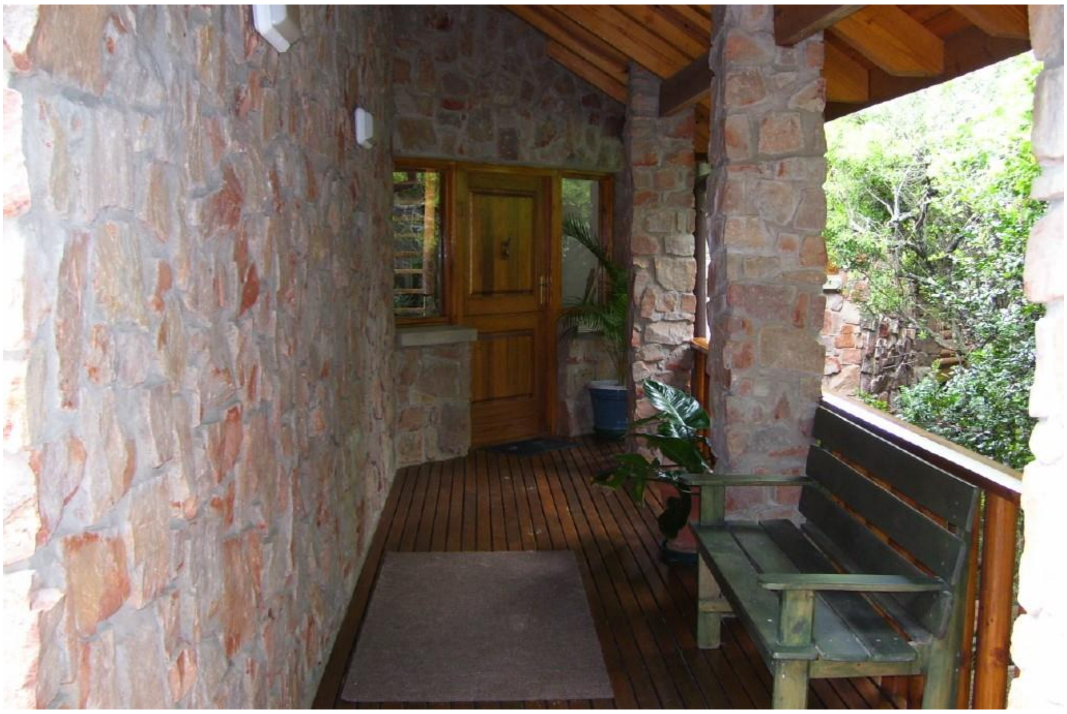


Plate 25: Verandas provide shade as well as insulating the house

Plate 26: Wooden balconies provide viewpoints while blending in with the vegetation

