	dry				19-27	7
F947	90588859	B8	28.191586	-25.859966	37	31	dry				26-31	7
F947	90588859	B9	28.190999	-25.859647	37	31	dry				21-31	7
F968	90562984	1	28.176029	-25.865515	36	30	dry	2-27				2
F968	90562984	2	28.176187	-25.865135	32	25	dry	1-25				2
F968	90562984	3	28.175587	-25.865067	32	26	dry	1-23				2
F968	90562984	4	28.17589	-25.864696	31	25	dry	1-25				2
F968	90562984	5	28.176294	-25.864634	27	21	dry	1-21				2
F968	90562984	6	28.175479	-25.864564	27	21	dry	1-21				2
F968	90562984	7	28.175399	-25.864231	37	31	dry	1-31				2
F968	90562984	8	28.176227	-25.864295	32	25	dry	1-23				2
F968	90562984	9	28.175996	-25.863953	36	30	dry	9-30				2

Appendix C:

Table indicating the sinkhole event record

Sinkhole No.	Feature Type	Date	Depth	Dimensions		Geological Formation	Comments	Possible Cause
				NS	EW			
S1	Subsidence					Monte Christo		
S2	Sinkhole		3.5	2	2	Monte Christo		Leaking water pipe, Rand Water Board
S3	Sinkhole		2	2	2	Monte Christo		Leaking storm water drain
S4	Sinkhole		2	2	2	Monte Christo		Leaking storm water drain
S5	Subsidence					Monte Christo		
S6	Sinkhole		1.5	5	5	Monte Christo		
S7	Sinkhole	30 March 1976	4	8	6	Monte Christo		
S8	Subsidence					Monte Christo		
S9	Subsidence					Monte Christo		
S10	Subsidence					Monte Christo		
S11	Subsidence	Prior Feb 1985		30	20	Monte Christo		
S12	Subsidence					Monte Christo		
S13	Subsidence					Monte Christo		
S14	Subsidence					Monte Christo		
S15	Sinkhole	24 March 1971	5.5	4.6	4.6	Monte Christo		
S16	Sinkhole	30 November 1978	2	2	2	Monte Christo		
S17	Subsidence					Monte Christo		
S18	Subsidence					Monte Christo		
S19	Sinkhole		6	6	6	Monte Christo	3 lives lost	Poor drainage and excavations
S20	Sinkhole		4	3.5	3.5	Monte Christo		Poor drainage, segment of pipe missing
S21	Subsidence	25 September 1973				Monte Christo		
S22	Subsidence	20 November 1995	7	3	2	Monte Christo	On island between two manholes, tunnel to north	Leaking storm water
S23	Subsidence	12 January 1988	1	1.5	1.5	Monte Christo		
S24	Sinkhole	19 November 1995	2	7	5	Monte Christo	On island between highway lanes	Leaking storm water drainage channel
S25	Subsidence					Monte Christo		

Sinkhole No.	Feature Type	Date	Depth	Dimensions		Geological Formation	Comments	Possible Cause
				NS	EW			
S26	Subsidence					Monte Christo		
S27	Sinkhole	11 August 1996	0.5	1.6	1.3	Monte Christo		
S28	Sinkhole		2	2	2	Monte Christo		Leaking storm water drain
S29	Subsidence	19 November 1973				Monte Christo		
S30	Sinkhole	13 December 2004		2	5	Monte Christo		Poor surface management, ponding water at low point
S31	Sinkhole	1 April 2005	1			Monte Christo		Pocket of loose soil
S32	Subsidence	February 1996		<2	<2	Monte Christo		Poor drainage into loosely compacted backfill
S33	Sinkhole	February 1996				Monte Christo		Poor water drainage over stand
S34	Sinkhole	25 February 2004	2	3	3	Monte Christo		Poor storm water drainage-accumulation on boundary wall
S35	Subsidence	18 February 2005				Monte Christo		Settlement of foundations triggered by a leaking water pipe
S36	Sinkhole	19 January 2005				Monte Christo		Surface water accumulation
S37	Sinkhole					Monte Christo		Insufficient flood drainage on sports field
S38	Sinkhole	February 2005				Monte Christo		
S39	Subsidence	8 December 2003				Monte Christo	House demolished	Storm water accumulation
S40	Sinkhole	17 January 2005	3	2	2	Monte Christo		Storm water accumulation, pipes could not accommodate heavy rains
S41	Sinkhole	29 July 1986	4	32	23	Monte Christo		Broken water pipe
S42	Sinkhole	10 February 2005				Monte Christo	House demolished	Leaking pipes
S43	Sinkhole					Lyttelton		
S44	Subsidence	19 January 2005		1	1	Lyttelton		Poor service drainage
S45						Syenite		
S46						Monte Christo		
S47	Subsidence					Monte Christo		
S48						Monte Christo		

