

## 2 Literature review

### 2.1 Dolomite Risk Management

Although the character of dolomite and the concept of risk associated with development on dolomite are researched extensively (BKS Raadgewende Ingenieurs, 1993; Bradley *et al.*, 1953; De Bruyn *et al.*, 2000; Geocon, 2003; Obbes, 2000), risk management on dolomite and especially the compilation of risk management strategies on dolomite is a relatively new concept.

Greg Heath from the Council for Geoscience reported after the Karst 2008 Conference held in Tallahassee, Florida, United States that although South Africa still has flaws in the system, it is way beyond that which is used in the United States (Council for Geoscience, 2010).

The general inclination of the book written by Waltham *et al.* (2005) with regards to development on dolomite is mostly reactive, with a strong focus on engineering techniques to combat sinkholes and subsidences, and a very limited focus on proactive or preventative management of the risk.

The following guideline documents are available when dealing with development on karst dolomite land in South Africa (Department of Water Affairs, 2009):

- A guideline for the assessment, planning and management of groundwater resources within dolomitic areas in South Africa: Department of Water Affairs and Forestry (2006)
- Guideline for Engineering Geological characterisation and development of dolomitic land: Council for Geoscience and the South African Institute of Engineering and Environmental Geologists (2003)
- Consultants Guide: Approach to sites on dolomite land: Council for Geoscience (2007a)
- The Department of Public Works Guideline PW344: Department of Public Works (2004, amended in 2010)

- Geotechnical site investigations for housing developments: National Department of Housing (2002)

The above guidelines will more than likely be surpassed by proposed guidelines of the South African Bureau of Standards (SABS) in due course. These standards will be known as:

- SANS 10400-B
- SANS 1936-1
- SANS 1936-2
- SANS 1936-3
- SANS 1936-4
- SANS 633
- SANS 644
- SANS 2001

The draft guidelines are available. SANS (2011) will be used as guiding document for the remainder of the project, with more detail on risk management following in the section below.

Risk management is the identification, assessment, and prioritisation of risks followed by coordinated and economical application or strategy of resources to minimize, monitor, and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities (International Organisation for Standards 2012).

A risk management strategy in the context of dolomite in this instance refers to an approach or set principles according to which plans are built to reduce risk. It is also the process of using scientific, planning, engineering and social processes, procedures and measures to manage an environmental hazard, and incorporates policies and procedures established to lower the likelihood of sinkholes and subsidence occurring

on dolomite land (Figure 2-1).

The objectives of developing a DRMS for land use and spatial development planning for the local authority, is to reduce the risk associated with dolomitic land. This method is guiding the process for establishing a DRMS through extensive research and studies, which can be seen in a preliminary Geo-Environmental Assessment of Dolomitic land in Potchefstroom (AGES, 2010b).



**Figure 2-1: Dolomite risk management**

## 2.2 *Dolomite Risk Management: case studies*

### 2.2.1 Case studies of sinkholes

There are several cases of devastation associated with uncontrolled development on dolomite.

Numerous single incidents are recorded in history. Recently, in Centurion, a sinkhole suddenly developed in a townhouse complex (Venter, 2005). In Blyvooruitzicht, an entire family were buried alive when a massive sinkhole occurred beneath their house. A total of 170 houses had to be evacuated from the surrounding houses (Lehmkuhl, 2010). Several examples of relocation projects are available, such as Westonarea (Bekkersdal Renewal Project, 2010), Khutsong (Urban Econ, 2008, South African Government Information, 2009 and Parliamentary Monitoring Group, 2009), Germiston and Boksburg (Louw, 2007), Thembalihle (Southern Metropolitan Local Council, 1998 and Radebe, 2007). Other relocation projects not related to dolomite, but related to informal settlement upgrading programmes, for example in Capt Town (Ross, 2005), and Gauteng (Huchzermeyer, 2006), have similar challenges.

It is evident from these case studies that:

1. Security of housing is acknowledged as a basic human need. When this security is threatened, people often react in panic. Inadequate information along with lack of understanding can cause chaos in a community, it is important to keep the affected communities informed throughout the whole process of infrastructure development and planning in terms of threats.
2. Communities are mostly resistant to relocation. Even when there is a major risk, if no impact has been felt by the community, they do not understand or believe the threats.
3. Understanding and education is often a stumbling block in these situations. If the community is not properly informed in language and words understandable to them, it causes confusion and distorted perceptions of the truth.

4. In the case of Khutsong and Bekkersdal – renewal projects have been implemented together with the relocation of communities living in high risk dolomitic areas. Costs of these projects are tremendous, and many benefits to the communities had to be included in the plans in order to get their participation in the relocation process.
5. Cases have been reported of relocated communities that moved back to their previous location even after better housing and basic services were provided to them. This is a result of established infrastructure and connections in the original location. These factors forms the social and material support of the personal networks the residents have built in the neighbouring areas. This is an important factor to take into consideration when planning relocation of a community.
6. It would seem that relocation of a community should be considered as a last resort and that all other options to upgrade existing infrastructure should be considered before any suggestion is made to relocate the affected community.
7. There are a number of economic factors that must be taken into account:
  - a. Job creation, as in employment
  - b. Value added (Gross Geographic Product)
  - c. Business output (or sales volume)
  - d. Personal income
8. As seen in Thembalihle, transparency and fairness are essential amongst the residents. These two principles are essential in progression and development, because fairness without transparency is not trustworthy. Consistency in the implementation of the process coincides with the fairness amongst individuals.
9. There must be a great consent for people that have been living in the areas for many years as well as for the children, women and elderly living in the settlements. These people will need to receive additional attention during the process to ensure that they vividly understand the process and the reasoning

behind the resettlement or upgrading.

10. Without the uplifting and building of the communities by means of employment of labour-intensive methods such as local construction companies and utilising local suppliers, the entire project could fail.

A few general ideas from the case studies which could enhance the efficiency of the project are:

1. The employment of local semi-skilled and unskilled labour. This can optimize the positive impact on poverty alleviation and personal/household income during the project.
2. Skills transfer and training of local workers during the project.
3. Ensuring that there are sufficient resources at their new locations.
4. Personal communication with each of the individuals in the areas that have to be moved concerning their specific requirements and wants and needs could be very fruitful in the long run.