

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 (Riamondo *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 Riamondo *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

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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.

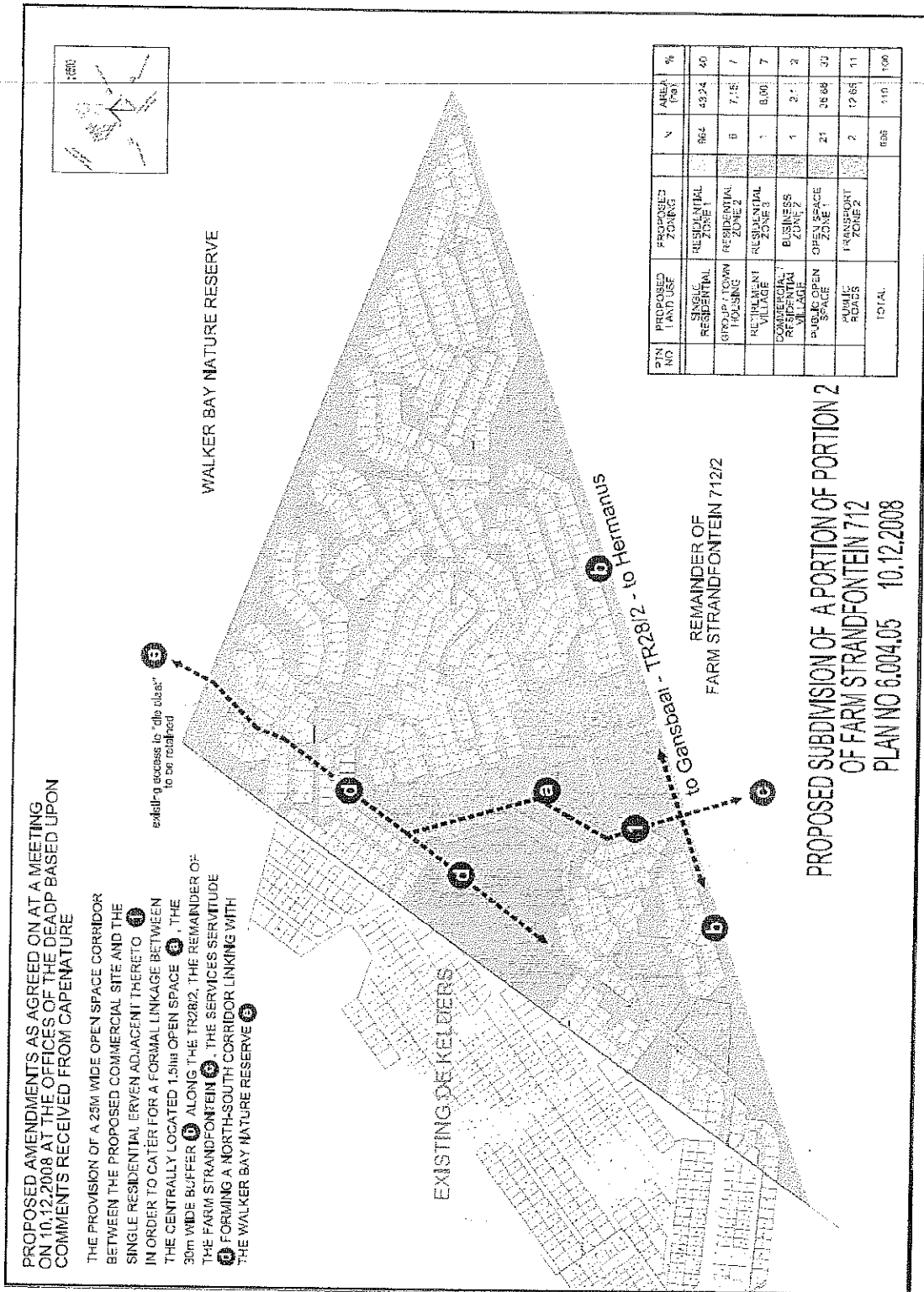


Figure 6. Initial Development Alternative 1.

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**).

