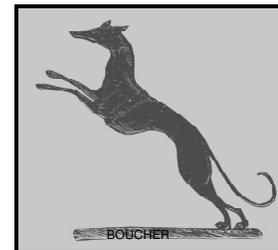


Ecological Research Report No. 151

Ekologiese Navorsingsverslag No. 151



**Botanical issues
relating to the proposed
KHOISAN BAY DEVELOPMENT,
on Portion 2 of the Farm
Strandfontein No. 712
De Kelders**

4 November 2009
Revised 3 May 2012

COMPILED BY - SAAMGESTEL DEUR

Dr C. Boucher

18 Patrys Street
Stellenbosch
7600
South Africa

Patrysstraat 18
Stellenbosch
7600
Suid-Afrika

Telephone / Fax 021 887 1421; Cell 083 628 2570

Telefoon / Faks 021 887 1421; Sel 083 628 2570

Botanical Issues relating to the proposed Khoisan Bay Development, De Kelders

CONTENTS

| | |
|---|----|
| Summary | 4 |
| 1. Introduction | 5 |
| 1.1 Location | 5 |
| 1.2 General flora and vegetation | 5 |
| 2. Zietsman's findings | 7 |
| 2.1 Flora and Vegetation | 7 |
| 2.1.1 <i>Olea exasperata</i> – <i>Thamnochortus guthrieae</i> Overberg Dune Strandveld community | 9 |
| 2.1.1.1 <i>Metalasia muricata</i> – <i>Olea exasperata</i> Overberg Dune Strandveld sub-community | 10 |
| 2.1.1.2 <i>Diosma subulata</i> – <i>Olea exasperata</i> Overberg Dune Strandveld sub-community..... | 10 |
| 2.1.1.3 <i>Pelargonium betulinum</i> – <i>Olea exasperata</i> Overberg Dune Strandveld sub-community | 11 |
| 2.1.1.4 <i>Erica plukenetii</i> var. <i>plukenetii</i> – <i>Olea exasperata</i> Overberg Dune Strandveld sub-community | 12 |
| 2.1.2 <i>Agathosma geniculata</i> – <i>Helichrysum retortum</i> Agulhas Limestone Fynbos community | 12 |
| 2.1.3 <i>Euclea racemosa</i> – <i>Pterocelastrus tricuspidatus</i> Overberg Dune Strandveld thicket community | 13 |
| 2.2 Zietsman's conservation recommendations | 14 |
| 3. Assessment of Zietsman's findings | 15 |
| 3.1 Flora | 15 |
| 3.2 Vegetation | 17 |
| 3.3 Alien flora | 18 |
| 3.4 Linkages | 19 |
| 4. Botanical impact of the proposed development | 19 |
| 4.1 Development Alternative 1 | 19 |
| 4.2 Development Alternative 2 integrating development with partial conservation | 21 |
| 4.3 Development Alternative 3 – Development of Portion 1 with an Extended Conservation Area | 27 |
| 4.4 Impact assessment evaluation | 28 |
| 5. Management issues | 30 |
| 5.1 Fires and Firebreaks | 30 |
| 5.2 Restrictions | 34 |
| 6 Offsets | 34 |
| 7. References | 35 |

Appendices

| | |
|--|----|
| Appendix 1. Threatened vegetation categories | 35 |
| Appendix 2. Threatened Ecosystem categories | 36 |
| Appendix 3. Categories for “Flora of Conservation Concern” | 37 |
| Appendix 4. Phytosociological table for area (data from M Zietsman re-analysed) | 39 |
| Appendix 5. Protocols for assessment of impacts associated with development alternatives | 40 |
| Appendix 6. Declaration of Independence of Practitioner | 42 |
| Appendix 7. Dr Charles Boucher Abridged CV. | 43 |

List of Figures

- Figure 1. The north-western part of the Khoisan Bay property with the stable dunefield in the foreground with the limestone cliffs at Die Plaat in the centre and Walker Bay in the left and the Kleinrivier Mountains in the distance.
- Figure 2. National potential vegetation map of the De Kelders area extracted from Mucina & Rutherford (2006). FS 7 = Overberg Dune Strandveld; FFI 1= Agulhas Limestone Fynbos; FFs 12 = Overberg Sandstone Fynbos; FOz 6 = Southern Coastal Forest.
- Figure 3. Detailed vegetation map of area by Zietsman (undated).
- Figure 4. Areas identified by Zietsman (undated) as containing sensitive vegetation.
- Figure 5. Khoisan Bay vegetation on stable dunes in foreground with Walker Bay Nature Reserve in middle to far distance showing recently stabilised to loose dunes (Photo by E. Foster).
- Figure 6. Initial development Alternative 1.
- Figure 7. Aerial image of the proposed Khoisan Bay development site showing environmental constraints, conservation areas, firebreaks and recommended buffer between the development, the Walker Bay Nature Reserve and the R43 provincial road.
- Figure 8. The layout of Development Alternative 2.
- Figure 9. Development Alternative 2, superimposed on the vegetation map and including the suggested outline from Figure 7 (pink development line) with the proposed compromise development outline (red boundary line) as in Figure 8.
- Figure 10. Development Alternative 2, superimposed on the GoogleEarth image.
- Figure 11. Portion 1 will be developed now as the Khoisan Bay development, with Portion 2 (Private Open Space) being earmarked for future development and Portion 3 being zoned as Public Open Space
- Figure 12. Alternative 3, Phase 1, plot layout with the Public Open Space along the R43 in green.
- Figure 13. Aerial image of Strandfontein Farm 712 (Portions 1 & 2) showing Alternative 3 Development Option (Portions 1 & 2), together with environmental constraints, conservation areas, firebreaks and recommended buffer between the development, the Walker Bay Nature Reserve and the R43 provincial road. (PrOS = Private Open Space).

List of Tables

- Table 1. Key descriptors for the *Olea exasperata* – *Thamnochortus guthrieae* Overberg Dune Strandveld community
- Table 2. Key descriptors for the *Metalasia muricata* – *Olea exasperata* Overberg Dune Strandveld sub-community
- Table 3. Key descriptors for the *Diosma subulata* – *Olea exasperata* Overberg Dune Strandveld sub-community
- Table 4. Key descriptors for the *Pelargonium betulinum* – *Olea exasperata* Overberg Dune Strandveld sub-community
- Table 5. Key descriptors for the *Erica plukenetii* var. *plukenetii* – *Olea exasperata* Overberg Dune Strandveld sub-community

- Table 6. Key descriptors for the *Agathosma geniculata* – *Helichrysum retortum* Agulhas Limestone Fynbos community
- Table 7. Key descriptors for the *Euclea racemosa* – *Pterocelastrus tricuspidatus* Overberg Dune Strandveld thicket community
- Table 8. Total area occupied by each plant community together with area proposed as Alternative 2, for development versus conservation
- Table 9. Total area occupied by each plant community together with area proposed as Alternative 3 for development versus that undeveloped and potentially all conserved
- Table 10. Botanical impact assessment of the "No Go" or Status Quo development alternative at Khoisan Bay, De Kelders
- Table 11. Botanical impact assessment of Alternative 1, the Full Area Development Option, at Khoisan Bay, De Kelders
- Table 12. Botanical impact assessment of Alternative 2, the 60% Development and 40% Conservation Option, at Khoisan Bay, De Kelders
- Table 13. Botanical impact assessment of Alternative 3, the 50% Development and 50% Conservation Option, at Khoisan Bay, De Kelders

Summary

Three communities with four sub-communities are identified on site in the Zietsman report. These are upheld. The 83 species (9 exotic aliens, 4 Red Data Book species) reported for the site is low for this diverse area. The vegetation is primarily Overberg Dune Strandveld and transitional vegetation developing toward Agulhas Sand Fynbos and Agulhas Limestone Fynbos. Three development alternatives and a "No Go" Option are evaluated. In Development Alternative 3, the preferred alternative, a natural buffer conservation area between the proposed development and the Walker Bay Nature Reserve, which includes a consolidated dune field, and another along the R43 road, are proposed. A large Public Open Space (54 ha) and a Private Open Space (18 ha), which together occupy 68% of this portion of the farm, are proposed in the preferred 3rd Alternative. A buffer with firebreak of 5.8446 ha parallels the development along the R43. Alternative 3 would incorporate examples of all the vegetation types present on the property in a consolidated area. The location of firebreaks are suggested but must be finalised in agreement with Walker Bay Nature Reserve management, who need to be involved in their maintenance and in the management of the conservation areas in consultation with an Environmental Control Officer appointed for the management of the estate.

1. Introduction

Khoisan Bay Developments (Pty) Ltd through Johan Neethling Environmental Services requested an evaluation of the Open Space System they proposed to determine whether it would meet environmental requirements as CapeNature were unsatisfied with the proposals put forward.

The Farm Strandfontein at De Kelders (**Figure 1**) was inspected on 3 April and 28 August 2009 followed later by discussions with C. Maartens (telephonic) and S. Ralston both of CapeNature to discuss their concerns about the proposed development. The basic proposals presented below are put forward to solve problems with the earlier development design so as to make it more acceptable to CapeNature. It is noted that the Fine-scale Spatial Diversity Conservation Plan for the area identifies the property as a “Critical Biodiversity Area” (S. Holness pers. com.).



Figure 1. The north-western part of the Khoisan Bay property with the stable dune field in the foreground with the limestone cliffs at Die Plaat in the centre and Walker Bay in the left and the Kleinrivier Mountains in the distance (Photo by E. Foster).

1.1 Location

The proposed Khoisan Bay Development site, 110 hectares in extent, abuts onto the northern extremity of De Kelders Town. The R43 Provincial Road borders the southern side of the property and the Walker Bay Nature Reserve the northern side.

The property is crossed by Municipal services servitude from De Kelders in the form of a pipeline and a gravel road).

1.2 General flora and vegetation

The Cape Floristic Kingdom, one of six world floral kingdoms, is internationally renowned for its special rich flora containing an estimated 9 000 species of vascular plants of which almost 69% are endemic (restricted to the region). This makes it one of the richest regions in the world in terms of botanical diversity. It is characterized by five endemic families and by the conspicuous presence of, amongst others, species belonging to the families Aizoaceae, Ericaceae, Fabaceae, Iridaceae, Orchidaceae, Proteaceae, Restionaceae, Rutaceae and Scrophulariaceae (Goldblatt & Manning, 2000).

The publication describing the national vegetation types by Mucina & Rutherford (2006) was not available to Zietsman (undated) although she refers to the accompanying national vegetation map (Mucina, Rutherford & Powrie, 2005) (**Figure 2**). The information included below from Mucina & Rutherford (2006) is provided to augment data provided in the Zietsman report.

An important major vegetation type difference relevant to the study area is the distinction between forest, strandveld and fynbos. Strandveld is a shrubland dominated by sclerophyllous, broad-leaved shrubs and are found closer to the seashore. In sheltered moister sites strandveld can grow taller and become replaced by low scrub milkwood forest. Structural and floristic differences between strandveld and fynbos are striking. Although restios can be common elements in both, the Proteaceae are absent from Strandveld while Ericaceae are extremely rare to absent altogether. The substrate of Strandveld is mineral-rich, with high concentrations of lime (locally called kalksteen) in coastal sands. An intricate relationship between topography, substrate type and age, local water-logging and fire dictates the distributional relationship between Strandveld and Fynbos (Mucina & Rutherford 2006).

Overberg Dune Strandveld (FS 7) is distributed from Rooiels (Kogelberg Biosphere Reserve) to Cape Infanta and is concentrated on the Agulhas Peninsula. It is found on Recent to Quaternary marine-derived calcareous sands (Bredasdorp Group) often in dune fields or coastal sands. It consists of up to 4 m tall closed evergreen sclerophyllous (hard-leaved) shrublands in wind-protected valleys forming low, 1 m tall, wind-shorn coastal thicket in exposed littoral situations.

Currently, this vegetation type has a similar status for Vegetation Conservation (Mucina & Rutherford 2006) and Ecosystem Threat (Government Gazette 2011) of “Least Threatened” (see **Appendix 1** for Threatened Vegetation Category and **Appendix 2** for Threatened Ecosystem Category explanations). This status is primarily attributed to a historical legacy of state-owned control of a number of erstwhile mobile coastal dune fields (to ensure their stabilisation) and thus of their present conservation through ownership being transferred from the erstwhile Department of Forestry to CapeNature. Walker Bay Nature Reserve (previously Forest Reserve) contributes significantly toward the conservation of the Overberg Dune

Strandveld. Private Nature Reserves also contribute to the conservation of certain important prime habitats. The survival of this vegetation is seriously threatened by the invasion of thicket-forming aliens such as *Acacia cyclops* (rooikrans), *Acacia saligna* (port jackson) and *Leptospermum laevigatum* (myrtle), urbanisation and cultivation.



Figure 2. National potential vegetation map of the De Kelders area extracted from Mucina & Rutherford (2006). FS 7 = Overberg Dune Strandveld; FF1 1= Agulhas Limestone Fynbos; FFs 12 = Overberg Sandstone Fynbos; FOz 6 = Southern Coastal Forest.

2. Zietsman's findings

2.1 Flora and Vegetation

Zietsman (undated) recorded 83 species on the property and lists six of these as Red Data Book threatened species and 14 as invader or problem plants. (These data are revised in the current report using more recent information.)

The following plant communities are identified by Zietsman (undated) (her nomenclature and numbering system is included to match the numbers used in her vegetation map (**Figure 3, Appendix 3**):

- 1 *Olea exasperata* – *Thamnochortus guthrieae* Overberg Dune Strandveld community
 - 1.1 *Metalasia muricata* – *Olea exasperata* Overberg Dune Strandveld sub-community
 - 1.2 *Diosma subulata* – *Olea exasperata* Overberg Dune Strandveld sub-community
 - 1.3 *Pelargonium betulinum* – *Olea exasperata* Overberg Dune Strandveld sub-community
 - 1.4 *Erica plukenetii* var. *plukenetii* – *Olea exasperata* Overberg Dune Strandveld sub-community
- 2 *Agathosma geniculata* – *Helichrysum retortum* Agulhas Limestone Fynbos community

3 *Euclea racemosa* – *Pterocelastrus tricuspidatus* Overberg Dune Strandveld thicket community

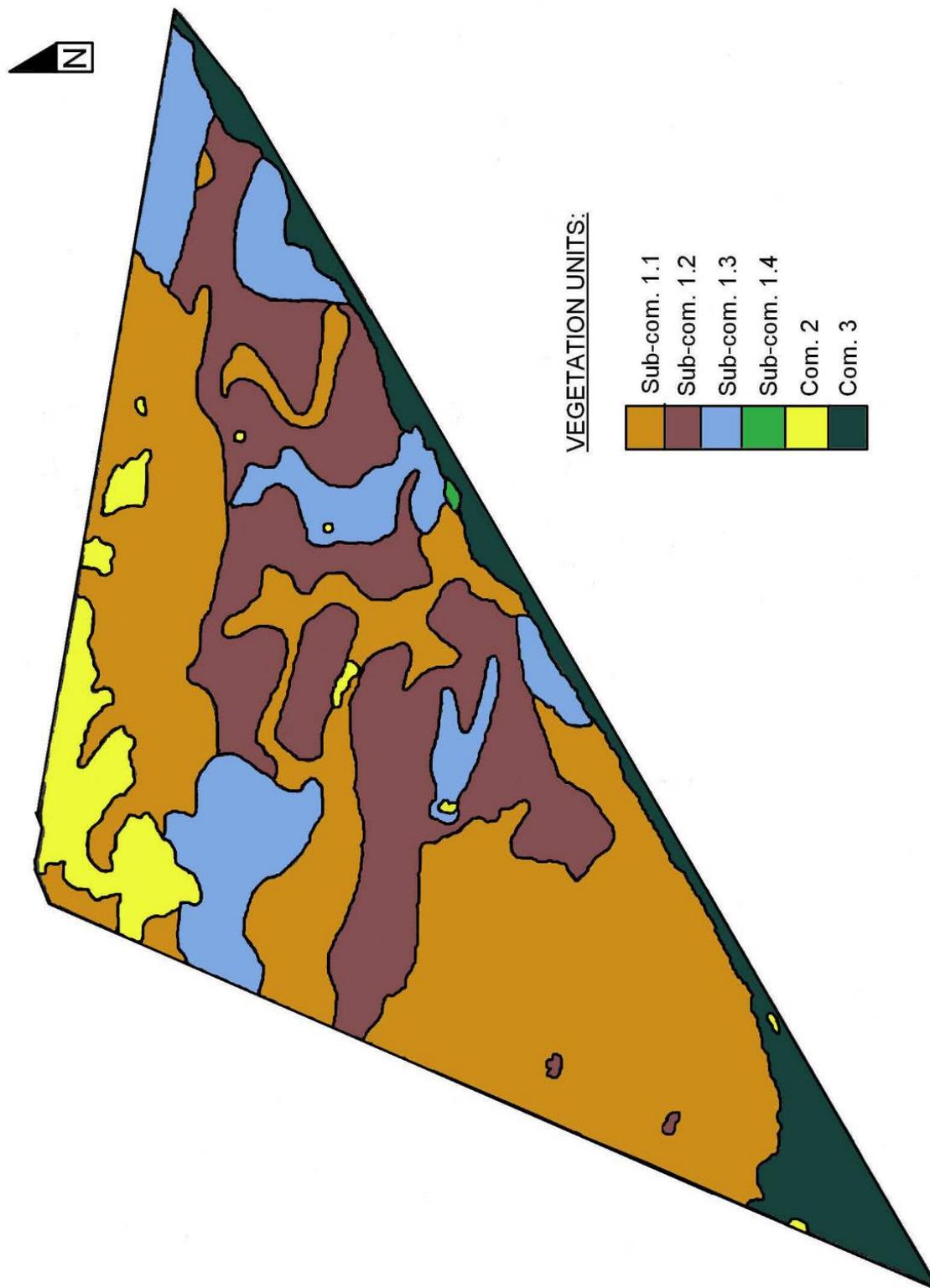


Figure 3. Detailed vegetation map of area by Zietsman (undated).