Plate 27: Garages and back entranceway

Plate 28: Large windows allow plenty of light

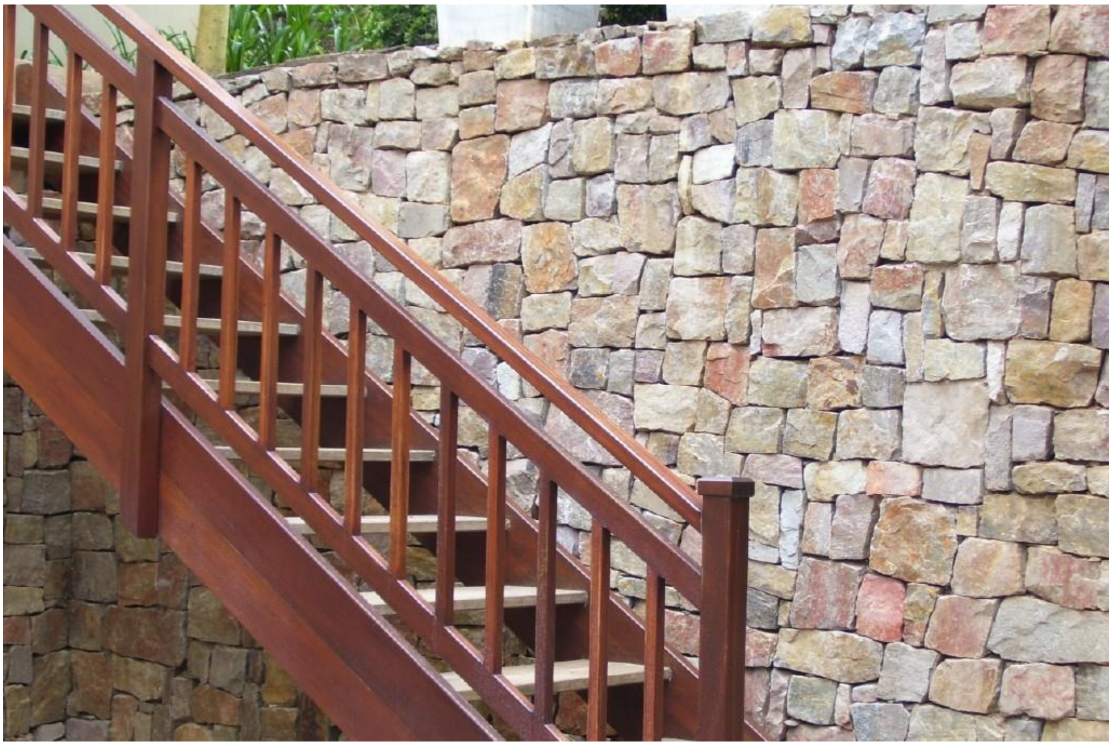


Plate 29: Wood and stone are used harmoniously in the design

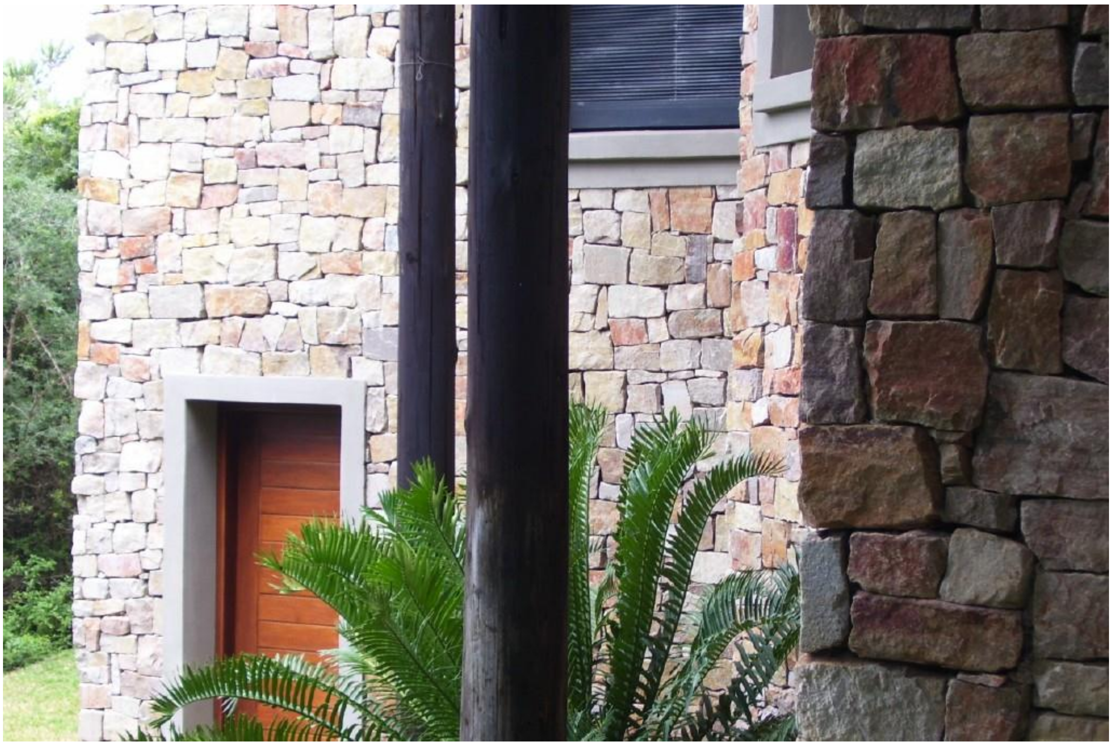


Plate 30: Indigenous vegetation is incorporated into the design

Appendix D – Specialist Reports

D1: D1: GEOLOGICAL, HYDROLOGICAL & GEOHYDROLOGICAL ASSESSMENT: DR MAURITZ VAN DER MERWE
D2: VEGETATION REPORT: Prof. Roy Lubke
D3: A PLANT SPECIES LIST OF BELTON FARM