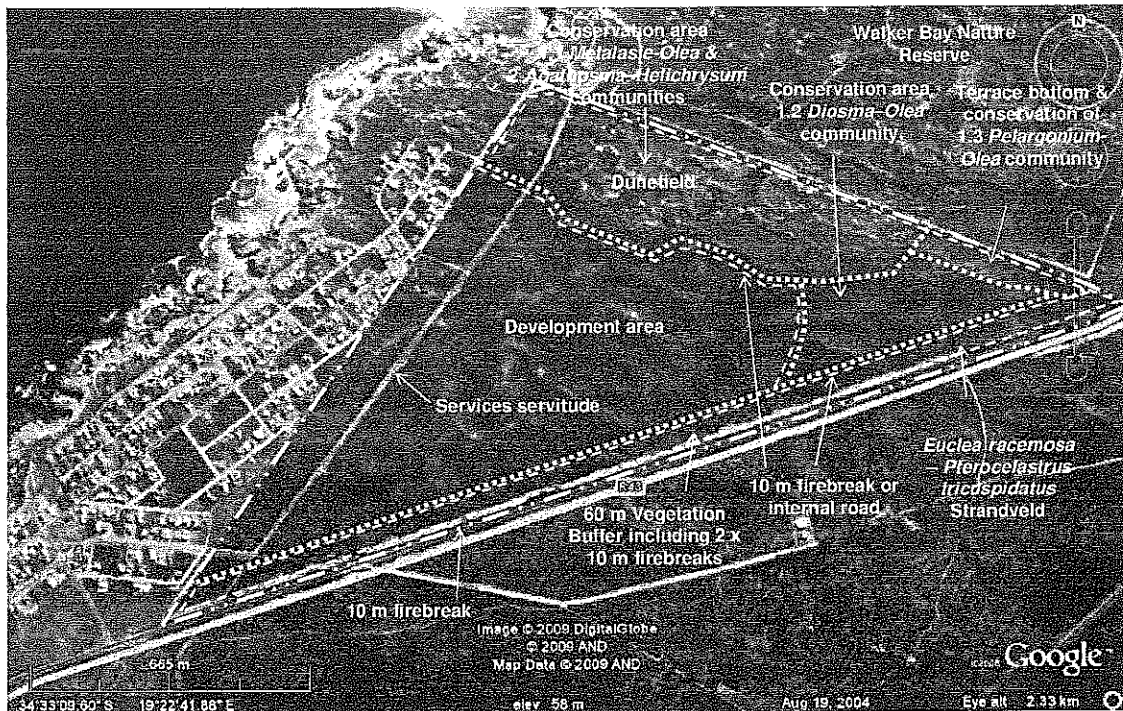


Figure 7. Aerial image of the proposed Khoisan Bay development site showing environmental constraints, conservation areas, firebreaks and recommended buffer between the development, the Walker Bay Nature Reserve and the R43 provincial road.