The description of each community is briefly condensed below to features essential for their identification and typification, while their distribution is included in **Figure 3**. The list of species found in each community is included here to assist in the diagnosis of each community as no phytosociological table is included in the Zietsman report. Changes to Flora of Conservation Concern (Red Data Book plants) status, subsequent to Zietsman's work, are indicated in each table and in section 3. The Flora of Conservation Concern category definitions, indicated by abbreviations in this section, are given in **Appendix 3**.

2.1.1 *Olea exasperata* – *Thamnochortus guthrieae* Overberg Dune Strandveld community

Table 1. Key descriptors for the *Olea exasperata* – *Thamnochortus guthrieae* Overberg Dune Strandveld community

| | |
|-----------------------------------|--|
| Area & % of total area | 94.11 ha or 86.45% |
| Soils | Sandy soils |
| Rockiness | 0 % |
| Characteristic species | <i>Diosma subulata</i> , <i>Thamnochortus insignis</i> , <i>Helichrysum pulchellum</i> , <i>Pelargonium suburbanum</i> subsp. <i>bipinnatifidum</i> , <i>Crassula nudicaulis</i> var. <i>nudicaulis</i> , <i>Brunsvigia orientalis</i> , <i>Ficinia pinguior</i> , <i>Erica plukenetii</i> var. <i>plukenetii</i> , <i>Trichocephalus stipularis</i> , <i>Metalasia muricata</i> , <i>Morella cordifolia</i> , <i>Pelargonium betulinum</i> , <i>Thamnochortus guthrieae</i> , <i>Passerina paleacea</i> |
| Red Data species | <i>Ficinia pinguior</i> (VU) |

The shrub *Olea exasperata* dominates this community. Other species found here include: the trees and shrubs: *Acacia cyclops**, *Anthospermum aethiopicum*, *Cassine peragua*, *Chrysanthemoides monillifera*, *Conicosia pugioniformis* subsp. *muirii*, *Euclea racemosa*, *Indigofera brachystachya*, *Jamesbrittenia albomarginata*, *Maytenus procumbens*, *Metalasia densa*, *Muraltia satureioides* var. *satureioides*, *Otholobium bracteolatum*, *Passerina vulgaris*, *Passerina rigida*, *Phyllica ericoides*, *Pterocelastrus tricuspidatus*, *Searsia glauca*, *Searsia laevigata* var. *villosa*, *Searsia lucida*, *Salvia africana-lutea*, *Sutera hispida*, *Tephrosia capensis*, *Zygophyllum flexuosum*; the grasses *Cenchrus incertus**, *Ehrharta villosa* var. *maxima*, *Pentaschistis calcicola* and *Koeleria capensis*, the restios *Calopsis viminea* and *Ischyrolepis eleocharis*; the sedge *Ficinia pinguior*; the geophyte *Brunsvigia orientalis*; the sub-shrubs *Chironia baccifera*, *Carpobrotus acinaciformis*, *Euphorbia arceuthobioides*, *Helichrysum patulum*, *Pelargonium capitatum*, *Selago polystachya*, *Senecio arenarius*, *Lyperia lychnidea* and the climbers *Cassytha ciliolata* and *Cissampelos capensis*.

Boucher (this report), provides detail from the further analysis of Zietsman's data to differentiate this community, namely, Boucher community number 2 the *Olea exasperata*-*Thamnochortus guthrieae* Coastal Dune Fynbos in **Appendix 4**.

2.1.1.1 *Metalasia muricata* – *Olea exasperata* Overberg Dune Strandveld sub-community

Table 2. Key descriptors for the *Metalasia muricata* – *Olea exasperata* Overberg Dune Strandveld sub-community

| | |
|-----------------------------------|--|
| Map identification | Sub-community 1.1 in Figure 3 |
| Area & % of total area | 50.70 ha or 46.57% |
| Soils | Sandy soils |
| Rockiness | 0 % |
| Characteristic species | <i>Pelargonium suburbanum</i> subsp. <i>bipinnatifidum</i> and <i>Morella cordifolia</i> |
| Red Data species | <i>Pentaschistis calcicola</i> (NT), <i>Thamnochortus guthrieae</i> (LC – delisted now) |

The dominant species in this sub-community is the shrub *Olea exasperata*. Other species found here include: the trees and shrubs: *Anthospermum aethiopicum*, *Cassine peragua*, *Euclea racemosa*, *Indigofera brachystachya*, *Maytenus procumbens*, *Metalasia muricata*, *Morella cordifolia*, *Muraltia satureioides* var. *satureioides*, *Passerina rigida*, *Phyllica ericoides*, *Pterocelastrus tricuspidatus*, *Salvia africana-lutea*, *Searsia glauca*, *Passerina paleacea*, *Searsia laevigata* var. *villosa* and *Zygophyllum flexuosum*; the sub-shrubs *Chironia baccifera* and *Selago polystachya*; the grass *Pentaschistis calcicola*; the restio *Thamnochortus guthrieae* and the climber *Cissampelos capensis*.

Boucher (this report), provides detail from the further analysis of Zietsman's data to differentiate this community, namely, Boucher community number 2.1, titled the *Olea exasperata-Metalasia muricata* Transitional Strandveld to Dune Fynbos, which is subdivided into two variations namely, 2.1.1 *Olea exasperata-Morella cordifolia* Transitional Strandveld to Dune Fynbos and 2.1.2 *Olea exasperata-Passerina corymbosa* Transitional Strandveld to Dune Fynbos in **Appendix 4**.

2.1.1.2 *Diosma subulata* – *Olea exasperata* Overberg Dune Strandveld sub-community

Table 3. Key descriptors for the *Diosma subulata* – *Olea exasperata* Overberg Dune Strandveld sub-community

| | |
|-----------------------------------|---|
| Map identification | Sub-community 1.2 in Figure 3 |
| Area & % of total area | 28.27 ha or 25.97% |
| Soils | Sandy soils |
| Rockiness | 0 % |
| Characteristic species | No plant species were recorded that are restricted to this vegetation unit |
| Red Data species | <i>Pentaschistis calcicola</i> (NT), <i>Carpobrotus acinaciformis</i> (LC – delisted now), <i>Thamnochortus guthrieae</i> (LC – delisted now) |

The dominant plant species in this sub-community is the shrub *Diosma subulata*. Other species found here include the trees and shrubs *Acacia cyclops**, *Olea exasperata*, *Passerina rigida*, *Pelargonium betulinum*, *Phyllica ericoides*, *Pterocelastrus tricuspidatus* and *Indigofera brachystachya*; the sub-shrubs *Carpobrotus acinaciformis*, *Conicosia pugioniformis* subsp. *muirii*, *Crassula nudicaulus* var. *nudicaulis* and *Euphorbia arceuthobioides*; the grasses *Pentaschistis calcicola* and *Koeleria capensis*; the restios *Calopsis viminea*, *Thamnochortus guthrieae* and *Ischyrolepis eleocharis*; and the parasite *Cassytha ciliolata*.

Boucher (this report), provides detail from the further analysis of Zietsman's data to differentiate this community, namely, Boucher community number 2.3, titled the *Olea exasperata-Diosma subulata* Dune Fynbos in **Appendix 4**.

2.1.1.3 *Pelargonium betulinum* – *Olea exasperata* Overberg Dune Strandveld sub-community

Table 4. Key descriptors for the *Pelargonium betulinum* – *Olea exasperata* Overberg Dune Strandveld sub-community

| | |
|-----------------------------------|--|
| Map identification | Sub-community 1.3 in Figure 3 |
| Area & % of total area | 15.05 ha or 13.83% |
| Soils | Sandy soils |
| Rockiness | 0 % |
| Characteristic species | <i>Thamnochortus insignis</i> , <i>Helichrysum pulchellum</i> , <i>Lyperia lychnidea</i> , <i>Passerina vulgaris</i> |
| Red Data species | <i>Helichrysum pulchellum</i> (LC - delisted now), <i>Pentaschistis calcicola</i> (NT), <i>Carpobrotus acinaciformis</i> (LC - delisted now), <i>Thamnochortus guthrieae</i> (LC - delisted now) |

The dominant plant species of this sub-community is the shrub *Olea exasperata*. Other species found in this sub-community include: the trees and shrubs: *Acacia cyclops**, *Anthospermum aethiopicum*, *Cassine peragua*, *Chrysanthemoides monilifera*, *Crassula nudicaulis* var. *nudicaulis*, *Euclea racemosa*, *Indigofera brachystachya*, *Metalasia muricata*, *Muraltia satureioides* var. *satureioides*, *Otholobium bracteolatum*, *Passerina paleacea*, *Pterocelastrus tricuspidatus*, *Searsia glauca*, *Sutera hispida*, *Tephrosia capensis*, and *Zygophyllum flexuosum*; the sub-shrubs *Carpobrotus acinaciformis*, *Euphorbia arceuthobioides*, *Helichrysum patulum*, *Pelargonium betulinum*, *Pelargonium capitatum*, *Selago polystachya* and *Wahlenbergia tenella*; the grasses *Cenchrus incertus**, *Ehrharta villosa* var. *maxima* and *Pentaschistis calcicola*; the restios *Calopsis viminea*, *Thamnochortus guthrieae* and *Ischyrolepis eleocharis*; the geophyte *Brunsvigia orientalis*; the annual *Senecio arenarius* and the climbers *Cassytha ciliolata* and *Cissampelos capensis*.

Boucher (this report), provides detail from the further analysis of Zietsman's data to differentiate this community, namely, Boucher community number 2.2, titled the *Olea exasperata-Helichrysum pulchellum* Dune Fynbos in **Appendix 4**.

2.1.1.4 *Erica plukenetii* var. *plukenetii* – *Olea exasperata* Overberg Dune Strandveld sub-community

Table 5. Key descriptors for the *Erica plukenetii* var. *plukenetii* – *Olea exasperata* Overberg Dune Strandveld sub-community

| | |
|-----------------------------------|---|
| Map identification | Sub-community 1.4 in Figure 3 |
| Area & % of total area | 0.09 ha or 0.08% |
| Soils | Sandy soils |
| Rockiness | 0 % |
| Characteristic species | <i>Erica plukenetii</i> var. <i>plukenetii</i> , <i>Trichocephalus stipularis</i> |
| Red Data species | <i>Ficinia pinguior</i> (VU – added now), <i>Pentaschistis calcicola</i> (NT), <i>Thamnochortus guthrieae</i> (LC - delisted now) |

The dominant plant species of this sub-community is the sedge *Ficinia pinguior*.

Other species found in this sub-community include: the trees and shrubs: *Cassine peragua*, *Euclea racemosa*, *Indigofera brachystachya*, *Jamesbrittenia albomarginata*, *Olea exasperata*, *Otholobium bracteolatum*, *Passerina rigida*, *Passerina paleacea*, *Phyllica ericoides*, *Pterocelastrus tricuspidatus*, *Searsia glauca*, *Searsia lucida* and *Tephrosia capensis*; the sub-shrub *Chironia baccifera*; the grasses *Koeleria capensis* and *Pentaschistis calcicola*; the restios *Calopsis viminea*, *Ischyrolepis eleocharis* and *Thamnochortus guthrieae*; the sedges *Ficinia pinguior*; the geophyte *Brunsvigia orientalis*; and the parasite *Cassytha ciliolata*.

Boucher (this report), provides detail from the further analysis of Zietsman's data to differentiate this community, namely, Boucher community number 2.4, titled the *Olea exasperata-Erica plukenetii* Dune Fynbos in **Appendix 4**.

2.1.2 *Agathosma geniculata* – *Helichrysum retortum* Agulhas Limestone Fynbos community

Table 6. Key descriptors for the *Agathosma geniculata* – *Helichrysum retortum* Agulhas Limestone Fynbos community

| | |
|-----------------------------------|---|
| Map identification | Community 2 in Figure 3 |
| Area & % of total area | 7.00 ha or 6.43% |
| Soils | Shallow rocky soils |
| Rockiness | 30% |
| Characteristic species | <i>Agathosma geniculata</i> , <i>Crassula expansa</i> , <i>Helichrysum retortum</i> , <i>Knowltonia vesicatoria</i> |
| Red Data species | <i>Agathosma geniculata</i> (NT), <i>Pentaschistis calcicola</i> (NT). |

The dominant plant species of the community is the shrub *Agathosma geniculata*. Other species found in this community include: the trees and shrubs: *Anthospermum aethiopicum*, *Euclea racemosa*, *Metalasia densa*, *Olea exasperata*, *Passerina rigida*, *Phylica ericoides*, *Pterocelastrus tricuspidatus*, *Searsia laevigata* var. *villosa*; the sub-shrubs *Chironia baccifera*, *Euphorbia arceuthobioides*, *Jamesbrittenia albomarginata*, *Selago polystachya*, *Sutera hispida*; the grasses *Pentaschistis calcicola* and *Koeleria capensis*; the restios *Calopsis viminea* and *Ischyrolepis eleocharis*; and the parasite *Cassytha ciliolata*.

Boucher (this report), provides detail from the further analysis of Zietsman's data to differentiate this community, namely, Boucher community number 3, titled the *Olea exasperata*-*Agathosma geniculata* Proto-Limestone Fynbos in **Appendix 4**.