D1: GEOLOGICAL, HYDROLOGICAL & GEOHYDROLOGICAL ASSESSMENT

Dr Mauritz van der Merwe

PHYSICAL ENVIRONMENT

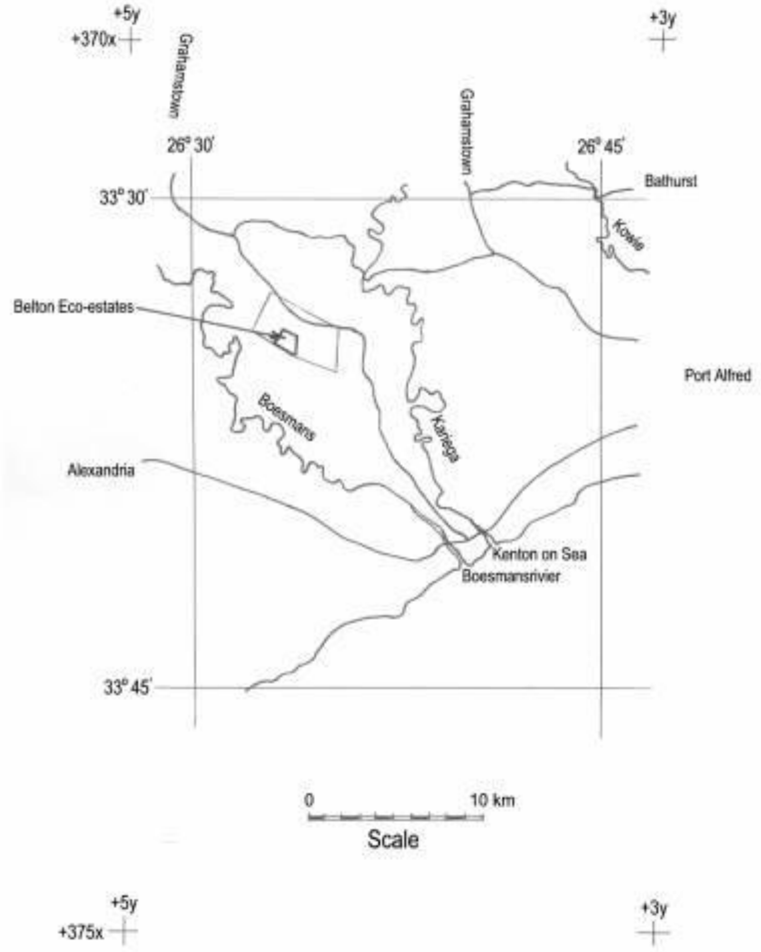
This section provides an overview of the project's geological environment. The role of this section is to provide a context for evaluation of project related activities. A locality plan of the project area is presented in Figure 1.