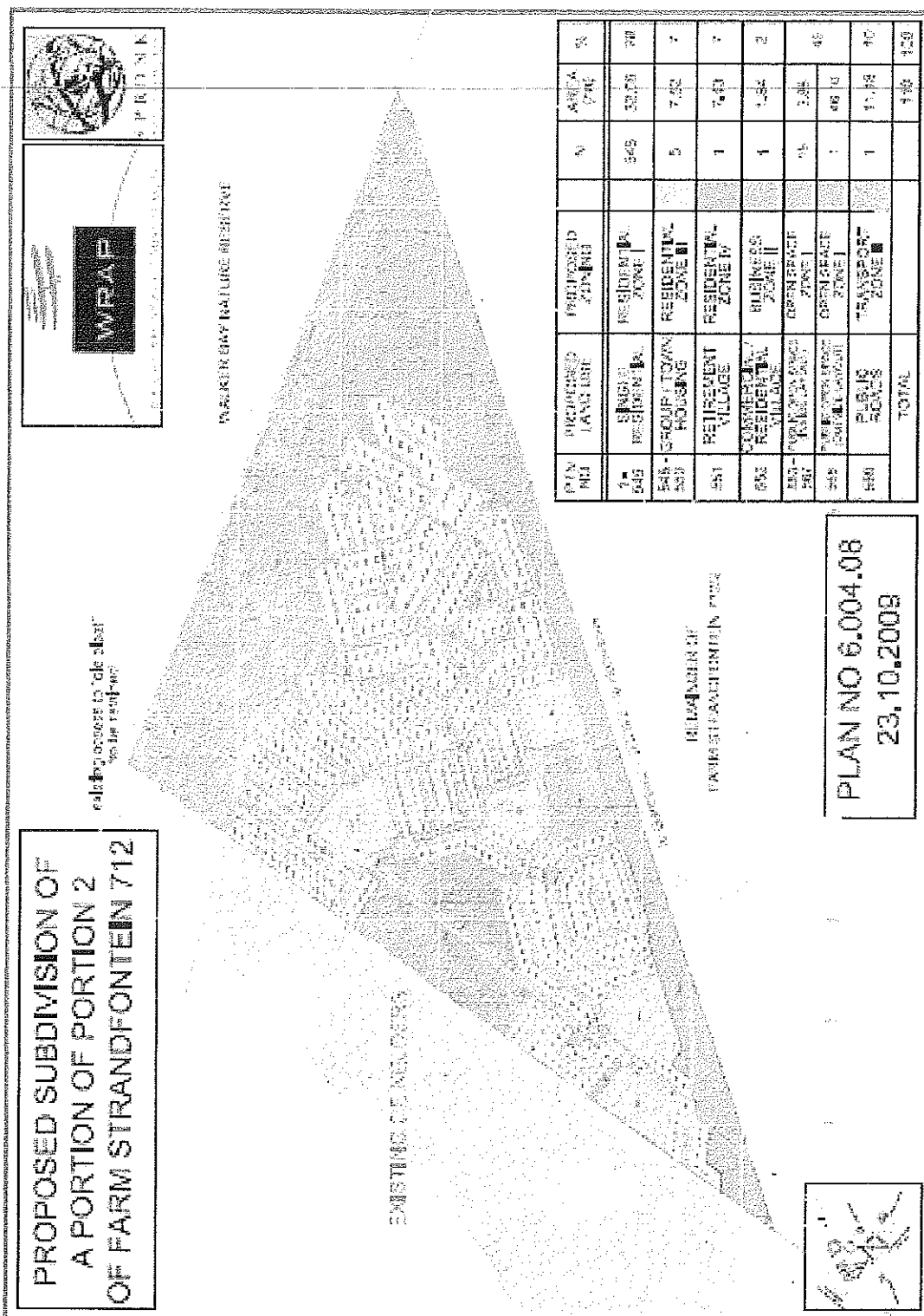


Figure 8. The layout of Development Alternative 2.