2.1.3 *Euclea racemosa* – *Pterocelastrus tricuspidatus* Overberg Dune Strandveld thicket community

Table 7. Key descriptors for the *Euclea racemosa* – *Pterocelastrus tricuspidatus* Overberg Dune Strandveld thicket community

| | |
|-----------------------------------|---|
| Map identification | Community 3 in Figure 3 |
| Area & % of total area | 8.80 ha or 8.08% |
| Soils | Sandy soils with rocks |
| Rockiness | 15% |
| Characteristic species | <i>Athanasia dentata</i> , <i>Ammi majus</i> *, <i>Avena fatua</i> *, <i>Bromus diandrus</i> *, <i>Cassine parvifolia</i> , <i>Centella virgata</i> , <i>Colpoon compressum</i> , <i>Cynodon dactylon</i> *, <i>Emex australis</i> *, <i>Eragrostis sarmentosa</i> *, <i>Euphorbia peplus</i> *, <i>Felicia aculeata</i> , <i>Festuca scabra</i> , <i>Lagarus ovatus</i> *, <i>Metalasia brevifolia</i> , <i>Passerina ericoides</i> , <i>Pelargonium myrrhifolium</i> , <i>Pennisetum villosum</i> *, <i>Solanum linnaeanum</i> *, <i>Tetragonia fruticosa</i> , <i>Thesium</i> sp., <i>Trachyandra hirsutiflora</i> , <i>Tribulus terrestris</i> *, <i>Wahlenbergia tenella</i> , <i>Sebaea aurea</i> |
| Red Data species | <i>Passerina ericoides</i> (NT- now changed to VU), <i>Carpobrotus acinaciformis</i> (LC - delisted now) |

The dominant species in the community are the alien invader tree *Acacia cyclops**, together with *Euclea racemosa*, *Pterocelastrus tricuspidatus* and *Olea exasperata*. Other species found in this community include: the trees and shrubs: *Anthospermum aethiopicum*, *Cassine peragua*, *Chrysanthemoides monilifera*, *Tephrosia capensis*, *Muraltia satureioides* var. *satireioides*, *Indigofera brachystachya*, *Otholobium bracteolatum*, *Passerina rigida*, *Phylica ericoides*, *Searsia glauca*, *Selago polystachya*, *Searsia laevigata* var. *villosa* and *Zygophyllum flexuosum*; the sub-shrubs *Carpobrotus acinaciformis*, *Helichrysum patulum*, *Pelargonium capitatum* and *Sutera hispida*, the grasses *Cenchrus incertus**, *Ehrharta villosa* var. *maxima*, and *Koeleria capensis*; the restios *Calopsis viminea* and *Ischyrolepis eleocharis*; the annual *Senecio arenarius*; and the climber *Cissampelos capensis*.

Boucher (this report), provides detail from the further analysis of Zietsman's data to differentiate this community, namely, Boucher community number 1, titled the *Olea exasperata-Eragrostis sarmentosa* Strandveld Thickets in **Appendix 4**.

2.2 Zietsman's conservation recommendations

The following extract is from Zietsman's (undated) conclusions (pages 39-40 of her report):

"All the vegetation units could be developed as no Critical Endangered or Endangered or Vulnerable ecosystems are present in the area, and as no Critical Endangered or Endangered or Vulnerable red data species were found in the area. It would however be very good if a part of Com. 2 containing the *Agathosma geniculata* population as well as *Pentascistis calcicola*, two Near Threatened red data species; and sub-com. 1.3, as well a buffer-zone around this area, (Fig. 2), containing three Least Concern red data species (*Carpobrotus acinaciformis*, *Helichrysum pulchellum* and *Thamnocortus guthrieae*), could be conserved. Due to the fact that the vegetations units do not belong to any threatened ecosystems or contains any highly important red data species the development of the vegetation units would, have either an impact of LOW (Com. 3) or MEDIUM (Com. 1 & 2) significance before mitigation and a LOW significance after mitigation. Where red data species occur, which area easily transplantable, a Search & Rescue operation could take place as an added mitigation measure or an alternative to the conservation of parts of these vegetation units. A Search & Rescue operation would however not be very effective for the *Agathosma geniculata* population, as this species is a medium shrub, which might not be easily transplantable.

It is recommended that the important vegetation areas, the undeveloped areas, as well as the vegetation buffer should be managed as described under 'General Management Principles'. All other vegetated areas can be developed. "

Zietsman provides the following map (**Figure 4**) indicating the location of her "important" vegetation units:

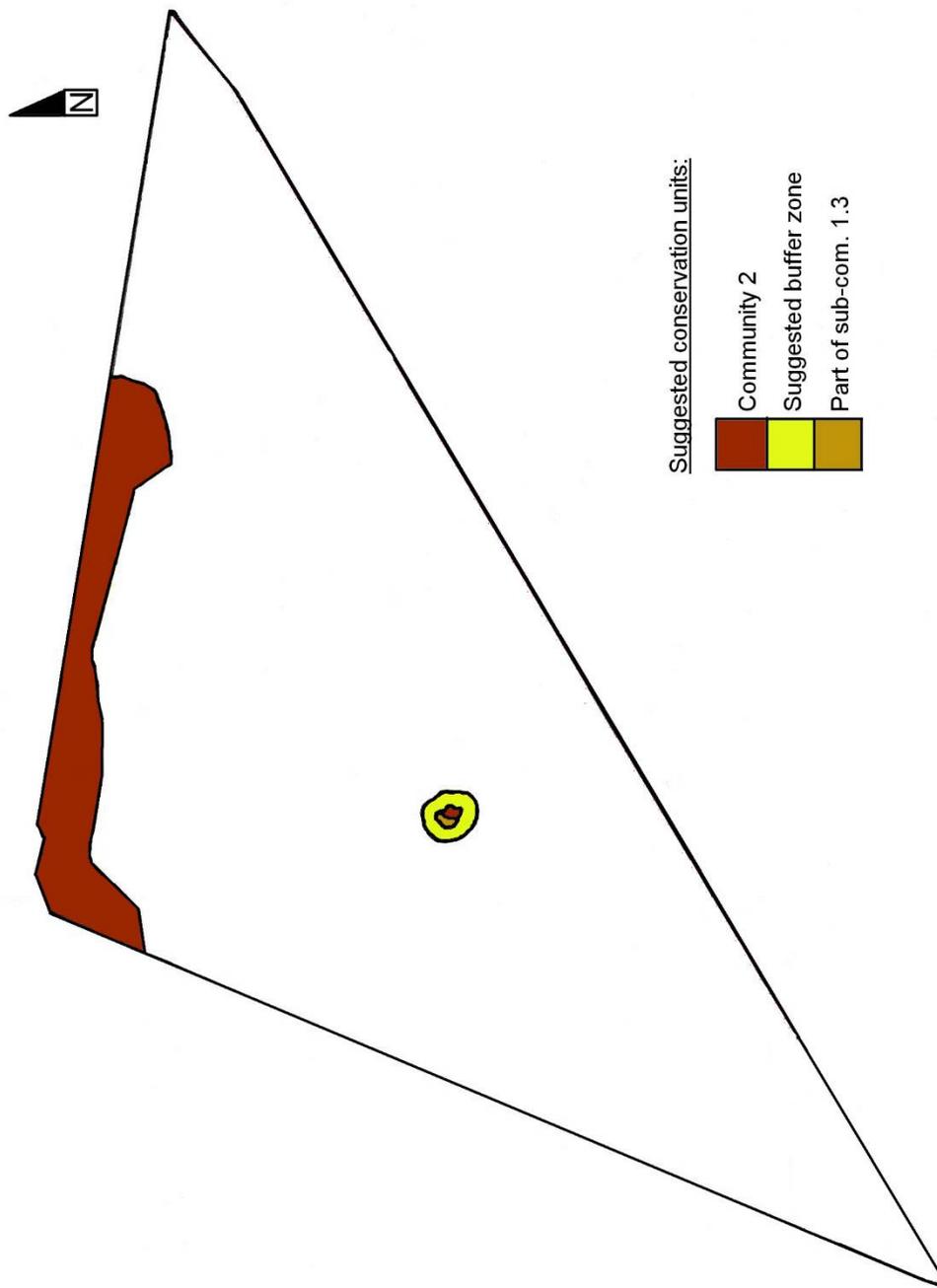


Figure 4. Areas identified by Zietsman (undated) as containing sensitive vegetation.

3. Assessment of Zietsman's findings

3.1 Flora

Zietsman (undated) recorded 83 species on the property. This is a low number for such a large and diverse area. Part of the area had been burnt when she undertook her study so it is presumed that she didn't sample this section. Zietsman (undated) does not indicate the location of the areas burnt immediately before her survey which she in all probability could not sample. This might explain some spatial differences in the mapping of her communities from

those observed in the field during the present evaluation and the rather low number of species recorded.

She listed six plants as Red Data Book (Flora of Conservation Concern) or threatened species and 15 as invader or problem plants. An examination of her list and comparison to the Red List of South African Plants (Riamoto *et al.* 2009) reveals the following:

- *Passerina ericoides* in the *Euclea racemosa* – *Pterocelastrus tricuspidatus* Overberg Dune Strandveld thicket community is **upgraded** to “Vulnerable” (changed status from “Near Threatened”).
- *Ficinia pinguior*, status = “Vulnerable”, must be **added** to the threatened plants listed on site. This species occurs in the *Erica plukenetii* var. *plukenetii* – *Olea exasperata* Overberg Dune Strandveld sub-community.
- The following two Red Data Book plants from her list are **still valid**: *Agathosma geniculata* (Near Threatened) and *Pentaschistis calcicola* var. *calcicola* (Near Threatened).
- The following three species are **not listed** as “Flora of Conservation Concern” (a revised term for threatened or red listed species) in Riamoto *et al.* (2009): *Carpobrotus acinaciformis*, *Helichrysum pulchellum* or *Thamnochortus guthrieae*.
- There are thus **four listed “Flora of Conservation Concern”** on the property.

No attempt was made by the author of the current report to test the comprehensiveness of Zietsman’s floral list because she does not claim that the list is complete, primarily because of the time allotted to undertake the original survey. Her survey was not conducted over a full year cycle thus certain components in the list are necessarily absent, such as, for example, of the Amaryllidaceae flowering in Autumn. Fire succession studies were also excluded because of time constraints. This naturally implies that the floral evaluation cannot be complete in terms of listing threatened Red Data Book flora. This is not a fatal flaw and should only be taken into cognisance when evaluating the data.

One obvious permanently recognisable perennial Protected Species not included in her species list is *Sideroxylon inerme* (milkwood), which occurs in Community 3 (*Euclea racemosa* – *Pterocelastrus tricuspidata* community). This plant may not be damaged except with the Administrators consent. The few plants present on the property along the fence adjoining the R43 road to De Kelders were damaged while making a firebreak. These individuals should be screened off to prevent future damage.

3.2 Vegetation

No phytosociological table is included in the Zietsman (undated) report made available to me, although preliminary table data were obtained more recently from her and are included here in a re-analysed form as **Appendix 4**. Zietsman's (undated) plant communities (**Figure 3**) could be related to those observed in the field, using her descriptions and vegetation maps. The communities could be identified in broad terms, albeit with some minor variation in the definition of her group 1.3, and their spatial distribution appears entirely adequate for the purposes at hand.

Differences between Zietsman's and Boucher's interpretations are at a sub-community level, particularly in respect of the subdivision of the *Olea exasperata-Thamnochortus guthrieae* Overberg Dune Strandveld (in particular Zietsman's community 1.3 which is differentiated into Boucher's communities 2.1.2 and 2.2 in **Appendix 4**). Boucher suggests that *Morella cordifolia* and *Passerina corymbosa* be used to differentiate nomenclaturally between the two variations of Transitional Strandveld to Dune Fynbos found on the recently stabilised coastal dunes here (Boucher's communities 2.1.1 and 2.1.2 in **Appendix 4**). The most complete Strandveld units are characterised by the indigenous species *Athanasia dentata*, *Eragrostis sarmentosa*, *Metalasia brevifolia*, *Passerina ericoides*, *Tetragonia fruticosa* and pioneer exotic species (*Ammi majus*, *Avena fatua*, *Bromus diandrus*, *Euphorbia peplus* and *Lagurus ovatus*) in disturbed areas. *Pterocelastrus tricuspidatus* and *Euclea racemosa*, together with the exotic *Acacia cyclops*, are dominant here and are grouped to form Boucher's Community 1 (**Appendix 4**). This coastal incomplete or transitional Dune Fynbos, which lacks Proteaceae and only has one ubiquitous Ericaceae, *Erica plukenetii* in a small area on site (Sub-community 1.4 in **Figure 4**), is characterised by the presence of *Crassula nudicaulis*, *Passerina paleacea* and *Thamnochortus guthrieae*.

Zietsman's *Agathosma geniculata-Helichrysum retortum* Agulhas Limestone Fynbos (Community 2 in **Appendix 4**) does not contain a typical suite of Agulhas Limestone Fynbos species, rather it has not differentiated into this vegetation type yet (for instance typical endemic characterising Ericaceae, Fabaceae, Proteaceae and Rutaceae, *inter alia*, are absent (Mucina & Rutherford 2006) and it is therefore termed Proto-Limestone Fynbos). *Erica plukenetii* is not considered to be a diagnostic species for Limestone Fynbos as it is also found, *inter alia*, in Sandstone Fynbos.

From a regional perspective the Khoisan Bay proposed development area supports a recently stabilised dune system (**Figure 5**) along its northern side, which forms a continuous natural unit with that on the adjacent Walker Bay Nature Reserve (**Figures 6 & 7**). These dune fields and the edge bordering on the R43 mainly carry Overberg Dune Strandveld (FS 7) and proto-

Agulhas Limestone Fynbos. The central to eastern part of the property carries transitional vegetation developing toward Agulhas Sand Fynbos (FFd 7). Neither of the latter vegetation types is present in a fully developed form on the property.

The transitional vegetation between Strandveld, Sand Fynbos and Limestone Fynbos is scientifically important to document and to study the development of each vegetation type especially with the current changes in climatic regimes.



Figure 5. Khoisan Bay vegetation on stable dunes in foreground with Walker Bay Nature Reserve in middle to far distance showing recently stabilised to loose dunes (Photo by E. Foster).

3.3 Alien flora

Four plants that are listed as exotic or problem plants by Zietsman are actually regarded by taxonomists to be indigenous to the Strandveld (*Cynodon dactylon*, *Emex australis*, *Eragrostis sarmentosa* and *Tetragonia fruticosa*). The nine remaining exotics are relatively few for an area bordering on a town and indicate that the vegetation is in very good condition.

The *Euclea racemosa* – *Pterocelastrus tricuspidatus* Overberg Dune Strandveld thicket community is heavily invaded by *Acacia cyclops* in particular, largely because of its proximity to disturbances including the R43 and adjacent older tracks through the veld, which have served as nodes of infestation.

3.4 Linkages

The main linkages on the property are between the coastal cliffs limestone habitat (**Figure 1**), the sand dunes system of the Walker Bay Nature Reserve (**Figures 5 & 7**) and the areas on the inland side of the R43 road (Grootbos Conservancy and adjacent properties).

4. Botanical impact of the proposed development

4.1 Development Alternative 1

In Alternative 1 (**Figure 6**) the development occupies most of the Khoisan Bay property with narrow fingers of vegetation surrounding the development and narrow bands of vegetation between tongues of houses. A centrally placed open space of 1.5 ha includes a patch of *Agathosma geniculata* – *Helichrysum retortum* Agulhas Limestone Fynbos community (Community 2 in **Figure 3**) supporting a small local colony of *Agathosma geniculata*.

It is inadvisable to place any development in the sensitive dune system as it can easily destabilise, through physical disturbance such as trampling or fire and it becomes far more sensitive with the current drying climatic trend with global warming in progress. The dune system forms a continuous natural unit with that on the Walker Bay Nature Reserve with Overberg Dune Strandveld (FS 7) and transitional vegetation developing toward Agulhas Sand Fynbos (FFd 7) on the one hand and Agulhas Limestone Fynbos (FFI 1) on the other.