Sinkhole No.	Feature Type	Date	Depth	Dimensions		Geological Formation	Comments	Possible Cause
				NS	EW			
S49		January 1995	10	4	4	Monte Christo		Leaking sewerage pipe
S50	Sinkhole	9 July 1999	2	2	2	Monte Christo		Leaking sewerage pipe
S51						Monte Christo		
S52	Sinkhole and Subsidence	February 1996				Monte Christo		High rainfall and poor drainage
S53						Monte Christo		
S54						Monte Christo		
S55	Sinkhole	January 1995	4	2	2	Monte Christo		Possible leaking sewerage pipe
S56						Monte Christo		
S57						Monte Christo		
S58						Monte Christo		
S59						Monte Christo		
S60	Subsidence	17 July 1989	0.13			Monte Christo		
S61	Sinkhole	January 1997	5	3	3	Monte Christo		Poor drainage of surface water
S62						Monte Christo		
S63	Sinkhole	14 February 1989	4.7	3.5	1.8	Monte Christo		Broken municipal water pipe
S64	Sinkhole	2 February 1996				Monte Christo		
S65	Sinkhole					Monte Christo		
S66	Sinkhole					Monte Christo		
S67	Sinkhole	17 March 1999	5	5	5	Monte Christo		Leaking main water pipe
S68						Monte Christo		
S69						Monte Christo		
S70	Sinkhole	January 1997	>6	1.5	1.5	Monte Christo		Possible poor backfilling of borehole
S71						Monte Christo		
S72						Monte Christo		
S73						Monte Christo		
S74						Monte Christo		

Sinkhole No.	Feature Type	Date	Depth	Dimensions		Geological Formation	Comments	Possible Cause
				NS	EW			
S75						Monte Christo		
S76	Sinkhole	January 1995	3	1	1	Monte Christo		Poor drainage of surface water
S77						Monte Christo		
S78		February 1992				Monte Christo		Poor subsurface material
S79						Monte Christo		
S80	Sinkhole	2 December 1998	2.5	1	1	Monte Christo		Leaking sewerage pipe connection
S81	Sinkhole	15 February 1991	2	1	1	Monte Christo		Leaking asbestos pipe
S82	Sinkhole	November 1995		<2	<2	Monte Christo		
S83						Monte Christo		
S84	Sinkhole	January 1995	5	3	3	Monte Christo		Possible storm water leakage
S85		September 1990				Monte Christo		
S86	Sinkhole	17 April 1993	1.5	2	2	Monte Christo		Ponding water
S87						Monte Christo		
S88	Sinkhole	13 February 1996				Lyttelton		Leaking services and poor drainage
S89	Subsidence					Monte Christo		Poor subsurface material
S90		4 February 1996				Lyttelton		Main water pipe burst
S91	Sinkhole	13 May 1995	4	13	13	Lyttelton		Leaking water services
S92	Sinkhole		3	7	7	Lyttelton		Leaking water pipe
S93	Cracks	24 February 1996				Monte Christo		Down pipes drained into garden, poor drainage
S94	Sinkhole	October 2007	6	3	5	Monte Christo		Poor storm water drainage
S95	Subsidence	October 2007	2	8	2	Monte Christo		
S96	Subsidence	January 2008		2	2	Monte Christo	Subsidence at the corner of the house, but can be repaired	Poor storm water drainage
S97	Subsidence	January 2008		15	15	Monte Christo	3 units demolished	Poor storm water drainage
S98	Sinkhole	August 2008	2	10	10	Monte Christo		Leaking Municipal Storm water Connection