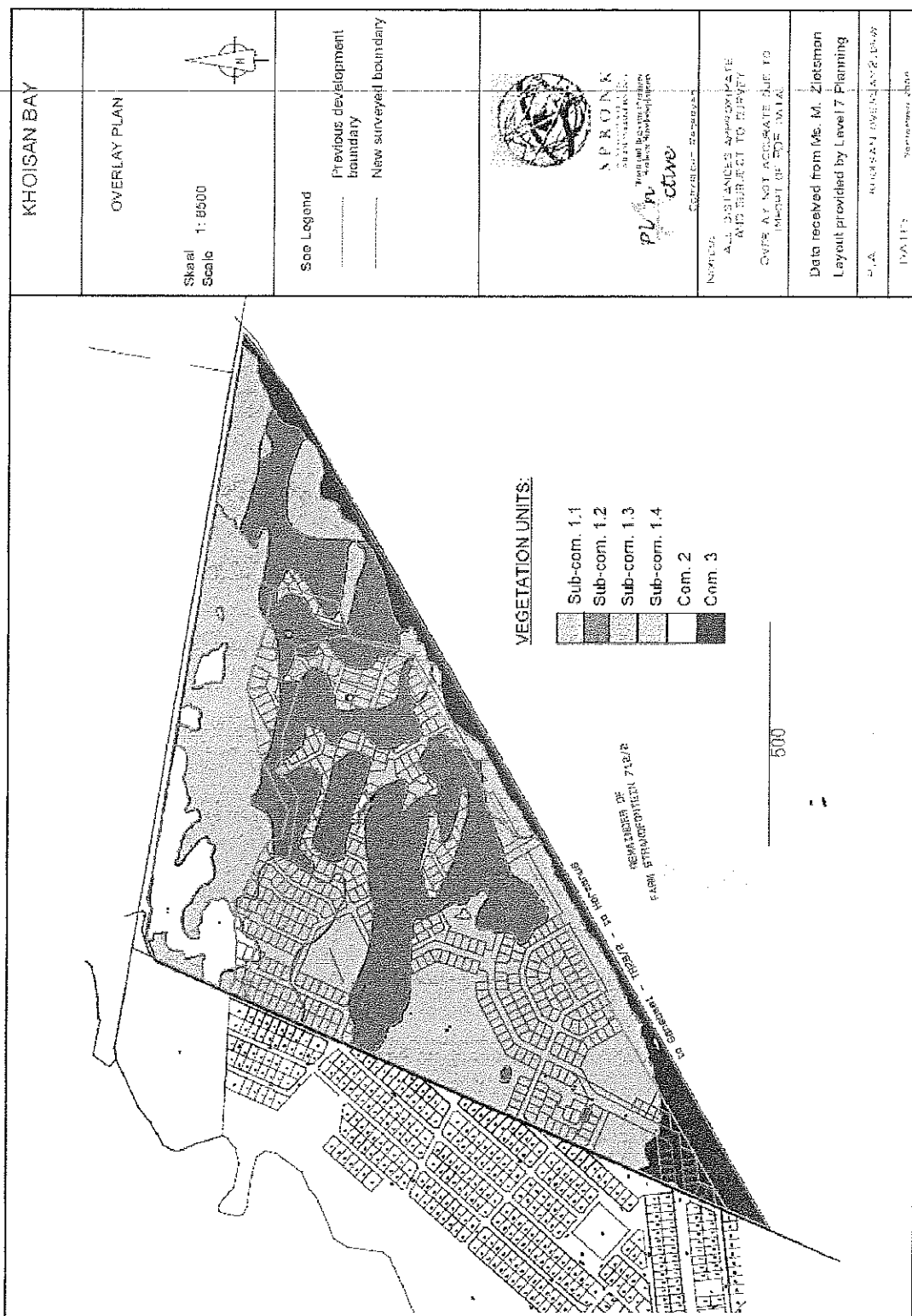


Figure 9. Development Alternative 2, superimposed on the vegetation map and including the suggested outline from Figure 7 (pink development line) with the proposed compromise development outline (red boundary line) as in Figure 8.