The buffer between the Walker Bay Nature Reserve and the proposed development is inadequate, being too narrow to adequately protect the Reserves fauna, flora and ambiance from negative urban features such as lights (disruptive to insect pollinators), alien seed rain, domestic animals and human activity particularly noise. Generally a buffer of 100 m is recommended around reserves. Fire which is necessary to maintain this vegetation cannot be managed in the narrow open space tongues between the houses. The presence of natural fauna such as snakes, rodents, scorpions and insects in these tongues does not accord with a housing development.

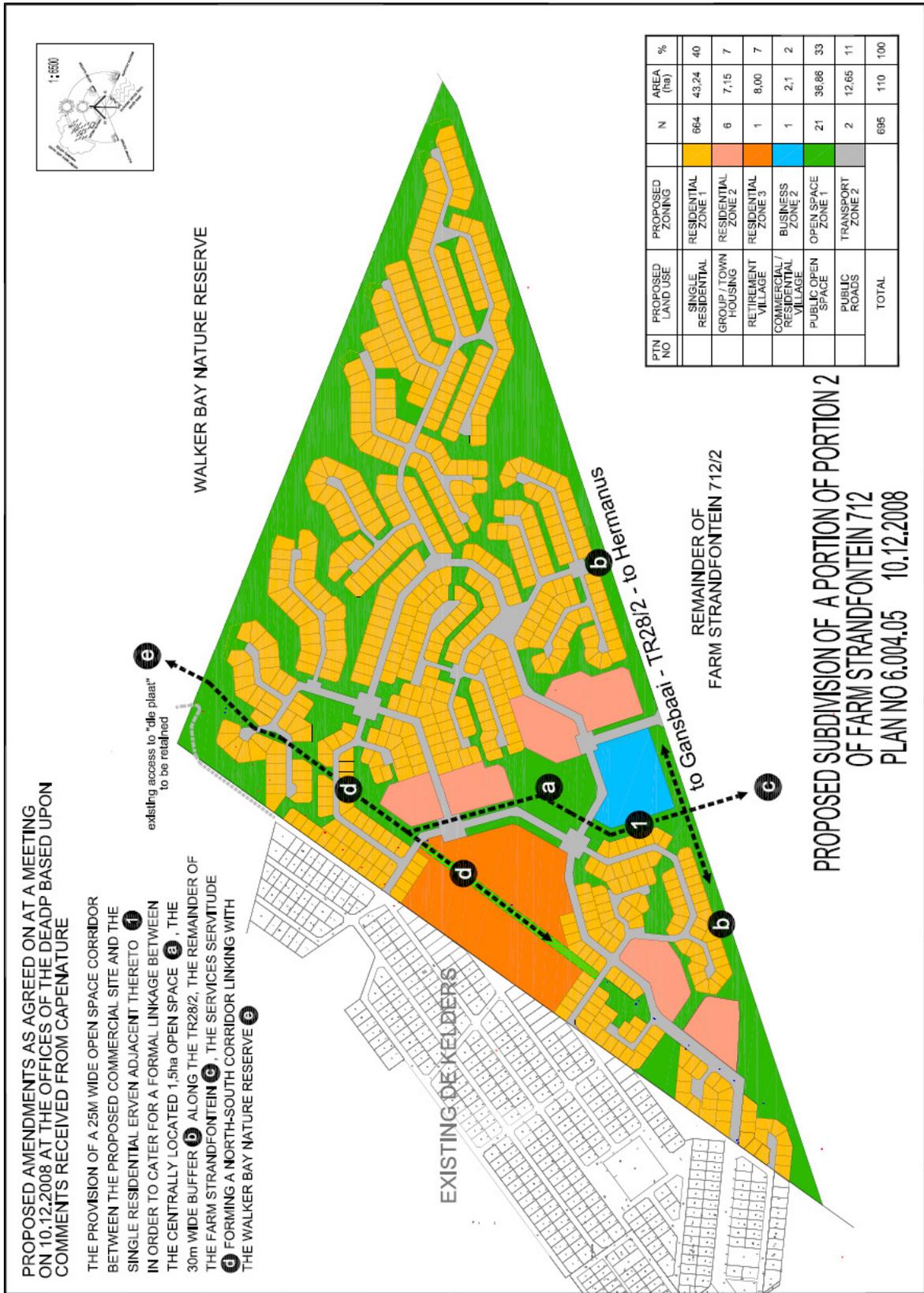


Figure 6. Initial Development Alternative 1.

4.2 Development Alternative 2 integrating development with partial conservation

The main concepts applied here are to a) maintain the close link between the highly threatened De Kelders limestone cliff habitat and the directly inland environment, b) to provide an adequate buffer between the Walker Bay Nature Reserve and the proposed development, c) to provide adequate space for firebreaks and d) to provide for the conservation of vegetation present on the property to the benefit of the inhabitants (**Figure 8**).

The proposed conservation area or portion (plot) 568 occupying 43.76 ha in Development Alternative 2 (**Figures 8-10**) is based on the distribution of communities presented in Zietsman's (undated) vegetation map (**Figure 3**), her important vegetation map (**Figure 4**), together with observations made on 3 April 2009 in mature vegetation. Almost 40% of the area is excluded from development (**Table 8**).



Figure 7. Aerial image of the proposed Khoisan Bay development site showing environmental constraints, conservation areas, firebreaks and recommended buffer between the development, the Walker Bay Nature Reserve and the R43 provincial road.

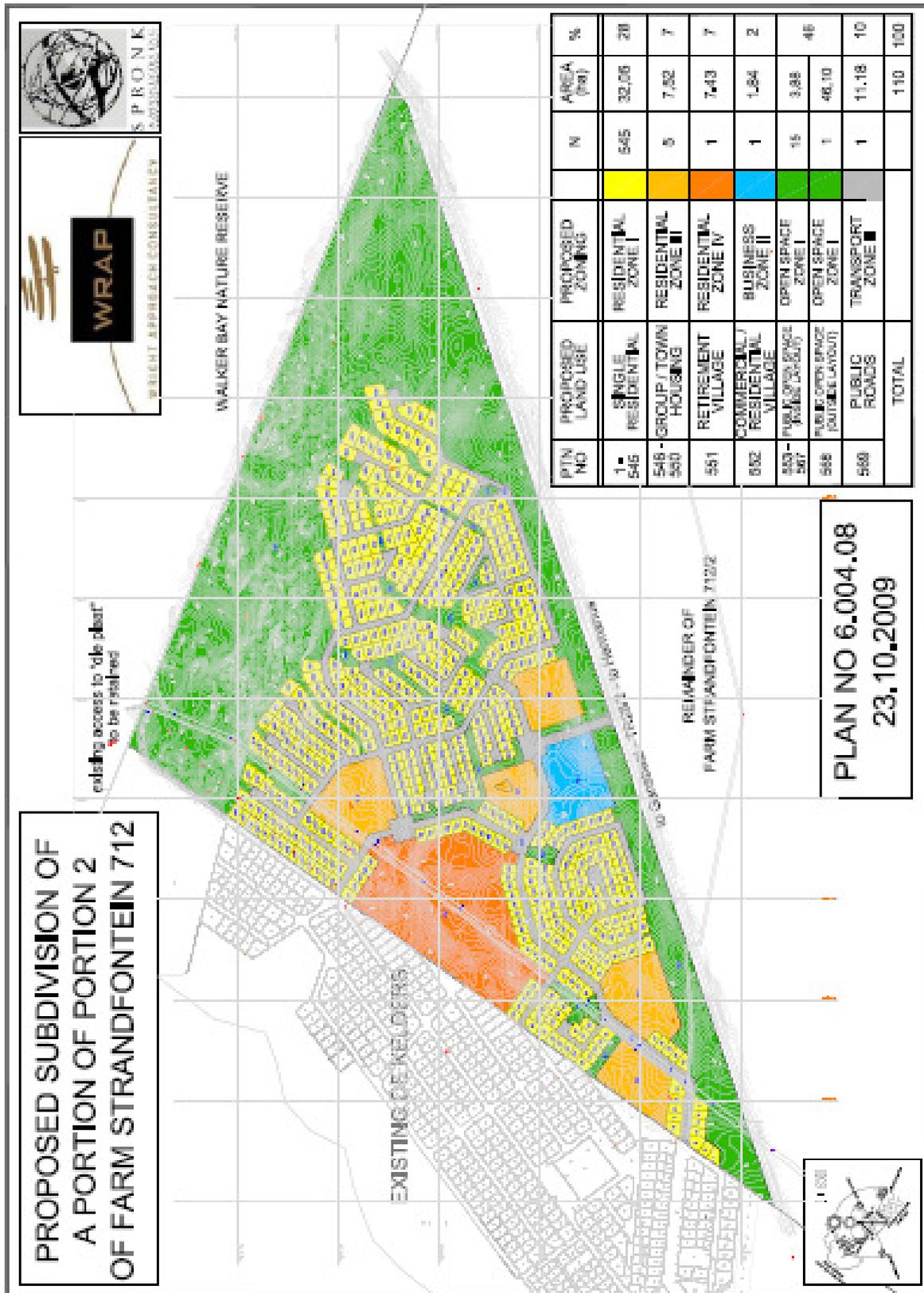


Figure 8. The layout of Development Alternative 2.

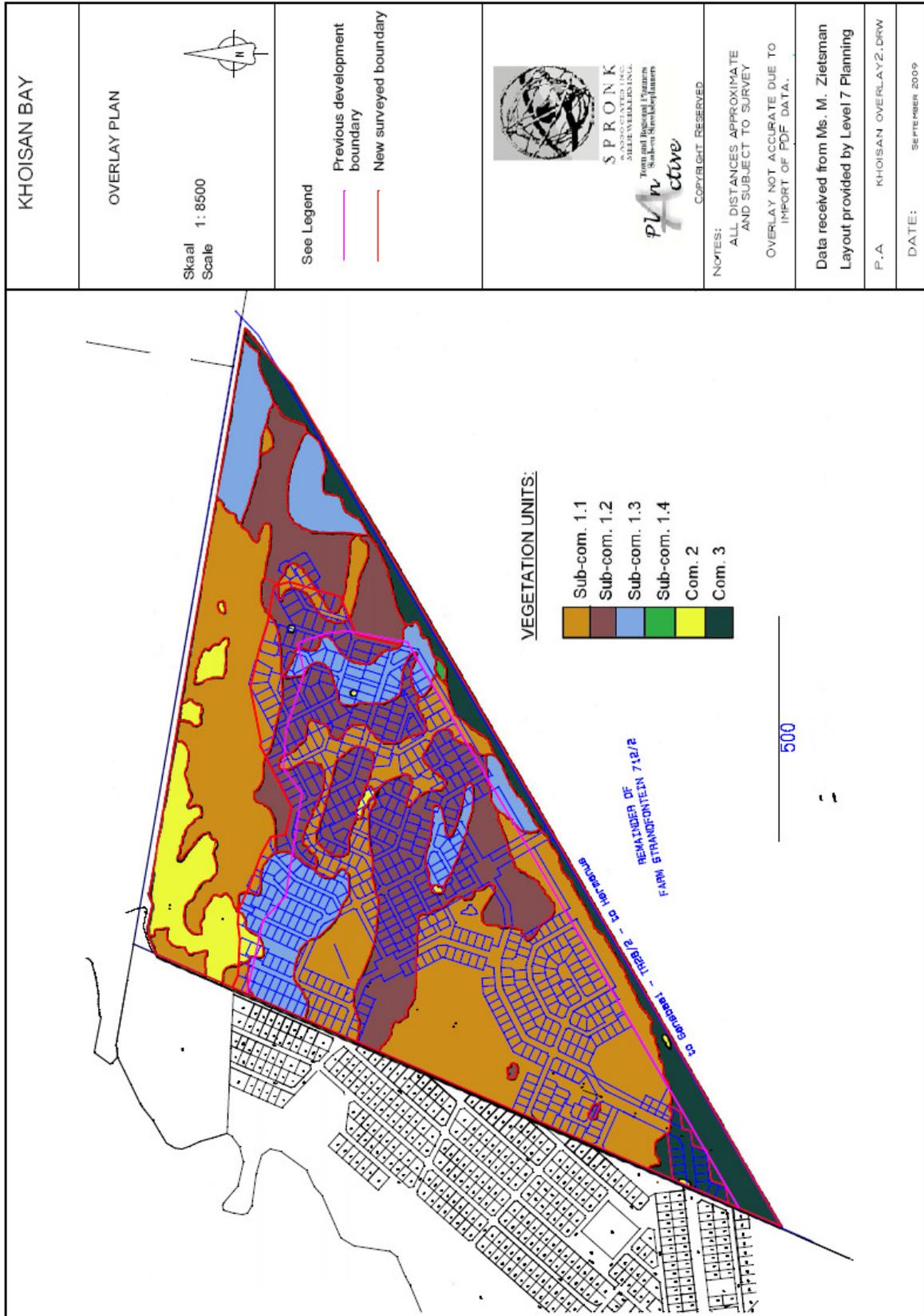


Figure 9. Development Alternative 2, superimposed on the vegetation map and including the suggested outline from Figure 7 (pink development line) with the proposed compromise development outline (red boundary line) as in Figure 8.

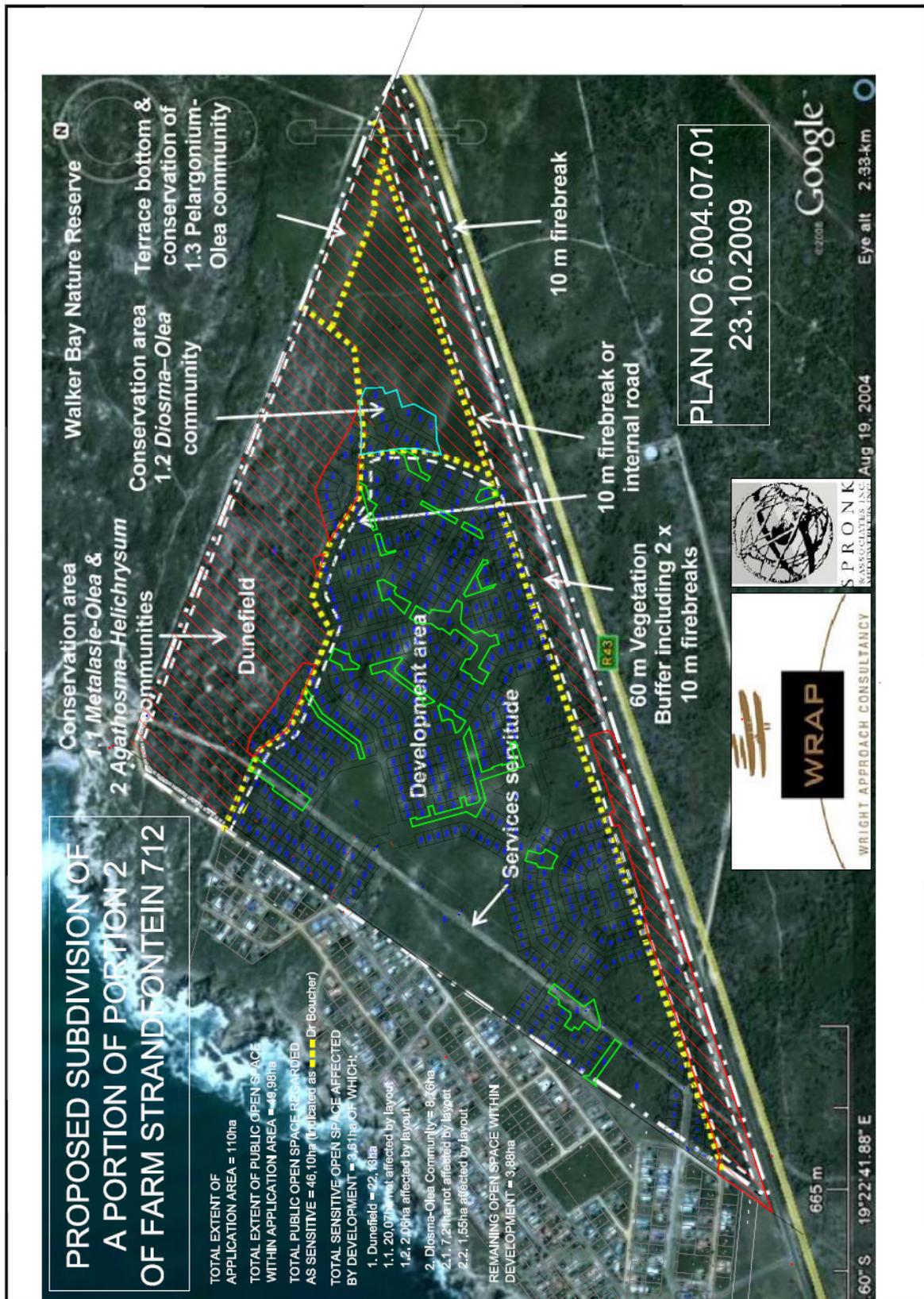


Figure 10. Development Alternative 2, superimposed on the GoogleEarth image.