GEOLOGICAL ENVIRONMENT

Geology/Lithology

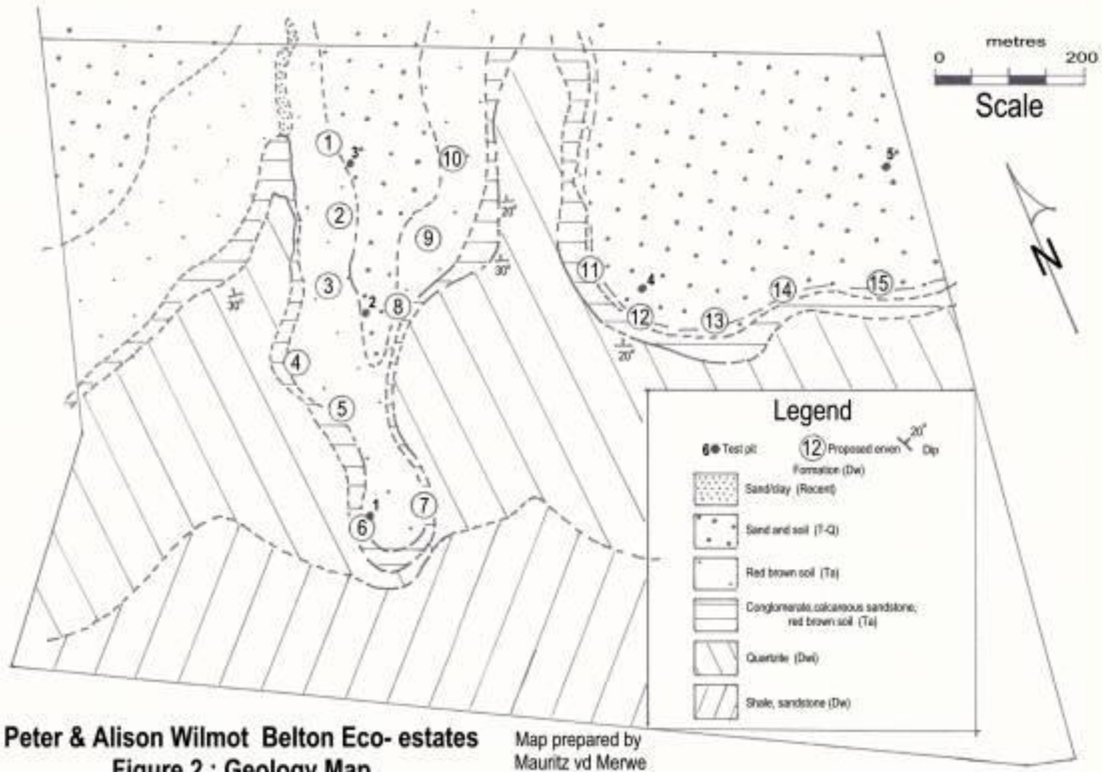
The proposed estate is underlain by paleo aeolian dunes of the Nanaga and underlying Alexandria Formations of the Algoa Group. The Nanaga Formation is mapped in brown with the symbol "T-Q" and the Alexandria Formation in pink with the symbol "Ta" on the published geological map. Both these formations are targets for the proposed developments in the area. The Nanaga Formation generally comprises variable components of dark brown to black sand, silt, clay and calcareous material whilst the Alexandria Formation consists of a red-brown sandy soil with scattered outcrops of calcareous sandstone and conglomerate that dips at 5^{o} NNE.

In the study area the Alexandria Formation is discordantly underlain at depth by quartzite of the Witpoort Formation that dips at between 20^{o} – 30^{o} to the NNE, steeper dips (50^{o} – 65^{o}) have been discerned in the immediate surroundings. This formation is mapped in light blue with the symbol "Dwi" on the published geological map. The Witpoort Formation is underlain by the Weltevrede Formation comprising shale and subordinate quartzite(sandstone) layers, on the published geological map it is mapped in khaki-green with the symbol "Dw". Both the abovementioned formations are of the Witteberg Group, Cape Supergroup. During the Cape Orogenesis the Cape Supergroup has been contorted and folded into syn-and anticlinal structures. A Geology Map the study area is presented in Figure 2.