Sinkhole No.	Feature Type	Date	Depth	Dimensions		Geological Formation	Comments	Possible Cause
				NS	EW			
S99	Sinkhole	January 2008	5	2	1	Monte Christo		Leaking sewerage pipe
S100	Subsidence	April 2008	2	20	15	Monte Christo	7 units affected, 2 demolished	Poor storm water drainage
S101	Sinkhole	3 February 2006		10	15	Monte Christo		After heavy rainfall and possible storm water drainage from highway
S102	Sinkhole	January 2008				Monte Christo	Damage to house, large cracks	
S103	Subsidence	February 2010				Monte Christo		
S104	Sinkhole	May 2010	1	2	2	Monte Christo	3 sinkholes with cracks around perimeter	
S105	Crack	June 2010		12	1	Monte Christo		
S106	Sinkhole	July 2010	4	5	2	Monte Christo		Burst water pipe
S107	Sinkhole	2010	1	1	2	Monte Christo		Storm water ponding
S108	Sinkhole	January 2011				Lyttelton		Leaking service
S109	Sinkhole	23 September 2011	5	12	12	Monte Christo		Leaking service
S110		24 February 1996				Monte Christo		Poor storm water drainage from gutters
S111						Monte Christo		
S112						Monte Christo		
S113	Sinkhole	Prior 2004				Monte Christo		Probable leaking bulk water service
S114	Subsidence	2 July 1972	3	6	1	Monte Christo		Burst water pipe
S115	Sinkhole	1974	3	6	6	Monte Christo		Ponding storm water
S116	Subsidence	27 February 1978	0.3			Monte Christo	Pavilion showed cracks	After heavy rains of Jan/Feb 1978
S117	Sinkhole	1972/1973				Monte Christo		Burst water pipe
S118	Sinkhole	March 1980	6	4	4	Monte Christo		
S119	Sinkhole	22 January 1975	1	4	4	Lyttelton		

Appendix D:

Tables 1 and 2 from the Draft SANS 1936-1:2012 Document: Permissible Land Usage Based on Inherent Hazard Class, Dolomite Area Designations and Footprint Investigations

4.3.3 On land categorized as D2 and D3, in terms of table 1, appropriate precautionary measures in accordance with the principles and requirements of SANS 1936-3 shall be implemented to mitigate the risks associated with the development of such land.

4.3.4 On land designated as D4, in terms of table 1, the following site-specific measures shall be implemented:

a) site characterization, analysis and design, specification of precautionary measures, supervision of implementation and formulation of a dolomite risk management plan shall be undertaken by a Competence Level 4 geo-professional (see annex A);

b) the foundation design, design of the structure, precautionary measures and dolomite risk management plan shall specifically address and effectively mitigate the dolomite risks present on the site;

c) the site characterization, foundation design and design of the structure, precautionary measures and dolomite risk management requirements shall be reviewed and approved by an independent Competence Level 4 geo-professional (see annex A) and, where relevant, by a structural engineer with a similar level of competence; and

d) all aspects of the development proposal shall be reviewed and approved by the local authority, who may request a further review by an authority-designated Competence Level 4 peer (see annex A), if required.

4.3.5 The owners of developments located on dolomite land shall establish and implement appropriate dolomite risk management strategies in accordance with the principles and requirements of SANS 1936-4 to mitigate the risks associated with developments on such land.

4.3.6 The local authorities in whose jurisdiction the developments in 4.3.2 to 4.3.5 fall shall establish, implement and maintain a dolomite risk management strategy in accordance with the principles and requirements of SANS 1936-4 to mitigate the risks associated with developments on such land.

4.3.7 Parcels of land underlain by the Black Reef Formation shall comply with the requirements of 4.3.1 to 4.3.6 unless such formation has been assessed as presenting no risk of sinkhole or subsidence formation in accordance with the requirement of SANS 1936-2, and is designated as D1.