Table 8. Total area occupied by each plant community together with area proposed as Alternative 2, for development versus conservation

| Community number | Community name | Total area (ha) | % of total area | Area (ha) to be developed | % to be developed | Area (ha) to be conserved | % conserved |
|-------------------------|--|------------------------|------------------------|----------------------------------|--------------------------|----------------------------------|--------------------|
| 1 | <i>Olea exasperata</i> – <i>Thamnochortus guthrieae</i> Overberg Dune Strandveld community | 94.11 | 86.45% | 64.86 | 68.92% | 29.25 | 31.08% |
| 1.1 | <i>Metalasia muricata</i> – <i>Olea exasperata</i> Overberg Dune Strandveld sub-community | 50.7 | 46.57% | 34.55 | 68.15% | 16.15 | 31.85% |
| 1.2 | <i>Diosma subulata</i> – <i>Olea exasperata</i> Overberg Dune Strandveld sub-community | 28.27 | 25.97% | 21.24 | 75.13% | 7.03 | 24.87% |
| 1.3 | <i>Pelargonium betulinum</i> – <i>Olea exasperata</i> Overberg Dune Strandveld sub-community | 15.05 | 13.83% | 9.07 | 60.27% | 5.98 | 39.73% |
| 1.4 | <i>Erica plukenetii</i> var. <i>plukenetii</i> – <i>Olea exasperata</i> Overberg Dune Strandveld sub-community | 0.09 | 0.08% | 0.00 | 0.00% | 0.09 | 100.00% |
| 2 | <i>Agathosma geniculata</i> – <i>Helichrysum retortum</i> Agulhas Limestone Fynbos community | 7.00 | 6.43% | 0.79 | 11.29% | 6.21 | 88.71% |
| 3 | <i>Euclea racemosa</i> – <i>Pterocelastrus tricuspidatus</i> Overberg Dune Strandveld thicket community | 8.80 | 8.08% | 1.20 | 13.64% | 8.30 | 94.32% |
| 1, 2, 3 | Totals = | 109.91 | 100.96% | 66.85 | 60.82% | 43.76 | 39.81% |

The small patch of *Agathosma geniculata* – *Helichrysum retortum* Agulhas Limestone Fynbos community (Community number 2) in the centre of the property (**Figures 3 & 4**), which Zietsman indicated as being important for conservation, because it was the only place she found a population of *Agathosma geniculata* to occur (most of the other calcrete patches were recently burnt when she undertook her survey), is not practical to manage in the context of the surrounding development and, additionally, is not viable in the long term in isolation because of its small size. *Agathosma geniculata* resprouts after fire and does not have a very high Flora of Conservation Concern (Red Data Book) status, it has a “Near Threatened” status (see category descriptions in **Appendix 1**), and is naturally distributed in coastal limestone from Stanford to Still Bay (Goldblatt & Manning 2000). No attempt has been made subsequent to Zietsman’s survey to determine whether this species occurs in the areas that were burnt when she undertook her survey. The species flowers from July to December through its range (Goldblatt & Manning 2000) and the current inspection was carried out on 3 April 2009, when it could not be positively identified. It is also not clear whether or not the species also occurs in the same habitats on the adjacent Walker Bay Nature Reserve (also partially burnt in photographs in Zietsman (undated)).

If development on the Alternative 2 footprint, indicated in **Figures 8 – 10**, is accepted, then an appropriate mitigation would be to harvest seed of *Agathosma geniculata* and to grow plants in a nursery for reintroduction into similar habitats in the proposed conservation area, if the species does not occur in these habitats already (i.e in the areas burnt when Zietsman did her survey).

Passerina ericoides (threat status = Vulnerable) occurs in the *Euclea racemosa* – *Pterocelastrus tricuspidatus* Overberg Dune Strandveld thicket community which is included within the conservation belt along the R43 road (94.32% of this community is proposed for conservation).

Pentaschistis calcicola var. *calcicola* (Near Threatened) was recorded in all four variations of the *Olea exasperata* – *Thamnochortus guthrieae* Overberg Dune Strandveld community (31.08% proposed for conservation) and in the *Agathosma geniculata* – *Helichrysum retortum* Agulhas Limestone Fynbos community (88.71% of this community is proposed for conservation). This provides an adequate area to protect this species on the property.

Most of the single small area supporting the *Erica plukenetii* var. *plukenetii* – *Olea exasperata* Overberg Dune Strandveld sub-community (Community 1.4 of Zietsman (undated)) on the property is included within the conservation belt along the R43 road.

4.3 Development Alternative 3 – Development of Portion 1 with an Extended Conservation Area

The amended application proposes the development of a portion one third of the size of the development area proposed for the previous application (from 110.23ha to ±37.8951ha) and creates far less residential opportunities than the previous application (downscaled from 1 850 residential units proposed in Development Alternative 1 to 472 units in Alternative 3). Only Portion 1 of the farm will be developed now as the Khoisan Bay development, Portion 2 (Private Open Space of 18 ha) is earmarked for possible future development and Portion 3 is zoned as Public Open Space 54 ha in extent (**Figure 11**). A Public Open Space buffer zone of 5.8 ha also borders on the R43 road (**Figure 12 & 13**).

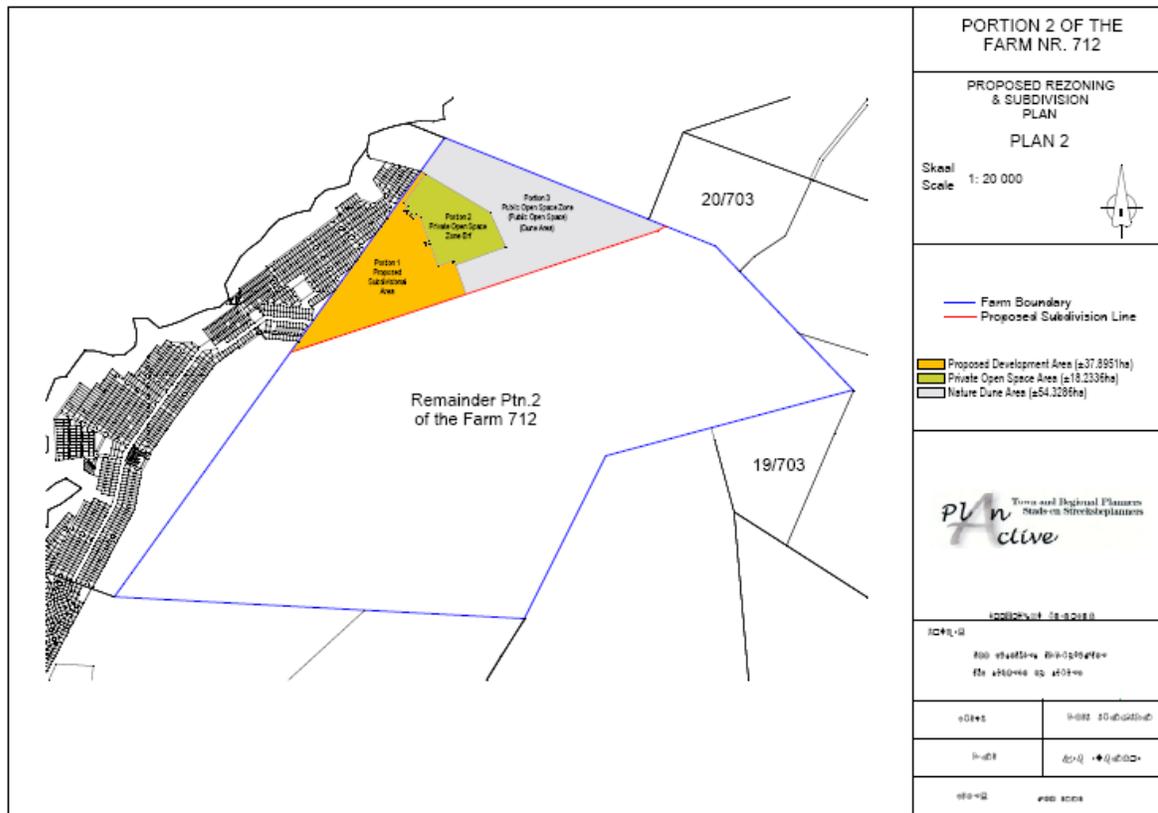


Figure 11. Portion 1 will be developed now as the Khoisan Bay development, with Portion 2 zoned Private Open Space and Portion 3 being zoned as Public Open Space

Details of the development plan for Portion 1 are presented in **Figure 12**.

Table 9. Total area occupied by each plant community together with area proposed as Alternative 3 for development versus that undeveloped and potentially all conserved

| Community number | Community name | Total area (ha) | % of total area | Area (ha) to be developed | % to be developed | Area (ha) undeveloped | % undeveloped |
|------------------|--|-----------------|-----------------|---------------------------|-------------------|-----------------------|---------------|
| 1 | <i>Olea exasperata</i> – <i>Thamnochortus guthrieae</i> Overberg Dune Strandveld community | 94.11 | 86.45% | 31.86 | 33.85% | 61.25 | 65.08% |
| 1.1 | <i>Metalasia muricata</i> – <i>Olea exasperata</i> Overberg Dune Strandveld sub-community | 50.7 | 46.57% | 25.68 | 50.65% | 25.02 | 49.35% |
| 1.2 | <i>Diosma subulata</i> – <i>Olea exasperata</i> Overberg Dune Strandveld sub-community | 28.27 | 25.97% | 5.50 | 19.46% | 21.77 | 77.01% |
| 1.3 | <i>Pelargonium betulinum</i> – <i>Olea exasperata</i> Overberg Dune Strandveld sub-community | 15.05 | 13.83% | 0.68 | 4.52% | 14.37 | 95.48% |
| 1.4 | <i>Erica plukenetii</i> var. <i>plukenetii</i> – <i>Olea exasperata</i> Overberg Dune Strandveld sub-community | 0.09 | 0.08% | 0.00 | 0.00% | 0.09 | 100.00% |
| 2 | <i>Agathosma geniculata</i> – <i>Helichrysum retortum</i> Agulhas Limestone Fynbos community | 7.00 | 6.43% | 0.05 | 0.71% | 6.95 | 99.29% |
| 3 | <i>Euclea racemosa</i> – <i>Pterocelastrus tricuspidatus</i> Overberg Dune Strandveld thicket community | 8.80 | 8.08% | 1.41 | 16.02% | 7.39 | 83.98% |
| 1, 2, 3 | Totals = | 109.91 | 100.96% | 33.32 | 30.32% | 75.59 | 68.77% |

Comments made about *Agathosma geniculata* for Alternative 2 still hold and there is a greater likelihood of viable populations being included within this expanded Alternative 3 conservation area. A larger portion of Communities 1.1, 1.2 and 1.3 in excellent condition, are included in the Public Open Space, than was the case with Alternative 2, while more of the eastern section of the *Euclea racemosa* – *Pterocelastrus tricuspidatus* Strandveld along the R43 is incorporated as a natural non-linear unit in contrast to that within the Phase 1 development.

All of the single small area supporting the *Erica plukenetii* var. *plukenetii* – *Olea exasperata* Overberg Dune Strandveld sub-community (Community 1.4 of Zietsman (undated)) on the property is included within the Public Open Space area.

4.4 Impact assessment evaluation

A summary of the impacts and their significance, associated with each development alternative, is presented in **Tables 10-13** using protocols contained in **Appendix 5**.

The “**No Go**” **Development Alternative** is preferred, from a biodiversity point of view, if the whole site were to be managed in a formal way for conservation. Unfortunately, uncontrolled wildfires are prevalent and invasion by exotic woody *Acacia* species, in particular, is taking place. This is unlikely to be correctly managed without incentives, such as funds being generated from some currently unknown source or, alternatively, through association with some development on the site or even legal steps being taken against the owners to ensure compliance.

Of the development proposals presented here, **Alternative 1** is associated with a total loss of most of the biological and physical features on site and presents an inadequate buffer to the adjacent Walker Bay Provincial Nature Reserve.

Alternative 2 has some negative impacts because of the loss of the central core of the site, but offers protection to 43.76ha or 39.81% of the vegetation, particularly that forming a buffer to the adjacent to the Walker Bay Nature Reserve. It also offers a screening buffer to the R43 road that would simultaneously serve to protect the different Strandveld communities found there while presenting a gradual introduction to De Kelders town. The developers requested some alterations to the initial boundary to development proposed, based mainly on interpretation of GoogleEarth aerial photograph images (**Figure 7** and the pink line in **Figure 8**). Field inspection of the revised proposal with a surveyor has resulted in a proposed development footprint limited to the red line in **Figure 8** as shown in **Figures 9 & 10**. The resultant remaining area of each vegetation unit, compared to that to be lost through development, is presented in

conservation areas, firebreaks and recommended buffer between the development, the Walker Bay Nature Reserve and the R43 provincial road. (PrOS = Private Open Space).

Table 8. The Development footprint of Alternative 2 results in almost 40% of the area being excluded from development for conservation.

Alternative 3, the preferred alternative, has an even greater reduction in the development footprint than either of the previous alternatives put forward. The total site under consideration here, namely Portion 2 of Strandfontein Farm 712, is 110.23 ha in extent. Phase 1 development occupies 37.8951 ha, with an additional Private Open Space of 18.2336 ha, thus leaving 54.1013 ha (49%) of the total site remain for title deed registration as a conservation area (**Figure 11, Table 9**). Initially, Phase 2 (**Figure 13**) is to be zoned as a Private Open Space, currently reserved for later development. An additional 5.8446 ha is set aside as a firebreak and buffer along the R43 parallel to the Phase 1 developed section. This buffer supports the *Euclea racemosa* – *Pterocelastrus tricuspidatus* Strandveld vegetation, which contains some *Sideroxylon inerme* (milkwood) plants.

About 50% of the property will be left as Public Open Space and needs to be managed for the conservation of its flora and vegetation. (A formal management plan needs to be developed in conjunction with Cape Nature, the adjacent property managers. The Private Open Space area, including the buffer along the R43 road, are, for the present, to be managed to support natural vegetation.

Alternative 3 offers a substantial buffer to the adjacent Walker Bay Nature Reserve and includes a wide Corridor linking inland and coastal areas. Alternative 3 would incorporate examples of all the vegetation types present on the property in a consolidated area. Most of the *Agathosma geniculata* – *Helichrysum retortum* Agulhas Limestone Fynbos community (Community 2) and all of the *Erica plukenetii* var. *plukenetii* – *Olea exasperata* Overberg Dune Strandveld sub-community (Community 1.4) will be left in tact. It would be an additional offset and mitigation if Phase 2 development of the Private Open Space was shelved completely as this would result in 68% of the farm being set aside for conservation of its excellent vegetation, which would complement the Walker Bay Nature Reserve. This mitigation is included in the assessment of the impact of Development Alternative 3 (**Table 12**).