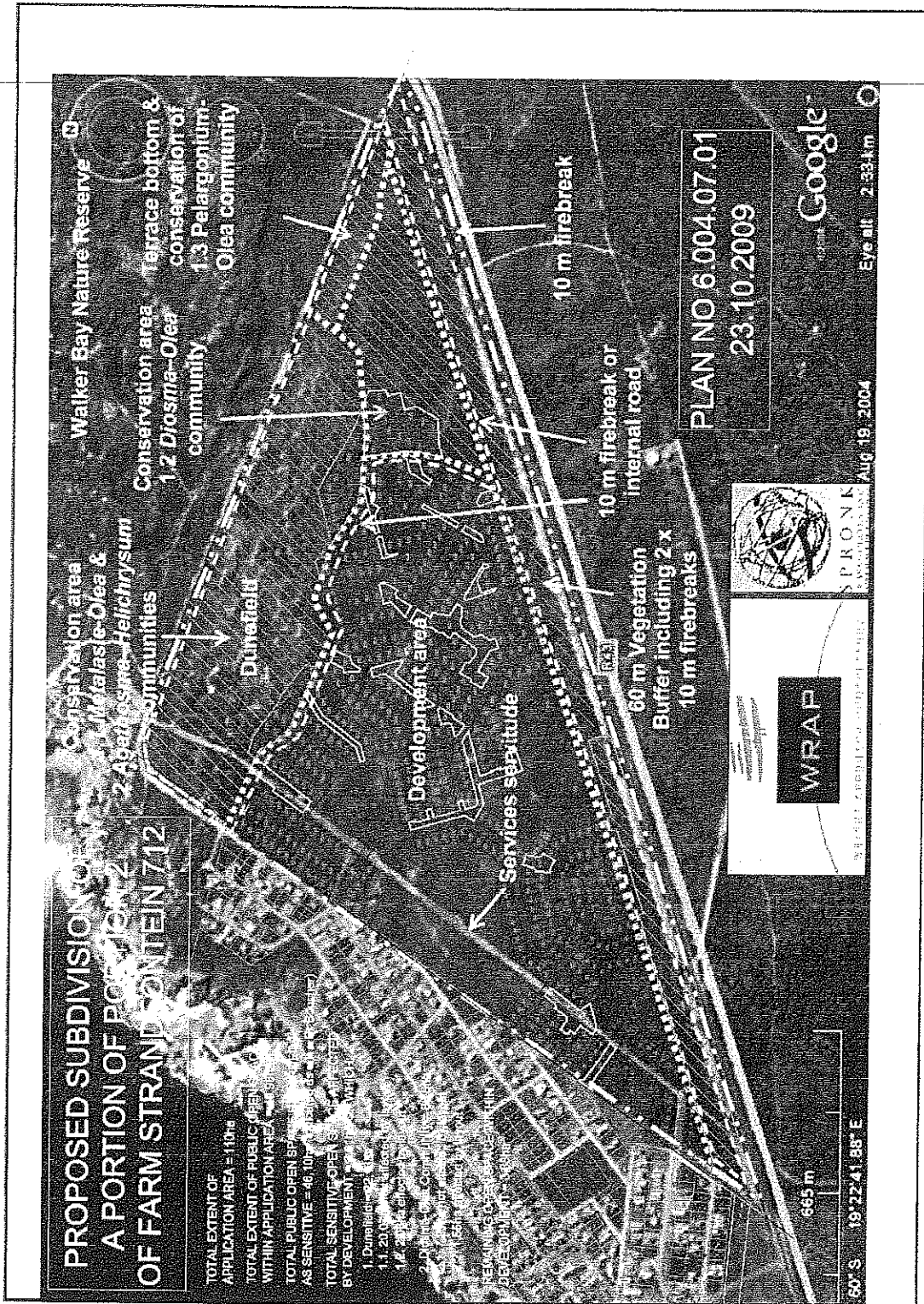


Figure 10. Development Alternative 2, superimposed on the GoogleEarth image.

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>Thamnochoris 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).

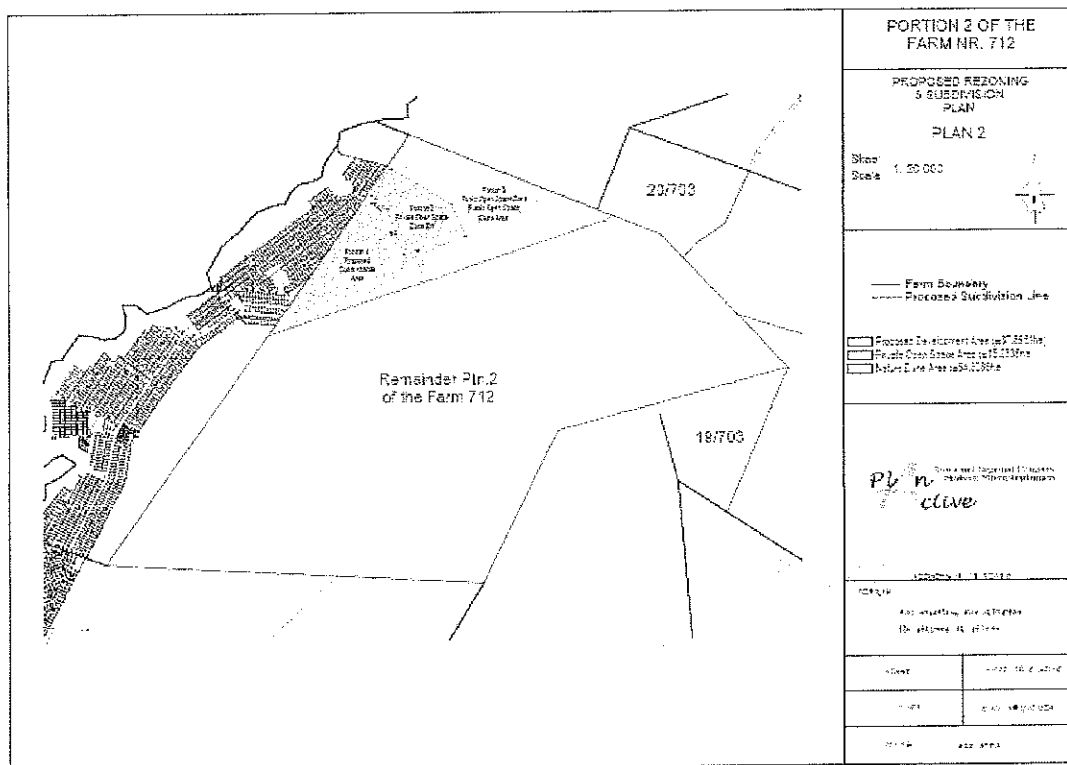


Figure 11. Portion 1 will be developed now as the Khoisan Bay development, with Portion 2 zoned Private Open Space and Portion 3 being zoned as Public Open Space