Peter & Alison Wilmot Belton Eco-estates
Figure 1 : Locality Map

Map prepared by
Mauritz vd Merwe
Martindale
6146



Peter & Alison Wilmot Belton Eco- estates
Figure 2 : Geology Map

Map prepared by
Mauritz vd Merwe
Martindale
6146

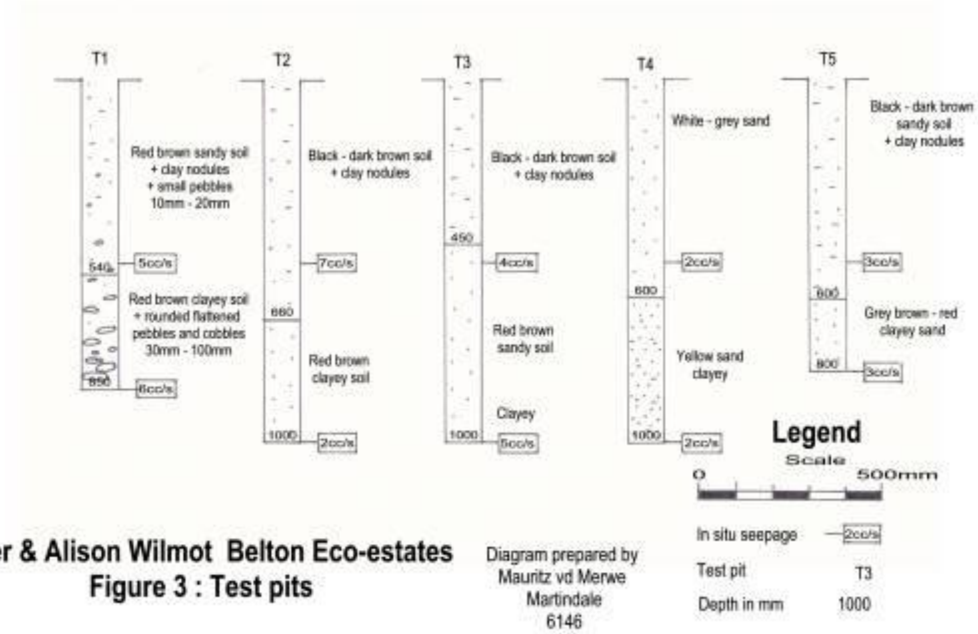
Geomorphology

The mountainous terrain between Grahamstown and the coast was formed during continental plate activities between 280 and 220 million years ago. Following the break up of Gondwanaland ± 100 million years ago, sea invaded the coastal region and eroded a level called the marine terrace that is also referred to as the African Marine Platform. This platform is present in the study area and occurs at depth at the contact between the underlying Witpoort Quartzite and the overlying Alexandria Formation.

The basal conglomerates and calcareous sandstones of the Alexandria Formation represent the original terrace level prior to a complex fluvial process of erosion and peneplanation that has denuded the original geomorphological environment.

Lowering of the sea level resulted in the uneven retreat of the sea with each regression being succeeded by a still-stand. During each still-stand a coastal dunefield was deposited, similar to the dunes currently forming along the beach-system. These inland dune systems became partly litified and formed the Alexandria and Nanaga Formations in the study area.

During the last (Recent) events of peneplanation in the study area the overlying Alexandria and Nanaga Formations have been eroded and denuded, and this has left two prominent NNE gulleys with a near vertical drop of ± 150 metres on either side of a prominent finger pointing SSW. There is no doubt that the junction between the overlying Alexandria and Nanaga Formations and the underlying Witteberg Group is an area that is vulnerable to future erosion. Excessive concentration of water close to the cliffs may cause slumping of the overlying layers as well as the underlying bedrock.



Peter & Alison Wilmot Belton Eco-estates
Figure 3 : Test pits

Soils

The soils of the Nanaga Formation are highly variable and comprise deeply weathered sand, silt and clay with in places clusters of clay nodules. They are of moderate to good agricultural value depending on the availability of water. These soils may have an affinity to erode if exposed to the atmosphere.

The Alexandria soils are typically red brown sandy – silty soils, irregularly scattered pebbles of quartzite can be discerned close to bedrock.

Soils along the steep slopes and in the adjoining gulleys overlying the Witteberg bedrocks comprise mainly of talus and debris, red-brown sandy soil. It erodes easily when exposed along steep slopes.

Geotechnical character of the soils

Altogether 5 trenches have been completed in the study area to determine the soil profiles and to perform in situ seepage tests at ± 500 mm and ± 1000 mm respectively to determine the seepage rates. The results are presented in Figure 3. The seepage rate at indicated depths varied between 2 cc/sec – 7 cc/sec. The soils are stable and compacted, no soil creep could be discerned in the trenches.