5. Management issues

5.1 Fires, firebreaks and buffers

Both external and internal firebreaks of at least 6m width are recommended here to protect property in the development, to prevent accidental fires on the property from escaping and importantly for internal vegetation management. The internal firebreak proposed could have been an internal track which could also have services located in it, as proposed in **Figure 7**, but

Table 9. Botanical impact assessment of the "No Go" or Status Quo development alternative at Khoisan Bay, De Kelders

| Alternative | Nature of impact | Potential Mitigation | With or Without mitigation | Status of the impact | Intensity / Magnitude | Duration of impact | Extent of impact | Irreplaceability | Reversibility | Probability | Degree of confidence | Significance | Sum |
|--------------------|---|---|----------------------------|----------------------|-----------------------|--------------------|------------------|------------------|---------------|-------------|----------------------|-----------------|-----------------|
| No Go (status quo) | Loss of biodiversity in South Africa will occur if all the vegetation on the property remains intact in present condition. | The potential for loss of biodiversity exists without management. This can be stopped by incorporating the property into the Walker Bay Nature Reserve or if another equally suitable conservation orientated body takes over ownership of the property, and manages it appropriately to benefit the natural biota. | Status quo - no mitigation | Negative | Very low | Medium Term | Regional | Low | High | Medium | Moderate | Low negative | |
| | Alien species invasion has increased and will progressively continue over time unless systematic scientific management and enforcement is introduced. | Provide funds for alien vegetation control and apply appropriate veld management practices | Status quo - no mitigation | Negative | High | Medium term | Local | Moderate | Low | Medium | High | Medium negative | Medium negative |

Table 10. Botanical impact assessment of Alternative 1, the Full Area Development Option, at Khoisan Bay, De Kelders

| Alternative | Nature of impact | Potential Mitigation | With or Without mitigation | Status of the impact | Intensity / Magnitude | Duration of impact | Extent of impact | Irreplaceability | Reversibility | Probability | Degree of confidence | Significance | Sum |
|---|---|--|----------------------------|----------------------|-----------------------|--------------------|------------------|------------------|---------------|-------------|----------------------|-------------------|-----|
| Alternative 1: Maximum development of site. | Loss of individuals of all 3 Flora of Conservation Concern (Red Data Book species) on site. | A population supporting a dense stand of <i>Agathosma geniculata</i> could be excluded from the development, but it would nevertheless be surrounded by it and it would disappear in time. This would only be a short-term solution. | Without | Negative | Medium | Permanent | Regional | Definite | Irreversible | High | High | Med-High negative | |
| | | | With | Negative | Medium | Permanent | Local | High | Irreversible | High | High | Med-High negative | |
| | Reduction in area of all 3 major dryland coastal vegetation types on site and virtually no contribution to biodiversity conservation in South Africa. | Establish natural conservation area around development to incorporate all plant communities and link to Walker Bay Nature Reserve | Without | Negative | Medium | Permanent | Regional | Definite | Irreversible | High | Medium | Med-High negative | |
| | | | With | Negative | Low | Long term | Regional | High | Irreversible | High | Medium | Med-High negative | |
| | No effective buffer between urban area and Walker Bay Provincial Nature Reserve. | Reduce extent of development along Reserve boundary by establishing a 100m wide buffer zone along property border. | Without | Negative | High | Permanent | National | High | No reversal | Definite | High | Very high | |
| | | | With | Positive | Medium | Long term | Regional | Moderate | Moderate | Medium | High | Medium | |
| | Inland to coast continuity of biological corridor between coastal limestone cliffs and inland Sandstone and Sand Fynbos largely impaired | Develop wide conservation corridor linking inland to coast in Sand Fynbos on property | Without | Negative | Medium | Permanent | Regional | Moderate | No reversal | High | High | Med-High negative | |
| | | | With | Negative | Low | Long term | Local | Moderate | Moderate | Medium | High | Medium negative | |
| | Fire hazard as fire protection reduced to a single break around perimeter of site with potential threat to houses from wild fires. | Widen buffer around development perimeter, establish double firebreaks and introduce management controls between firebreaks on property that result in alternating veld ages from that on the adjacent Walker Bay Nature Reserve. | Without | Negative | High | Permanent | Local | High | Low | Definite | High | High | |
| | | | With | Negative | Medium | Medium | Local | Moderate | Moderate | High | Medium | Medium negative | |

Table 11. Botanical impact assessment of Alternative 2, the 60% Development and 40% Conservation Option, at Khoisan Bay, De Kelders

| Alternative | Nature of impact | Potential Mitigation | With or Without mitigation | Status of the impact | Intensity / Magnitude | Duration of impact | Extent of impact | Irreplaceability | Reversibility | Probability | Degree of confidence | Significance | Sum |
|--|--|--|----------------------------|----------------------|-----------------------|--------------------|------------------|------------------|---------------|-------------|----------------------|-------------------|-----|
| Alternative 2: Mix of 60% development and 40% conservation. | Loss of individuals of all 3 Flora of Conservation Concern (Red Data Book species) on site | Conservation opportunity for all 3 Flora of Conservation Concern species on site in proposed conservation area, but <i>in situ</i> loss of a population of <i>Agathosma geniculata</i> . Undertake detailed survey to establish accuracy of RDB spp. data in respect of <i>Agathosma geniculata</i> . Ensure re-establishment and long-term management of threatened species in suitable parts of conservation area on property. | Without | Negative | Medium | Permanent | Regional | High | Low | High | Medium | Med-High negative | |
| | | | With | Negative | Low | Permanent | Local | Moderate | Low | Medium | Medium | Medium negative | |
| | Reduction in area of all 3 major dryland coastal vegetation types on site and virtually no contribution to biodiversity conservation in South Africa | Inclusion of significant areas of all 3 major dryland coastal vegetation types, including variations, on site in conservation area. | Without | Negative | Medium | Permanent | Regional | High | Irreversible | Medium | Medium | Medium negative | |
| | | | With | Negative | Low | Long term | Local | Low | Moderate | Medium | High | Medium negative | |
| | Loss of biodiversity in South Africa. | Proclamation of Conservation area as proposed. Vegetation management plan required. | Without | Negative | Low | Permanent | Local | Moderate | Low | Medium | High | Medium negative | |
| | | | With | Negative | Low | Permanent | Regional | Low | Moderate | Medium | High | Low negative | |
| | Development impact on Walker Bay Nature Reserve. | Adequate buffer conservation area established. Ensure that pets and inhabitants respect the buffer. Appoint a qualified Environmental Control Officer to manage conservation area on scientific basis in conjunction with Walker Bay Reserve. | Without | Negative | Medium | Permanent | Regional | Moderate | Low | Medium | Medium | Medium negative | |
| | | | With | Negative | Low | Permanent | Local | Low | High | Low | High | Low negative | |
| | Loss of inland to coast continuity corridor between coastal limestone cliffs and inland Sandstone and Sand Fynbos. | Inland to coast continuity corridor maintained through proclamation of Conservation area. Vegetation management plan required | Without | Negative | Medium | Medium term | Local | Moderate | Low | Medium | Medium | Medium negative | |
| | | | With | Negative | Low | Long term | Local | Low | Low | Low | High | Low negative | |
| | Fire hazard present. | Effective management plan enabled. Fire breaks on perimeter of site and along edge of development. Natural vegetation on site managed in different time phases from the adjacent units on Walker Bay Provincial Nature Reserve reducing fire hazard for both entities | Without | Negative | High | Permanent | Local | Moderate | Low | High | High | Med-High negative | |
| | | | With | Negative | Medium | Medium term | Site | Low | Moderate | Medium | Medium | Low negative | |

Table 12. Botanical impact assessment of Alternative 3, the 50% Development and 50% Conservation Option, Plus 16% Private Open Space, at Khoisan Bay, De Kelders

| Alternative | Nature of impact | Potential Mitigation | With or Without mitigation | Status of the impact | Intensity / Magnitude | Duration of impact | Extent of impact | Irreplaceability | Reversibility | Probability | Degree of confidence | Significance | Sum |
|---|---|---|----------------------------|----------------------|-----------------------|--------------------|------------------|------------------|---------------|-------------|----------------------|-------------------|-----|
| Alternative 3: The preferred option. Mix of 50% development and 50% conservation plus 16% Private Open Space | Loss of individuals of all 3 Flora of Conservation Concern (Red Data Book species) on site. | Conservation opportunity for all 3 Flora of Conservation Concern on site in proposed conservation area, with protection of a population of <i>Agathosma geniculata</i> . Ensure re-establishment (Search-and-Rescue) and long-term management of threatened species in suitable parts of conservation area on property. | Without | Negative | Medium | Permanent | Local | Moderate | Low | Medium | Medium | Medium negative | |
| | | | With | Negative | Low | Permanent | Site | Low | Low | Low | Medium | Low negative | |
| | Reduction in area of 3 Sub-communities of Community 1 (<i>Olea exasperata</i> – <i>Thamnochortus guthrieae</i> Overberg Dune Strandveld community) and all of the <i>Erica plukenetii</i> var. <i>plukenetii</i> – <i>Olea exasperata</i> Overberg Dune Strandveld Sub-community, with considerable potential contribution to biodiversity conservation in South Africa. | No further development after Phase 1 | Without | Negative | Medium | Permanent | Local | Low | Low | Medium | Medium | Medium negative | |
| | | | With | Negative | Very Low | Long term | Local | Very low | Moderate | Medium | High | Low negative | |
| | Loss of biodiversity in South Africa. | Proclamation of Conservation area as proposed fixed in title deeds. Vegetation management plan required. | Without | Negative | Low | Permanent | Local | Low | Low | Medium | High | Medium negative | |
| | | | With | Negative | Low | Permanent | Regional | Very low | Moderate | Medium | High | Low negative | |
| | Development impact on Walker Bay Nature Reserve is less as an adequate buffer and conservation area is established. . | HOA must ensure that pets and inhabitants respect the buffer. Appoint a qualified Environmental Control Officer to manage conservation area on scientific basis in conjunction with Walker Bay Reserve. This is a positive mitigation to the present ineffective access control. | Without | Negative | Low | Permanent | Local | Low | Low | Medium | Medium | Medium negative | |
| | | | With | Positive | Very Low | Permanent | Site | Very low | High | Low | High | Low positive | |
| | Loss of inland to coast continuity corridor between coastal limestone cliffs and inland Sandstone and Sand Fynbos. | Inland to coast continuity corridor maintained through proclamation of Conservation area in title deeds. Vegetation management plan and ECO required. | Without | Negative | Low | Medium term | Site | Low | Low | Medium | Medium | Low negative | |
| | | | With | Positive | Very Low | Long term | Local | Very low | Low | Low | High | Low positive | |
| | A fire hazard is present, but the conservation area is large enough for an effective management plan to be enabled to limit damage and to benefit vegetation. | Fire breaks around perimeter of site and along edge of development. Natural vegetation on site managed in different time phases internally and from the adjacent units on Walker Bay Provincial Nature Reserve, reducing fire hazard for both entities. | Without | Negative | High | Long term | Local | Low | Moderate | High | High | Med-High negative | |
| | | | With | Positive | Very Low | Medium term | Site | Very low | High | Low | Medium | Low positive | |

this possibility has been negated in Alternative 2, (**Figure 8**) where plots have been extended into the buffer and a mowed firebreak outside the edge of the erven is anticipated. The firebreak with Alternative 2 would destroy vegetation through its being shifted into the conservation buffer zone. This problem has been solved in Alternative 3 by enlarging the conservation area and adding a Private Open Space area to accommodate this change.

It is extremely important to realise that periodic controlled fires are a vitally necessary factor in the management of this vegetation (excluding the *Euclea racemosa* – *Pterocelastrus tricuspidatus* Overberg Dune Strandveld thicket community (Zietsman's community 1.3). A fire management plan will have to be established in conjunction with CapeNature officials on the Walker Bay Reserve. Home owners on the Khoisan Bay development will have to formally agree to this practice when purchasing any property on Khoisan Bay.

Any development on the edge of a nature reserve requires agreement with the reserve management staff on the management of the buffer that is located on the developer's property. This requires both parties to sit down and draw up an agreement that is mutually acceptable. The location, width and management of firebreaks must be finalised in conjunction with the Manager of the Walker Bay Nature Reserve.

5.2 Restrictions

Restrictions must be placed on lighting adjoining the conservation areas. Bells are necessary on cats and dogs must be kept on leads outside owners properties in all communal areas.

Runoff from roads and properties are not to be directed into the conservation areas as this would change the natural water balance in the vegetation and then alter their composition.

6 Offsets

An offset would be to establish the Khoisan Bay conservation area as proposed in Alternative 3, with development of Phase 1 only, with a Management Advisory Committee and the support of CapeNature. The agreed conservation area would need to be entrenched in the title deeds of the property in perpetuity. The scientific management of the natural areas on the Khoisan Bay property is an essential part of this offset.

A resident Environmental Control Officer can be tasked to be responsible for the day-to-day management of the natural areas. This is management is at the cost of the development. Another potential offset would be the establishment of an environmental information and

educational facility based on the property that would be beneficial to the development's inhabitants as well as to the wider local community. Funding is required to undertake this type of activity. Funding can be generated through recycling waste materials, and through a basic levy established with the transfer of each property to a new owner, in addition to a monthly levy. The funds must be managed by an independent organisation (e.g. WWF). Quarterly reports on activities are to be compiled and distributed to agreed state, provincial, municipal and NGO bodies. Any surplus funds could also be applied for scientifically based, community-approved local environmental projects which need not be confined to those necessary for the management of the Khoisan Bay natural environment.

7. References

- Goldblatt, P. & Manning, J. 2000. Cape plants: A conspectus of the Cape Flora of South Africa. *Strelitzia* 9.
- Government Gazette, 2011. No 32689, General Notice 1477. National List of Threatened Ecosystems.
- Mucina, L. & Rutherford, M. C. (eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria. ISBN-13:978-1-919976-21-1; ISBN-10:1-919976-21-3
- Mucina, L., Rutherford, M. C. & Powrie, L.W. (eds) 2005. Vegetation map of Southern Africa, Lesotho and Swaziland, 1:1 000 000 scale sheet maps. South African National Biodiversity Institute, Pretoria. ISBN 1-919976-22-1.
- Raimondo, D., Van Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C., Kamundi, D.A. & Manyama, P.A. (eds) 2009. Red List of South African plants. *Strelitzia* 25. South African National Biodiversity Institute, Pretoria. ISBN: 978-1-919976-52-5.
- Zietsman, M.M. Undated. Revised botanical assessment for Portion 2 of the Farm Strandfontein nr. 712, De Kelders, Gansbaai. Unpublished report produced by Marzie Ecological Services for

Appendices

Appendix 1. Threatened Vegetation categories

Mucina and Rutherford (2006) use the following categories of threat for their national vegetation types:

- Critically Endangered – This type has been transformed to such an extent that the remaining habitat is less than that required to represent 75% of species diversity (i.e., the biodiversity target).
- Endangered – These types have lost up to 40% of their original extent and are exposed to partial loss of ecosystem function.

- Vulnerable – This vegetation has lost up to 20% of its original extent, which could result in some ecosystem functions being altered.
- Least Threatened – No significant ecosystem functioning disruption is assumed. This vegetation still possesses more than 80% of their original extent intact.

Appendix 2. Threatened Ecosystem categories

The Biodiversity Act (Act 10 of 2004) provides for listing of threatened or protected ecosystems in one of the following four categories, with further qualification using criteria listed in the table below. The list of threatened terrestrial ecosystems presented here supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (NSBA) of 2004.