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>Thamnochorus guthrieae</i> Overberg Dune Strandveld community	94.11	86.45%	31.86	33.85%	61.25	65.08%
1.1	<i>Metastasia 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

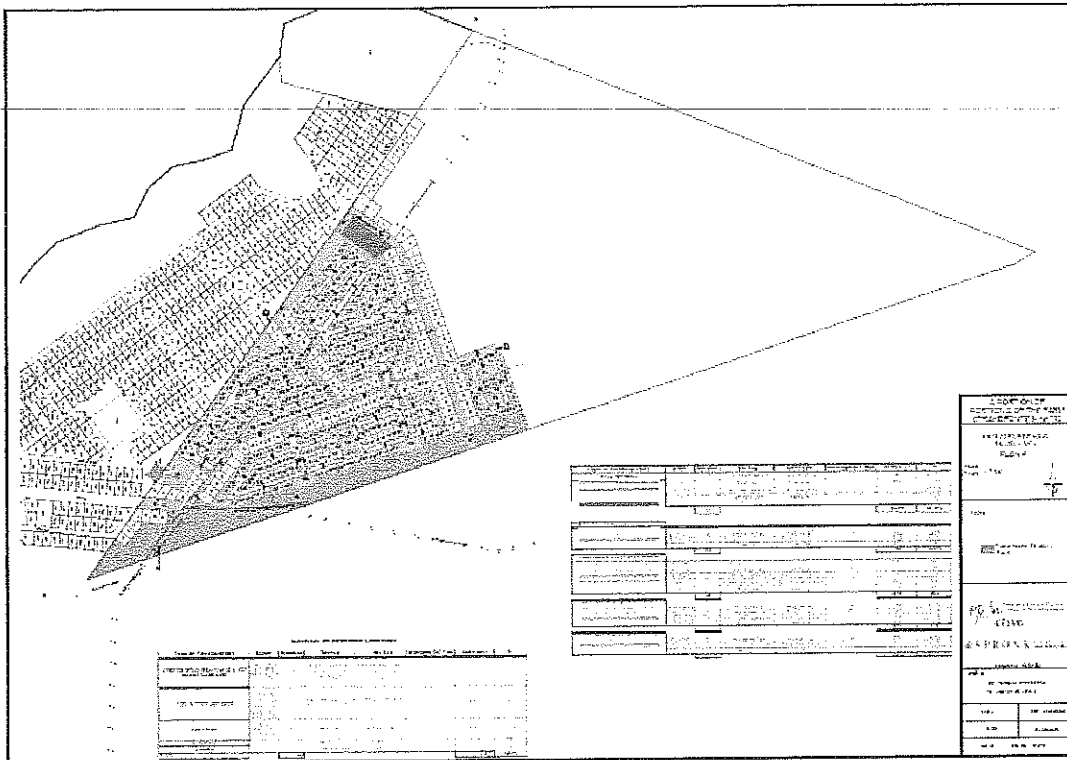


Figure 12. Alternative 3, Phase 1, plot layout with the Public Open Space along the R43 in green.