Hydrological Environment

Surface Water Resource

Surface seeps and gully head environments were noted in the vicinity of the proposed building sites. These seeps occur at the level at the base of the Alexandria Formation with the underlying Witpoort Quartzite (± 236 – 237 m. a. s. l.).

Ground Water Resource

At the present no ground water resources are being tapped on the proposed site. However, any future plans to utilize this resource should take cognizance of the possibility of intrusion of saline sea water into fresh ground water resources if pumped from levels deeper than ± 20 m.a.s.l.

Rain Water

It is the intention to harvest rain water. Permanent residents should however, be informed to supplement calcium, magnesium, phosphorus and zinc and fluoride to prevent osteoporosis and caries respectively.

Paleontological Resources

Neither the Nanaga nor Alexandria Formations are documented for paleontological material. However, fossils and fossil sites have been documented to occur in the Witpoort and Weltevrede Formations.

Aggregate and Building Material

Suffice building aggregate occurs on the site: Witpoort Quartzite and Weltevrede Shale talus/debris are all ideal building material. The sand on the property is also of a good quality.

ROADS

The proposed road system to the Belton Eco- estates comprises of ± 0.85 km of an existing access gravel road and approximately 4.33 km of new roads and is depicted on Figure 4. This road system has two entrances to the property from the R343 (the main tar road from Grahamstown to Kenton on Sea).

The E road is 1.46 km long and then reaches the service road, it is underlain by the Nanaga Formation.

The W road is underlain by the Nanaga Formation for 1.73 km and then by a strip 0.38 km long underlain by the Alexandria Formation.

The road that links the W to the E road has a strip of 0.32 km that is underlain by the Witpoort Formation where it bridges the valley between erven 10 and 11.

Soil cover

The Nanaga and Alexandria Formations are both covered by sandy soils with a patch of clayey soil ± 0.25 km long approximately 0.77 km from the W entrance. The weathered residuum of the Witpoort Formation consists of sandy soil, soil, talus/debris and fractured rock and outcrop of quartzite. All of the above except the clay forms a proper stratum for roads.

Quality of road stratum

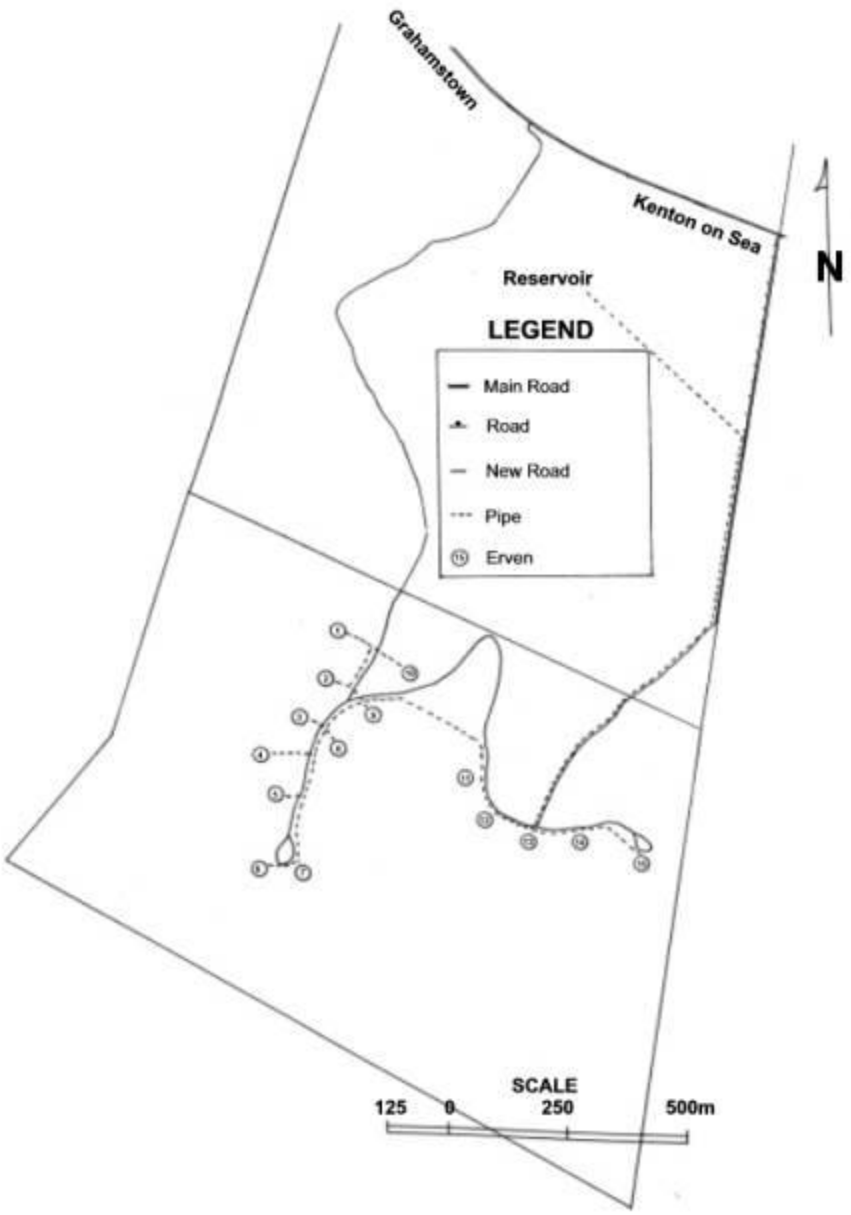
The soil and sandy soil provide proper road aggregate, it requires to be graded and compacted. Talus/debris also provide good road building material provided it is properly compacted.