- **critically endangered (CR) ecosystems**, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation;
- **endangered (EN) ecosystems**, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems;
- **vulnerable (VU) ecosystems**, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems;
- **protected ecosystems**, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed as critically endangered, endangered or vulnerable

Criteria used to identify threatened terrestrial ecosystems, with thresholds for critically endangered (CR), endangered (EN) and vulnerable (VU) ecosystems

| Criterion | CR | EN | VU |
|---|---|---|---|
| A1: Irreversible loss of natural habitat | Remaining natural habitat ≤ biodiversity target | Remaining natural habitat ≤ (biodiversity target + 15%) | Remaining natural habitat ≤ 60% of original area of ecosystem |
| A2: Ecosystem degradation and loss of integrity* | ≥ 60% of ecosystem significantly degraded | ≥ 40% of ecosystem significantly degraded | ≥ 20% of ecosystem significantly degraded |
| B: Rate of loss of natural habitat** | | | |
| C: Limited extent and imminent threat | -- | Ecosystem extent ≤ 3 000ha, and imminent threat | Ecosystem extent ≤ 6 000ha, and imminent threat |
| D1: Threatened plant species associations | ≥ 80 threatened Red Data List plant species | ≥ 60 threatened Red Data List plant species | ≥ 40 threatened Red Data List plant species |
| D2: Threatened animal species associations** | | | |

| | | | |
|---|---------------------------------------|--|---|
| E: Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan | Very irreplaceability and high threat | high and Very irreplaceability and medium threat | high and Very irreplaceability and low threat |
| F: Fragmentation** | | | |

* Because of data constraints, Criterion A2 has been applied to forests but not to other vegetation types.

** Because of data constraints, Criteria B and D2 are dormant at this stage and thresholds have not been set for these criteria. Further testing of Criterion F is needed to determine whether it is a workable criterion for terrestrial ecosystems.

Appendix 3. Categories for “FLORA of Conservation Concern”

Categories of threatened plants used in this study are extracted from Raimondo *et al.* (2009), as follows:

- Extinct (EX) - A taxon is Extinct when there is no reasonable doubt that the last individual has died. Taxa are listed as Extinct only once exhaustive surveys throughout the historic range have failed to record an individual.
- Extinct in the Wild (EW) - A taxon is Extinct in the Wild when it is known to survive in cultivation or as a naturalized population (or populations) well outside the past range.
- Critically Endangered (CR PE) - Critically Endangered (Possibly Extinct) taxa are those that are, on the balance of evidence, likely to be extinct, but for which there is a small chance that they may be extant. Hence they should not be listed as Extinct until adequate surveys have failed to record the taxon.
- Critically Endangered (CR) - A taxon is Critically Endangered when the best available evidence indicates that it meets any of the five IUCN criteria for Critically Endangered, and is therefore facing an **extremely high risk** of extinction in the wild. Quantitative thresholds based on the rate of population decline, small geographic range, small population size or very restricted distribution and the quantitative analysis of extinction rate within this criterion are given in Table 2.1 in Raimondo *et al.* (2009).
- Endangered (EN) - A taxon is Endangered when the best available evidence indicates that it meets any of the five IUCN criteria for Endangered, and is therefore facing a **very high risk** of extinction in the wild. Quantitative thresholds based on the rate of population decline, small geographic range, small population size or very restricted distribution and the quantitative analysis of extinction rate within this criterion are given in Table 2.1 in Raimondo *et al.* (2009).
- Vulnerable (VU) - A taxon is Vulnerable when the best available evidence indicates that it meets any of the five IUCN criteria for Vulnerable, and is therefore facing a **high risk** of extinction in the wild. Quantitative thresholds based on the rate of population decline, small geographic range, small population size or very restricted distribution and the quantitative analysis of extinction rate within this criterion are given in Table 2.1 in Raimondo *et al.* (2009).
- Near Threatened (NT) - A taxon is Near Threatened when available evidence indicates that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future.

- Critically Endangered (CR) – A taxon is Critically Endangered when it is known to occur only at a single site, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to the five IUCN criteria.
- Rare – A taxon is Rare when it meets any of the four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to the five IUCN criteria.
- Declining (DEC) – A taxon is Declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline in the population.
- Data Deficient Insufficiently Known (DDD) - A taxon is rated as Data Deficient Insufficiently Known when there is inadequate information to make an assessment of its risk of extinction, but the taxon is well-defined. Data Deficient is not a category of threat. However, listing of taxa in this category indicates that more information is required and that future research could show that a threatened classification is appropriate.
- Data Deficient Taxonomically Problematic (DDT) – A taxon is DDT when taxonomic problems hinder its distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.
- Least Concern (LC) - A taxon is rated as Least Concern when it has been evaluated against the five IUCN criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened.

Appendix 4. Phytosociological data for area (data from M Zietsman (2008) re-analysed)

| Taxon / sample number | Conservation Concern Status | 1 | 2 | 3 | 8 | 7 | 4 | 9 | 6 | 5 | No. of area in 39 |
|--|-----------------------------|----|----|----|----|----|----|----|----|----|------------------------|
| Boucher communities | | 1 | | | | | | | 3 | 4 | |
| Zietsman community identification number | | 3 | | | | | | | 2 | 3 | |
| No. of species in sample plot | | 25 | 19 | 15 | 15 | 11 | 15 | 22 | 22 | 13 | No. of occurrences per |
| 1. Olea exasperata-Muraltia saturoioides Overberg Dune Strandveld Thicket on calcareous sands & calcare rocks | | | | | | | | | | | |
| Muraltia DC. var. saturoioides | LC | + | + | + | + | | | | | | 4 |
| Cissampelos L.f. | LC | + | | + | + | | | | | | 3 |
| Helichrysum (L.) D.Don | LC | + | + | | | | | | | | 3 |
| Maytenus procumbens (L.f.) Loes. | LC | 1 | 2b | 2a | | | | | | | 3 |
| Pelargonium capitatum (L.) L'Hér. | LC | + | + | | | | | | | | 3 |
| Salvia africana-lutea L. | LC | 1 | + | + | | | | | | | 3 |
| Senecio Thunb. | LC | + | + | | | | | | | | 3 |
| Zygophyllum Eckl. & Zeyh. | LC | + | | + | + | | | | | | 3 |
| Ehrlarta J.H.Schult. var. maxim Stapf | LC | 2b | | | 4 | | | | | | 2 |
| Cenchrus M.A.Curtis | NE | + | | | + | | | | | | 2 |
| Wahlienbergia tenella (L.f.) Lammers | LC | R | | | + | | | | | | 2 |
| 1. Olea exasperata-Eragrostis Strandveld Thickets | | | | | | | | | | | |
| Eragrostis (Thunb.) Trin. | LC | + | + | | | | | | | | 2 |
| Metalsia brevifolia (Lam.) Levyns | LC | + | + | | | | | | | | 2 |
| Passerina L. | VU | + | + | | | | | | | | 2 |
| Athanasia (L.) L. | LC | + | + | | | | | | | | 2 |
| Avena fatua L. | NE | 2a | + | | | | | | | | 2 |
| Euphorbia L. | NE | + | + | | | | | | | | 2 |
| Tetragonia L. | LC | + | + | | | | | | | | 2 |
| Ammi L. | NE | R | + | | | | | | | | 2 |
| Sebaea aurea (L.f.) Roem. & Schult. | LC | + | | | | | | | | | 1 |
| Bromus Roth | NE | 1 | | | | | | | | | 1 |
| Cassine parvifolia Sond. | LC | + | | | | | | | | | 1 |
| Centella (L.f.) Drude | LC | R | | | | | | | | | 1 |
| Osyris compressa (P.J.Bergius) A.D.C. | LC | + | | | | | | | | | 1 |
| Cynodon (L.) Pers. | LC | + | | | | | | | | | 1 |
| Emex Steinh. | NE | R | | | | | | | | | 1 |
| Felicia aculeata Grau | LC | + | | | | | | | | | 1 |
| Festuca scabra Vahl | LC | + | | | | | | | | | 1 |
| Laqurus ovatus L. | NE | 1 | | | | | | | | | 1 |
| Pelargonium myrthifolium (L.) L'Hér. | LC | + | | | | | | | | | 1 |
| Pennisetum villosum R.Br. ex Fresen. | NE | + | | | | | | | | | 1 |
| Solanum Hepper & Jaeger | LC | + | | | | | | | | | 1 |
| Thesiu sp. | LC | + | | | | | | | | | 1 |
| Trachyandra (Adamson) Oberm. | LC | + | | | | | | | | | 1 |
| Tribulus L. | LC | R | | | | | | | | | 1 |
| 2. Olea exasperata-Thamnochortus guthrieae Coastal Dune Fynbos | | | | | | | | | | | |
| Thamnochortus Pillans | LC | | | 2a | + | | 2a | + | | | 4 |
| Passerina Wikstr. | LC | | | 1 | + | | | + | | | 3 |
| Brunsvigia orientalis (L.) Aiton ex Eckl. | LC | | | | + | | | + | | | 2 |
| Crassula nudicaulis L. var. nudicaulis | LC | | | | | + | + | | | | 2 |
| 2.1 Olea exasperata-Metalsia muricata Transitional Strandveld to Dune Fynbos | | | | | | | | | | | |
| Metalsia (L.) D.Don | LC | | | 1 | + | | | | | | 2 |
| 2.1.1 Olea exasperata-Morella cordifolia Transitional Strandveld to Dune Fynbos | | | | | | | | | | | |
| Morella (L.) Killick | LC | | | | + | | | | | | 1 |
| Pelargonium bipinnatifidum (Harv.) D.A.Boucher | LC | | | | + | | | | | | 1 |
| 2.1.2 Olea exasperata-Passerina corymbosa Transitional Strandveld to Dune Fynbos | | | | | | | | | | | |
| Passerina Eckl. ex C.H.Wright | LC | | | | + | | | | | | 1 |
| Lyperia (L.) Druce | LC | | | | R | | | | | | 1 |
| 2.3 Olea exasperata-Helichrysum pulchellum Dune Fynbos | | | | | | | | | | | |
| Helichrysum pulchellum DC. | LC | | | | | + | | | | | 1 |
| 2.2 Olea exasperata-Diosma subulata Dune Fynbos | | | | | | | | | | | |
| Diosma J.C.Wendl. | LC | | | | | | 4 | R | | | 2 |
| Thamnochortus Mast. | LC | | | | | | 2a | | | | 1 |
| 2.4 Olea exasperata-Erica plukenetii Dune Fynbos | | | | | | | | | | | |
| Erica pinquior C.B.Clark | VU | | | | | | | 3 | | | 1 |
| Erica plukenetii L. subsp. plukenetii | LC | | | | | | | + | | | 1 |
| Trichocephalus stipularis (L.) Brongn. | LC | | | | | | | + | | | 1 |
| 3. Olea exasperata-Agathosma geniculata Proto-Limestone Fynbos | | | | | | | | | | | |
| Agathosma Pillans | NT | + | | | | | | | 2a | | 2 |
| Helichrysum (L.) Willd. | LC | | | | | | | | + | | 1 |
| Knowltonia (L.f.) Sims | LC | | | | | | | | + | | 1 |
| Crassula Dryand. subsp. expansa | LC | | | | | | | | + | | 1 |
| Widespread species common to the Olea exasperata-Pterocelastrus communities in the study area | | | | | | | | | | | |
| Olea exasperata Jacq. | LC | + | 2a | 3 | + | 4 | 2a | + | 1 | 3 | 9 |
| Pterocelastrus (Lam.) Walp. | LC | 2a | 2a | 1 | + | 1 | + | + | 1 | 1 | 9 |
| Calopsis viminea (Rottb.) H.P.Linder | LC | + | + | 2b | 1 | 2a | 2a | 2a | 2a | 2a | 9 |
| ? Pentaschistis calicicola H.P.Linder var. calicicola | NT | + | + | + | 1 | + | + | + | + | + | 9 |
| ? Pentaschistis calicicola H.P.Linder var. hirsut H.P.Linder | VU | | | | | | | | | | 0 |
| Phylla ericoides L. var. ericoides | LC | + | + | 1 | | 2a | 1 | 2a | 2a | 1 | 8 |
| Ischyrolepis eleocharis (Mast.) H.P.Linder | LC | + | + | 1 | 1 | | 2b | + | 2a | 1 | 8 |
| Passerina Wikstr. | LC | + | + | 2a | | | 2b | + | 2a | 2a | 8 |
| Indigofera (DC.) E.Mey. | LC | + | + | + | | | 2a | + | | 2b | 7 |
| Euclea Murray | LC | 1 | 2b | 1 | + | + | | 1 | 1 | | 7 |
| Cassine L. | LC | + | | | | 2b | | | + | 1 | 6 |
| Searsia (Thunb.) Moffett | LC | + | 1 | 1 | 1 | | | 1 | | + | 6 |
| Selago L. | LC | + | + | + | 1 | + | | | + | | 6 |
| Otholobium (Eckl. & Zeyh.) C.H.Stirt. | LC | + | + | | 1 | | | + | | 2a | 5 |
| Acacia A.Cunn. ex G.Don | NE | 3 | 4 | | | + | R | | | | 4 |
| Anthospermum L. | LC | + | | + | | + | | | + | | 4 |
| Carpobrotus (L.) L.Bolus | LC | + | | + | | + | | | | + | 4 |
| Cassytha ciliolata Nees | LC | | | + | | | + | + | + | | 4 |
| Chrysanthemoides monilifera (L.) Norl. | LC | + | + | 1 | | | | | | + | 4 |
| Jamesbrittenia albomarginata Hilliard | LC | R | + | | | | | + | + | | 4 |
| Koeleria (Steud.) Nees | LC | + | | | | | 1 | + | + | | 4 |
| Tephrosia (Jacq.) Pers. | LC | + | + | | + | | | + | | | 4 |
| Chironia L. | LC | | | + | | | | + | + | | 3 |
| Metalsia densa (Lam.) P.O.Karis | LC | + | + | | | | | | + | | 3 |
| Searsia (L.) F.A.Barkley var. villos (L.f.) Moffett | LC | + | + | + | | | | | + | | 3 |
| Rhus L. | LC | + | + | | | | | + | | | 3 |
| Chaenostoma (Thunb.) Benth. | LC | + | + | | + | | | | + | | 3 |
| Conicosia pugoniformis (L.) N.E. Br. subsp. muiirii Ihlenf. & Gerbaulet | LC | + | | | | | | + | | | 2 |
| Euphorbia Boiss. | LC | | | + | | | + | | | + | 3 |
| Pelargonium betulinum (L.) L'Hér. | LC | | | | + | | + | | | R | 3 |

Appendix 5. Protocols for assessment of impacts associated with development alternatives

For each potential impact, the **EXTENT** (spatial scale), **MAGNITUDE**, **DURATION** (time scale), **PROBABILITY** of occurrence, **IRREPLACEABLE** loss of resources and the **REVERSIBILITY** of potential impacts must be assessed by the specialist by using the results of their specialist studies. The assessment of the above criteria will be used to determine the significance of each impact, with and without the implementation of the proposed mitigation measures. The scales to be used to assess these variables and to define the rating categories are tabulated in the tables below.