4.3.8 In proposing suitable foundation types in D3 and D4 areas, consideration shall be given to the potential loss of support which could be anticipated for the designated inherent hazard class based on expected initial sinkhole size. The philosophy to be applied to the design of the foundations is that there shall be sufficient structural integrity and stability to allow occupants to safely escape in the event of sudden loss of support below the foundations of a structure.

Table 1 — Dolomite area designations

Dolomite area designation	Description
D1	No precautionary measures are required.
D2	General precautionary measures, in accordance with the requirements of SANS 1936-3, that are intended to prevent the concentrated ingress of water into the ground, are required.
D3	Precautionary measures in addition to those pertaining to the prevention of concentrated ingress of water into the ground, in accordance with the relevant requirements of SANS 1936-3, are required.
D4	The precautionary measures required in terms of SANS 1936-3 are unlikely to result in a tolerable hazard. Site-specific precautionary measures are required.

Table 2 — Permissible land usage per inherent hazard class

1	2	3	4	5	6	7	8	9	10
Land usage		Inherent hazard class determined in accordance with the requirements of SANS 1936-2							
Designation	Description	1	2	3	4	5	6	7	8
		Dolomite area designation and footprint investigation requirement							
Commercial and miscellaneous non-residential usage									
C1	Places of detention, police stations, and institutional homes for the handicapped or aged	D3 + FPI					D4		
C2	Hospitals, hostels, hotels	D3 + FPI						D4	
C3	Commercial developments ≤ 3 storeys, including railway stations, shops, wholesale stores, offices, places of worship, theatrical, indoor sports or public assembly venues, other institutional land uses such as universities, schools, colleges, libraries, exhibition halls and museums, light (dry) industrial developments, dry manufacturing, commercial uses such as warehousing, packaging, and electrical sub-stations, filling stations	D2 + FPI	D3 + FPI					D4	
C4	Commercial developments > 3 storeys, including railway stations, shops, wholesale stores, offices, places of worship, theatrical, indoor sports or public assembly venues, other institutional land uses such as universities, schools, colleges, libraries, exhibition halls and museums, light (dry) industrial developments, dry manufacturing, commercial uses such as warehousing, packaging, and electrical sub-stations	D2 + FPI	D3 +FPI	D4					
C5	Fuel depots, processing plants or any other areas for the storage of liquids, waste sites.	D2 + DLI	D3 + DLI				D4		
C6	Outdoor storage facilities, stock yards, container depots	D2 + DLI	D3 + DLI						D4
C7	Parking garages	D2	D3 + FPI					D4	
C8	Parking areas	D2	D3					D4	
DLI = Design level investigation in accordance with the requirements of SANS 1936-2, as deemed appropriate by the competent person. FPI = Design level investigation specifically below the footprint of the structure.									