Clay and clayey material is not stable and become slippery when wet.

Construction

The sandy soils, soil and talus/debris must be graded and compacted several times.
The clayey and rocky stretches must be covered with proper road building aggregate and graded and compacted properly. Loose boulders must be removed.

The roads must be strictly maintained and provided with the necessary culvert and shoulder system to cope with rainwater.



Peter & Alison Wilmot Belton Eco-estates
Figure 4: Road and Pipeline Map

Map prepared by:
Mauritz vd Merwe
Martindale
6146

PIPELINE

The proposed pipeline is ± 3.35 km long and is located mainly along the roads. It can be placed at a depth of 300 mm along the entire distance since the stratum consists of soils and sand. However, in the valley between erven 9 and 11 where rock outcrops and loose boulders occur it may require deviations from the proposed plans.

RECOMMENDATIONS

In the case of the proposed erven which are situated near to the edge of the cliffs, it is suggested to move numbers 4 to 8 and 11 and 12 away from the escarpment by at least 25 metres to prevent possible future slumping as a result of concentration of rain water close to a dwelling.

Also consider the following suggestions.
Construct the road along the eastern boundary for at least another 0.4 km and then join it with a curve with the service road close to erven 15. (Fewer trees will have to be cleared along this route).

Straighten the W entrance to avoid two sharp bends close to the main road. (This proposal would shorten the road system by ± 0.20 to 0.25 km).

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APPENDIX D2: VEGETATION REPORT

Professor R A Lubke

1 Introduction

The overall aim of this study is to identify the potential for development within the study area with respect to the existing flora and vegetation on the site and provide input regarding the impact of the proposed development on the vegetation. This study is a rapid survey to identify possible fatal flaws and/or significant issues associated with proposed development in the region. The following issues are addressed in the report:

- A brief introduction to the vegetation, its classification and description of the plant communities of the study area.
- An account of any rare and protected plant species on the site.
- A map based on sensitivity and conservation priority assessment of the vegetation types of the area.

No accounts of the vegetation and flora of this specific region are available. A number of site visits were made and the vegetation and plants were sampled at a number of sample sites throughout the region, especially where the development was to occur or where roads were planned.