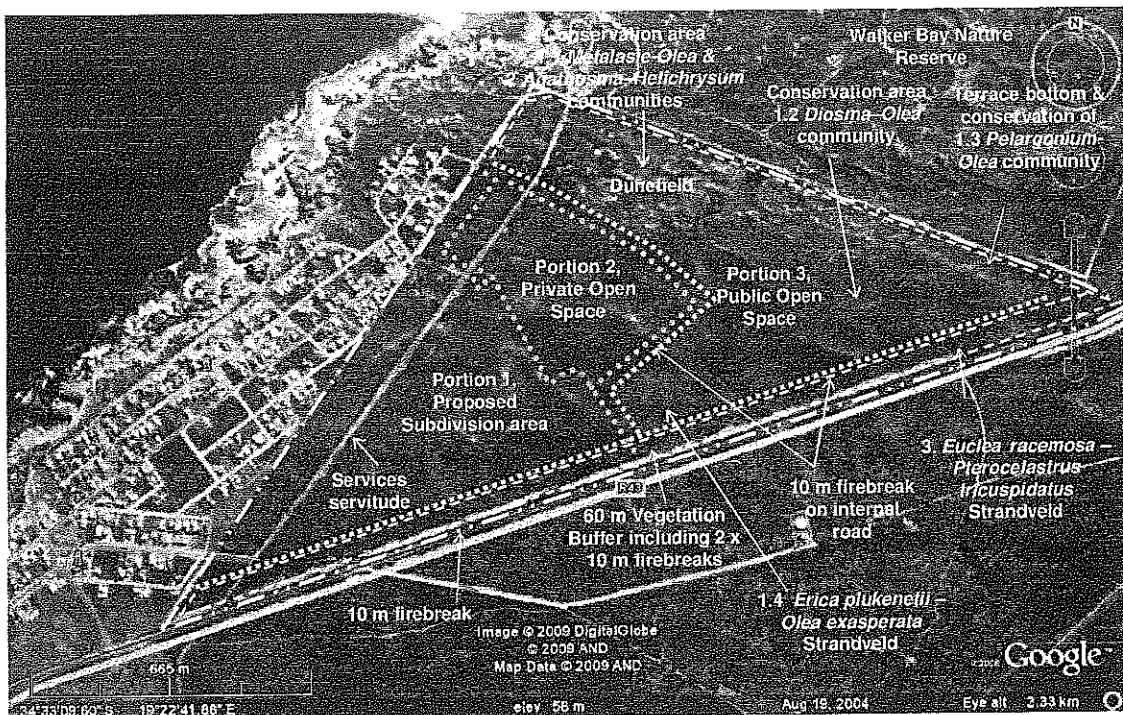


Figure 13. Aerial image of Strandfontein Farm 712 (Portions 1 & 2) showing Alternative 3 Development Option (Portions 1 & 2), together with environmental constraints,

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

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	Irreversibility	Reversibility	Probability	Degree of confidence	Significance	Sum
No Go (status quo)	Loss of biodiversity in South Africa will occur progressively continue over time unless systematic management and enforcement is introduced.	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 flora.	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	Irreversibility	Reversibility	Probability	Degree of confidence	Significance	Sum
Alternative 1: Maximum development of site.	Loss of individuals of all 3 Flies 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	
	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	With	Negative	Medium	Permanent	Local	High	Irreversible	High	High	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	
	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	With	Positive	Medium	Long term	Regional	Moderate	Moderate	Medium	High	High	Medium
	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	Medium	Permanent	Regional	Moderate	No reversal	High	High	High	Med-High negative
			With	Negative	Low	Long term	Local	Moderate	Moderate	Moderate	Medium	High	Medium negative
			Negative	High	High	Permanent	Local	High	Low	Definite	High	High	High
			Negative	Medium	Medium	Medium	Local	Moderate	Moderate	High	Medium	Medium negative	Med-High negative

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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	Irreversibility	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 their situ-ness of a population of <i>Agallosma geniculata</i> . Undertake detailed survey to establish accuracy of RDB spp. data in respect of <i>Agallosma 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	Without	Negative	Medium	Permanent	Regional	High	Irreversible	Medium	Medium	Medium negative	
			With	Negative	Low	Long term	Local	Low	Moderate	Medium	Medium	High	Medium negative	
	Loss of biodiversity in South Africa.	Proclamation of Conservation area as proposed. Vegetation management plan required.	Without	Without	Negative	Low	Permanent	Local	Moderate	Low	Medium	High	Medium negative	
			With	Negative	Low	Permanent	Regional	Low	Moderate	Medium	High	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	Without	Negative	Medium	Permanent	Regional	Moderate	Low	Medium	Medium	Medium negative	
			With	Negative	Low	Permanent	Local	Low	High	Low	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	Without	Negative	Medium	Medium term	Local	Moderate	Low	Medium	Medium	Medium negative	
			With	Negative	Low	Long term	Local	Low	Low	Low	Low	High	Low negative	
Fire hazard present.	Effective management plan enabled. Fire orients 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	Without	Negative	High	Permanent	Local	Moderate	Low	High	High	Med-High negative		
		With	Negative	Medium	Medium term	Site	Low	Moderate	Moderate	Medium	Medium	Low negative	Medium negative	