Table 2 *(continued)*

<table>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td colspan="2">Land usage</td><td colspan="8">Inherent hazard class determined in accordance with the requirements of SANS 1936-2</td></tr>
<tr><td rowspan="2">Designation</td><td rowspan="2">Description</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td colspan="8">Dolomite area designation and footprint investigation requirement</td></tr>
<tr><td colspan="10">High rise dwelling units</td></tr>
<tr><td>RH1</td><td>> 10 storeys</td><td colspan="8">D4</td></tr>
<tr><td>RH2</td><td>> 3 storeys with a population of ≤ 1 500 people per hectare</td><td>D2 + FPI</td><td colspan="7">D4</td></tr>
<tr><td>RH3</td><td>> 3 storeys with a residential coverage ratio of ≤ 0,4, no higher than 10 storeys, and a population of ≤ 800 people per hectare</td><td>D2 + FPI</td><td colspan="4">D3 + FPI</td><td colspan="3">D4</td></tr>
<tr><td colspan="10">Low rise dwelling units</td></tr>
<tr><td>RL1</td><td>≤ 3 storeys with 80 to 120 units per hectare and a population not exceeding 600 people per hectare</td><td colspan="2">D2 + FPI</td><td colspan="6">D4</td></tr>
<tr><td>RL2</td><td>≤ 3 storeys with up to 80 units per hectare and a population not exceeding 400 people per hectare</td><td colspan="2">D2 + FPI</td><td colspan="3">D3 + FPI</td><td colspan="3">D4</td></tr>
<tr><td colspan="10">Dwelling houses</td></tr>
<tr><td>RN1</td><td>Up to 60 dwelling houses per hectare with stands larger than 150 m^2, and a population of ≤ 300 people per hectare</td><td>D2</td><td>D3</td><td colspan="6">D4</td></tr>
<tr><td>RN2</td><td>Up to 25 dwelling houses per hectare with stands no smaller than 300 m^2, and a population of ≤ 200 people per hectare</td><td>D2</td><td colspan="3">D3</td><td colspan="4">D4</td></tr>
<tr><td>RN3</td><td>Up to 10 dwelling houses per hectare with 1 000 to 4 000 m^2 stands, and a population of ≤ 60 people per hectare</td><td>D2</td><td colspan="3">D3</td><td>D3 + FPI</td><td colspan="3">D4</td></tr>
<tr><td colspan="10">Other</td></tr>
<tr><td>AO</td><td>Agriculture that does not require irrigation in any form or the storage of water, parkland and public open spaces that are not irrigated and grazing pastures</td><td colspan="8">See SANS 1936-4</td></tr>
<tr><td colspan="10">DLI = Design level investigation in accordance with the requirements of SANS 1936-2, as deemed appropriate by the competent person.
FPI = Design level investigation specifically below the footprint of the structure.</td></tr>
</table>

Table 2 *(concluded)*

<table>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td colspan="2">Land usage</td><td colspan="8">Inherent hazard class determined in accordance with the requirements of SANS 1936-2</td></tr>
<tr><td rowspan="2">Designation</td><td rowspan="2">Description</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td colspan="8">Dolomite area designation and footprint investigation requirement</td></tr>
<tr><td>A1</td><td>Agriculture that requires intensive irrigation</td><td colspan="8">See SANS 1936-4</td></tr>
<tr><td>A2</td><td>Agriculture that requires irrigation, including botanical gardens, sports fields, driving ranges, golf courses, parkland and public open spaces</td><td colspan="8">See SANS 1936-4</td></tr>
<tr><td colspan="10">DLI = Design level investigation in accordance with the requirements of SANS 1936-2, as deemed appropriate by the competent person.
FPI = Design level investigation specifically below the footprint of the structure.</td></tr>
<tr><td colspan="10">NOTE 1 D1, D2, D3 and D4 have the meanings assigned in table 1.</td></tr>
<tr><td colspan="10">NOTE 2 Residential coverage ratio = footprint area/site area.</td></tr>
</table>

Table 3 — Permissible infrastructure and social facilities per inherent hazard class

<table>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td colspan="2">Infrastructure and social facilities</td><td colspan="8">Inherent hazard class determined in accordance with the requirements of SANS 1936-2</td></tr>
<tr><td rowspan="2">Designation</td><td rowspan="2">Description</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td colspan="8">Dolomite area designation</td></tr>
<tr><td>IN1</td><td>Trunk roads (national and regional roads which facilitate intercity travel) and primary distributor roads (major arterial roads forming the primary network for an urban area as a whole), railway lines, power lines, runways, bulk pipelines, including water, sewer, fuel and gas lines, and pump stations</td><td>D2</td><td colspan="5">D3</td><td colspan="2">D4</td></tr>
<tr><td>IN2</td><td>Reservoirs and public swimming pools, water care works, attenuation and retention ponds for stormwater management and artificial lakes</td><td>D2</td><td colspan="4">D3</td><td colspan="3">D4</td></tr>
<tr><td>IN3</td><td>Cemeteries</td><td colspan="4">D3</td><td colspan="4">D4</td></tr>
<tr><td>IN4</td><td>Dams, slimes dams</td><td>D3</td><td colspan="7">D4</td></tr>
<tr><td>IN5</td><td>Solid waste disposal facilities</td><td colspan="6">D3</td><td colspan="2">D4</td></tr>
<tr><td colspan="10">NOTE D1, D2, D3 and D4 have the meanings assigned in table 1</td></tr>
</table>