2 Flora

In this study 169 plant species were recorded which are listed in Appendix D1. This is somewhat less than the total possible as the thicket vegetation was not studied in any detail as this is unlikely to be affected by development. It is useful to have a full list of possible species of the study area but not necessary to make judgements on the impacts of the vegetation on the flora.

The major families (with species numbers in brackets) from this list are: Asteraceae (daises – 23), Poaceae (grasses - 16), Fabaceae (legumes – 7), Crassulaceae (6), Euphorbiaceae (7), Ebenaceae (6) and Anacardiaceae (7). There may well be more grasses and sedges in the area as the grasslands, were not studied over the seasons and many were not flowering. The succulents were well represented with 6 *Crassula* spp., 7 *Euphorbia* spp., 5 *Aloe* spp. and 3 species of mesems (vygies). This is indicative of the tall succulent thicket of the region. The woody shrubs are common in the thicket vegetation, Rhus spp. (karee) being the most common with 6 species. Helichrysum spp. (everlastings) and Senecio spp. are the most abundant herbs (both of the Asteraceae family – daisies) which occur in a variety of habitats and vegetation types.

No species of special concern, such as endangered species, were recorded.

Alien Invasive Plant species

Invasion of exotic alien vegetation (Table 2.1) is situated in some areas which need to be controlled. The weeds in this table that are category 1 weeds according to the agricultural resources act (Act No. 43 of 1983) require appropriate removal and control as stipulated by the act.

Table 2.1: Alien Weeds and Invasive Plant species of concern

No.	Botanical Name	Common name	Family	Type	Category*
22	*Pinus pinaster*	Scotch pine	Pinaceae	Invader	2
5417	*Opuntia ficus-indica*	Prickly pear	Cactaceae	Weed	1
7144	*Lantana camara*	Lantana	Verbenaceae	Weed	1
7407	*Solanum elaeagnifolium*	*Silverleaf bitter* apple	Solanaceae	Weed	1

***Regulation 15 of the Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)**

A few specimens of the Scotch pine (*Pinus pinaster*) occur as well the succulent alien species the prickly pear (*Opuntia ficus-indica*). The *Silverleaf bitter* apple (*Solanum elaeagnifolium) occurs mainly in kikuyu grasslands.* Alien plant invassion is not a problem in this area at all.

3 Vegetation description

In a similar study along a river gorge (the Blaaukrantz Nature Reserve) Llyod's (1987) recorded eight plant communities, namely: Sub-succulent Thicket, Grassland with scattered Thicket, Bushclumps, Acacia-invaded Bushclump, Olea Bushclump, Xeric Kaffrarian Succulent Thicket, Riverine Bush and Scree slope. He thus recognised various thicket communities on the various slopes of the reserve and the invasion of grassland and savanna and grassland by woody species. In this area the site is not as large or as variable in sites or landform. However his vegetation types, as seen below, are similar to the current site:

Succulent Thicket – on steep south and west-facing slopes with *Euphorbia triangularis* and *E.tetrangona*, *Aloe* spp. and mesems with some non-succulent shrubs.
Xeric Thicket – a scattered dense thicket of diverse non-succulent shrubs and small trees.
Acacia Savanna – spaced *Acacia karroo* trees and some other small trees or shrubs with grasses on deeper soils. It is rapidly invaded by woody trees and shrubs.
Grassland – on hill tops and above the woody communities a mixed diverse grassland of grasses and herbs Llyod (1987).

On the proposed Belton Eco-estate the vegetation around the site of the proposed development is discussed below:

- **Succulent Thicket** - as described above is found on the steeper slopes. Valley Thicket (or Bushveld sensu Acocks 1975) is dense vegetation that consists of predominately shrubs and trees as well as climbers (. There are no distinct woody plant strata or much ground cover in thicket. In Succulent Thicket the dominant trees are *Euphorbia* spp. Along with many other woody species.
- **Xeric Thicket** is composed of many tree and shrub species with many different co-dominant woody species .
- **Bushclumps in Grassland** are scattered throughout the grassland , and vary in size depending on the degree of woody plant invasion. Many grasses and herbs of grassland, and shrubs and trees of the thicket are present.