Evaluation components, ranking scales and descriptions (criteria)

| Evaluation component | Ranking scale and description (criteria) |
|--|---|
| MAGNITUDE of NEGATIVE IMPACT (at the indicated spatial scale) | <p>10 - Very high: Bio-physical and/or social functions and/or processes might be <i>severely</i> altered.</p> <p>8 - High: Bio-physical and/or social functions and/or processes might be <i>considerably</i> altered.</p> <p>6 - Medium: Bio-physical and/or social functions and/or processes might be <i>notably</i> altered.</p> <p>4 - Low : Bio-physical and/or social functions and/or processes might be <i>slightly</i> altered.</p> <p>2 - Very Low: Bio-physical and/or social functions and/or processes might be <i>negligibly</i> altered.</p> <p>0 - Zero: Bio-physical and/or social functions and/or processes will remain <i>unaltered</i>.</p> |
| MAGNITUDE of POSITIVE IMPACT (at the indicated spatial scale) | <p>10 - Very high (positive): Bio-physical and/or social functions and/or processes might be <i>substantially</i> enhanced.</p> <p>8 - High (positive): Bio-physical and/or social functions and/or processes might be <i>considerably</i> enhanced.</p> <p>6 - Medium (positive): Bio-physical and/or social functions and/or processes might be <i>notably</i> enhanced.</p> <p>4 - Low (positive): Bio-physical and/or social functions and/or processes might be <i>slightly</i> enhanced.</p> <p>2 - Very Low (positive): Bio-physical and/or social functions and/or processes might be <i>negligibly</i> enhanced.</p> <p>0 - Zero (positive): Bio-physical and/or social functions and/or processes will remain <i>unaltered</i>.</p> |
| DURATION | <p>5 - Permanent</p> <p>4 - Long term: Impact ceases after operational phase/life of the activity > 20 years.</p> <p>3 - Medium term: Impact might occur during the operational phase/life of the activity – 5 - 20 years.</p> <p>2 - Short term: Impact might occur during the construction phase - < 5 years.</p> <p>1 - Immediate</p> |
| EXTENT (or spatial scale/influence of impact) | <p>5 - International: Beyond National boundaries.</p> <p>4 - National: Beyond Provincial boundaries and within National boundaries.</p> <p>3 - Regional: Beyond 5 km of the proposed development and within Provincial boundaries.</p> <p>2 - Local: Within 5 km of the proposed development.</p> <p>1 - Site-specific: On site or within 100 m of the site boundary.</p> <p>0 - None</p> |

| | |
|---|--|
| IRREPLACEABLE loss of resources | 5 – Definite loss of irreplaceable resources. 4 – High potential for loss of irreplaceable resources. 3 – Moderate potential for loss of irreplaceable resources. 2 – Low potential for loss of irreplaceable resources. 1 – Very low potential for loss of irreplaceable resources. 0 - None |
| REVERSIBILITY of impact | 5 – Impact cannot be reversed. 4 – Low potential that impact might be reversed. 3 – Moderate potential that impact might be reversed. 2 – High potential that impact might be reversed. 1 – Impact will be reversible. 0 – No impact. |
| PROBABILITY (of occurrence) | 5 - Definite: >95% chance of the potential impact occurring. 4 - High probability: 75% - 95% chance of the potential impact occurring. 3 - Medium probability: 25% - 75% chance of the potential impact occurring 2 - Low probability: 5% - 25% chance of the potential impact occurring. 1 - Improbable: <5% chance of the potential impact occurring. |

| Evaluation component | Ranking scale and description (criteria) |
|------------------------------|--|
| CUMULATIVE impacts | High: The activity is one of several similar past, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern. Medium: The activity is one of a few similar past, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern. Low: The activity is localised and might have a negligible cumulative impact. None: No cumulative impact on the environment. |

Once the evaluation components have been ranked for each potential impact, the significance of each potential impact will be assessed (or calculated) using the following formula:

| |
|--|
| $\text{SP (significance points)} = (\text{magnitude} + \text{duration} + \text{extent} + \text{irreplaceable} + \text{reversibility}) \times \text{probability}$ |
|--|

The maximum value is 150 SP (significance points). The unmitigated and mitigated scenarios for each potential environmental impact should be rated as per the table below.

Definition of significance ratings (positive and negative)

| Significance Points | Environmental Significance | Description |
|---------------------|----------------------------|--|
| 125 – 150 | Very high (VH) | An impact of very high significance will mean that the project cannot proceed, and that impacts are irreversible, regardless of available mitigation options. |
| 100 – 124 | High (H) | An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options. |
| 75 – 99 | Medium-high (MH) | If left unmanaged, an impact of medium-high significance could influence a decision about whether or not to proceed with a proposed project. Mitigation options should be relooked. |
| 40 – 74 | Medium (M) | If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with a proposed project. |
| <40 | Low (L) | An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation. |
| + | Positive impact (+) | A positive impact is likely to result in a positive consequence/effect, and is likely to contribute to positive decisions about whether or not to proceed with the project. |

Appendix 6. Declaration of Independence of Practitioner

In terms of Chapter 5 of the National Environmental Management Act of 1998 specialists involved in Impact Assessment processes must declare their independence and include an abbreviated *Curriculum Vita*.

I, Dr Charles Boucher (Sole proprietor of C Boucher Botanical Surveys), do hereby declare that I am financially and otherwise independent of the client and their consultants, and that all opinions expressed in this document are substantially my own.



Date: 30 April 2012

CHARLES BOUCHER
(Pr. Sci. Nat. registration no.: 737/83)

18 Patrys Street, Stellenbosch 7600, South Africa
Telephone: 021 887 1421; 083 628 2570

Appendix 7. Dr Charles Boucher Abridged CV.

OCCUPATION : Botanical Ecological Consultant (Retired Lecturer, Stellenbosch University, since 2005)
NAME OF FIRM & STAFF : Sole Proprietor - C Boucher Botanical Surveys
DATE OF BIRTH : 14 August 1944
PROFESSIONAL EXPERIENCE : 46 Years
NATIONALITY : South African

PROFESSIONAL REGISTRATION

- South African Council for Natural Scientific Professions - Registered Professional Botanical Scientist (since 1983). Registration no. 737 / 83.
- South African Institute of Ecologists and Environmental Scientists (professional member 1991-2005).

Membership of PROFESSIONAL Organizations and Societies

- Botanical Society of South Africa (life member).
- Wild Life and Environment Society of South Africa (life member).
- South African Association of Botanists (life member).

PROFESSIONAL LISTING

- Marquis Who's Who in the World annually since 2005
 - Outstanding Scientists of the 21st century – inaugural edition.
-

KEY QUALIFICATIONS

Forty six years botanical, ecological and vegetation survey research experience. Specialist in Southern African riparian and wetland vegetation ecology, of the littoral vegetation of South Africa and of the general vegetation of southern South Africa. Experienced in rehabilitation of vegetation in the Cape. Undertaken research into Cape endemic plants, rare species, utilizable species and invader problem plants. Nineteen years full-time lecturing experience presenting numerous courses and guidance annually to 1st, 2nd, 3rd, honours, 23 masters and six PhD students. Specialist consultant to the South African government and to private firms on selected environmental issues requiring botanical ecological expertise.

Education

1987 Ph.D. Univ. of Stellenbosch. (Thesis title: *A phytosociological study of transects through the western Cape coastal foreland, South Africa.*)
1974 Fortran Programming certificate, Univ. of Stellenbosch.
1972 M.Sc. Univ. of Cape Town. (Thesis title: *The vegetation of the Cape Hangklip Area.*)
1968 B.Sc. Hons. (Botany), Univ. of Stellenbosch.
1966 B.Sc. (Botany and Zoology), Univ. of Stellenbosch.

EMPLOYMENT RECORD

2005 – present Proprietor of C Boucher Botanical Ecological consultancy.
1988 – 2005 Senior Lecturer, Botany Department, University of Stellenbosch. (Acting head of department when head absent). Retired 2005.
1986 – 2005 Botanical ecological consultant.
1986 – 1987 Lecturer, Botany Department, University of Stellenbosch.
1983 – 1985 Officer-in-Charge, Botanical Research Unit, Stellenbosch.
1968 – 1985 Agricultural Researcher, Botanical Research Institute.
1966 – 1967 Assistant Curator, Botanic Garden, University of Stellenbosch.

Professional service

20 MAJOR PROJECTS

- Vegetation survey of the Kogelberg State Forest and surrounding areas. Researcher: C. Boucher (1969-1974).
- An autecological investigation of the rare-and-endangered Proteaceae, *Orothamnus zeyheri*. Researcher: C. Boucher (1974-1981).
- A broad-scale categorization and description of the vegetation of the western Cape Coastal Foreland. Researcher: C. Boucher (1982-1988).

- Germination experiment and salt tolerance determinations of selected indigenous grazable Namaqualand plants. Researchers: Honours- and M.Sc. students (1989-1991).
- Vegetation rehabilitation experiments along the Namaqualand Coastal Plain. Researchers: C. Boucher and D. Molyneux (1989-1992).
- Littoral vegetation of South African coastline from Namaqualand to Eastern Cape (1990-1993).
- The flora of Namaqualand. Researchers: D. Court (1986-1989), A. le Roux (1986-) and D.A. Boucher (1990-1996).
- Development of personal computer programmes to analyse phytosociological data. Researcher: C. Boucher (1991-1993).
- The compilation of a data catalogue for the Fynbos Biome. Researchers: C. Boucher, C. Marais, D.J. McDonald and D. Erasmus (1993-1996).
- Contributed Fynbos Biome vegetation maps and selected descriptions for Vegmap Project (production of an updated vegetation map of South Africa). (1999-2004). References: Mucina, L., Rutherford, M.C. & Powrie, L.W. 2005 (Editors). Vegetation map of South Africa, Lesotho and Swaziland, 1:1 000 000 scale sheet maps. South African National Biodiversity Institute, Pretoria. ISBN 1-919976-22-1. Mucina, L. & M.C. Rutherford 2006 (Editors), The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19: 53-219. South African Biodiversity Institute, Pretoria. ISBN 13: 978-1-919976-21-1 & 10: 1-919976-21-3.
- The restoration of part of the Lourens River for Crowther Campbell & Associates (1999-2003).
- Investigation of Olifants-Doring Rivers Irrigation Schemes (WODRIS). (Arcus Gibb for Dept Agriculture & Dept. Water Affairs & Forestry) (2001-2003).
- Determination of baseline botany for monitoring of Berg River preparatory to the construction of the Berg River Dam in Franschoek (2003-2007).
- Development of botanical ecological management and conservation systems for the following golf course estates or proposed estates:- a) Langebaan Country Estate; b) Stellenbosch Mountain Course at Paradyskloof; c) Pearl Valley Estate, Paarl (2003-2006).
- Assessment of botanical impact of raising wall of Clanwilliam Dam (for DWAF through Aurecon (was Ninham Shands) (2005-2006).
- Establishment of a conservation system on the Harmony Flats, Gordon's Bay. (2004-2008)
- Specialist Leader, Terrestrial fauna & flora component, Cape Metropolitan Area sensitivity analysis and mapping (1999).
- Specialist Consultant for Department Water Affairs & Forestry, Gibb Africa, Aurecon (was Ninham Shand), Freshwater Consulting Group and Southern Waters CC for the assessment of riparian and wetland vegetation of the following rivers and wetlands including water demand in respect of proposed dams: Berg, Breede, Diep, Doring, Eerste, Elands, Groen, Groot Brak & associated Wilderness rivers, Hex, Hopies, Klapmuts, Lourens, Molenaars, Mosselbank, Olifants (WC), Palmiet, Riebeeck, Riviersonderend, Silvermine, Sir Lowry's Pass, Spoornetkloof, Swart and Witels in the Fynbos Biome as well as Lower Orange in South Africa, Senqu, Senqunyane, Matsoku & Malibatso Rivers in Lesotho and wetlands Rietvlei, Papenkuils & Zeekoeivlei. (1991-2009).
- Botanical issues relevant to potential dam sites for Cape Town Water Supply Augmentation through Aurecon (2009-2010).
- Botanical research and adviser for mining in three tributaries of the Breede River, Worcester, for the production of road-building materials (2011).

13 SPECIALIST MANAGEMENT CONTRIBUTIONS

Completed

- South African Association of Botanists
 - South West Cape Branch:- Committee Member (1980-84, 1992), Secretary (1974-75), Treasurer (1972-73), Vice-Chairman (1976-77) and Chairman (1978-79, 1993-94);
 - National Committee:- Member (1977-78) and National Secretary (1983-84); Congress Organizing Committees (1979, 1984); Chairman Organising Committee of 1996 Stellenbosch Congress).

- Member, Committee for the establishment of Conservation Priorities along the Western Cape Coastal Foreland. (Task completed 1985).
- Member, Cape Peninsula Protected Natural Environment Advisory Board (1992-93).
- Botanical Advisor - Upgrading of the Eerste and Plankenbrug Rivers, Stellenbosch Town Council. (1993-2003).
- Co-ordinating Committee member of National Botanical Institute Vegmap Project to produce an updated vegetation map of South Africa. Specifically tasked as responsible for Fynbos Biome maps (1999-2003).
- Specialist Ecological Consultant for Application to Man & the Biosphere Advisory Committee of UNESCO for the international recognition of the West Coast Biosphere Reserve, co-ordinated by Dennis Moss Partnership (1999).
- Steering Committee member of Water Research Commission Committee:- Ecological & Geomorphological Principles for River Rehabilitation (1999-2003).
- Member, Dept Water Affairs & Forestry, Advisory Committee for Development of Western Cape Regional Water Resources Strategy (2000-2002).
- Steering Committee member of Water Research Commission:- Groundwater (Aquifer) dependant ecosystems in key hydrological settings in South Africa (2003-2005).

Current

- Scientific Advisory Board for the management of Paarl Mountain Nature Reserve. Board member 1991-2002 & 2009-2010, Chairman 2003-2008 & 2011-present.
- Member, Overberg Review Committee for assessing management of properties on the Agulhas Plain that are owned by Cape Nature Conservation and the Denel Group (The Agulhas Plain National Park is an affiliated member) (2000-present).
- Member of Table Mountain Group Aquifer Study & Pilot Abstraction Alliance for City of Cape Town through Aurecon (2002-present).
- Member, DEA&T Review panel for Eskom's Proposed Nuclear Power Station EIA's (2008-present).
- Environmental Adviser for the upgrading of the MR269 road from Shaw's Pass through Hemel-en-Aarde Valley for the Cape Provincial Administration (2011-present).

AWARDS

- Botanical Advisor - Revegetation of the National Road (N1) through Du Toitskloof (1990-1997). **Team awarded the South African Institution of Civil Engineering / Construction World Award for Engineering Excellence for 1997.**
- Member, Environmental assessment, monitoring and restoration Working Group of Houwteq Industrial Site, Houwhoek (1987-1996). **Team awarded 1992 National Premium EPIC award for Integrated Environmental Management.**
- Specialist Consultant for development of the Lower Silvermine River Flood Control Scheme (1998-2002). **Team awarded the South African Institution of Civil Engineering Branch Award for Excellence in Civil Engineering in the Western Cape for 2002.**
- De Lange, J.H., Van Der Walt, J.J.A. & Boucher, C., 1993. Autecological studies on *Audouinia capitata* (Bruniaceae). 5. Seed development, abortion and pre-emergent reproductive success. *S. Afr. J. Bot.* 59(2): 156-167. **Awarded the Compton Prize for the best publication in the South African Journal of Botany during 1993.**
- Botanical Advisor – The restoration of part of the Lourens River for Megan Anderson Landscape Architects through Crowther Campbell & Associates (1999-2003). **Team won national Award of Excellence for Design for the period 2009-2011 from the Institute for Landscape Architecture in South Africa.**

Educational

Led 6 Ph.D. and 23 Master degree students to complete their studies. External examiner for 4 Ph.D. students. External evaluator for 1 Professorate and 6 Masters degree students. Internal examiner for 5 Master degree students. Referee / Reviewer for 8 professional journals. One Patent pending.

Trustee

Member of Board of Trustees for The Molly Lazarus Trust, which serves to manage the Puntjie National Heritage Site, Heidelberg District.

PUBLICATIONS AND REPORTS

Total number publications, reports & presentations = 408, consisting of:-

- Theses = 2
- Chapters in books = 15
- Scientific articles in refereed journals = 71
- Articles without referees = 8
- Articles in CD's = 2
- Articles in conference proceedings = 14
- Unpublished botanical reports = 208
- International presentations = 10
- National congress and workshop presentations = 50
- Regional meeting presentations = 28
- Public lectures = 26
- Total number of conferences, symposia, working groups attended = 96

Languages

First language: English (speaking, reading and writing, all excellent)

Other languages: Afrikaans (speaking, reading and writing, all excellent)

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe me, my qualifications and experience.



Date: 30 April 2012

CHARLES BOUCHER
(Pr. Sci. Nat. registration no.: 737/83)

18 Patrys Street, Stellenbosch 7600, South Africa
Telephone: 021 887 1421; 083 628 2570