Alternative	Nature of Impact	Potential Mitigation	With or Without mitigation	Status of the Impact	Intensity / Magnitude	Duration of Impact	Extent of Impact	Irreversibility	Reversibility	Probability	Degree of confidence	Significance	Sum	
Alternative 3: The preferred development option. Mix of 50% 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 to proceed in conservation area, with protection of a population of <i>Alphitonia genicoides</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>Thamnochortis guilfoylei</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	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	Local	Low	Low	Medium	High	Medium negative	
			With	Negative	Low	Permanent	Regional	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. There is a positive mitigation to the present ineffective access control.	Without	Negative	Low	Permanent	Local	Local	Low	Low	Medium	Medium	Medium negative	
			With	Positive	Very Low	Permanent	Site	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	Site	Low	Low	Medium	Medium	Low negative	
			With	Positive	Very Low	Long term	Local	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 the hazard for both entities.	Without	Negative	High	Long term	Local	Local	Low	Moderate	High	High	Med-High negative		
		With	Positive	Very Low	Medium term	Site	Site	Very low	High	Low	Medium	Low positive	Low Negative	

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

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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 \leq biodiversity target	Remaining natural habitat \leq (biodiversity target + 15%)	Remaining natural habitat \leq 60% of original area of ecosystem
A2: Ecosystem degradation and loss of integrity*	\geq 60% of ecosystem significantly degraded	\geq 40% of ecosystem significantly degraded	\geq 20% of ecosystem significantly degraded
B: Rate of loss of natural habitat**			
C: Limited extent and imminent threat	--	Ecosystem extent \leq 3 000ha, and imminent threat	Ecosystem extent \leq 6 000ha, and imminent threat
D1: Threatened plant species associations	\geq 80 threatened Red Data List plant species	\geq 60 threatened Red Data List plant species	\geq 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 high and high threat	Very high and medium threat	Very high 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.

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- 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 Consent Status	1	2	3	8	7	4	9	6	5	No. of occurrences per
Boucher communities		1			2				3	4	39
Zietsman community identification number		3		z.1.	z.1.	z.2.	z.2.		2	3	
No. of species in sample plot		25	19	15	15	11	15	22	22	13	No. of occurrences per
1. <i>Olea exasperata</i>-<i>Muraltia saturoideles</i> Overberg Dune Strandveld Thicket on calcareous sands & calcareous rocks											
<i>Muraltia</i> DC. var. <i>saturoideles</i>	LC	+	+	+	+						4
<i>Cissampelos</i> L.f.	LC	+	+	+	+						3
<i>Helichrysum</i> (L.) D. Don	LC	+	+	+	+						3
<i>Mitrasacme procumbens</i> (L.f.) Loos	LC	1	2b	2a							3
<i>Palargonium capitatum</i> (L.) L'Hér.	LC	+	+	+	+						3
<i>Salvia africana-lutea</i> L.	LC	1	+	+							3
<i>Senecio</i> Thunb.	LC	+	+	+	+						3
<i>Zygophyllum</i> Edd. & Zeyh	LC	+	+	+	+						3
<i>Ehretia</i> J.H. Schult. var. <i>maxim</i> Steud.	LC	2b									2
<i>Cenchrus</i> M.A. Curtis	NE	+									2
<i>Wahlenbergia tenella</i> (L.f.) Lamour.	LC	R									2
1. <i>Olea exasperata</i>-<i>Eragrostis</i> Strandveld Thicket											
<i>Eragrostis</i> (Thunb.) Trin.	LC	+	+								2
<i>Metastela brevifolia</i> (Lam.) Lévyns	LC	+	+								2
<i>Passerina</i> L.	VI	+	+								2
<i>Athanasia</i> (L.) L.	LC	+	+								2
<i>Avena latius</i> L.	NE	2a	+								2
<i>Euphorbia</i> L.	NE	+	+								2
<i>Tetragonia</i> L.	LC	+	+								2
<i>Anem</i> L.	NE	R	+								2
<i>Sebaea aurea</i> (L.f.) Rood. & Schult.	LC		+								1
<i>Bromus</i> Roth	NE	1									1
<i>Cassia parvifolia</i> Sond.	LC	+									1
<i>Cenitella</i> (L.f.) Drude	LC	R									1
<i>Oxyris compressa</i> (P.J. Berquist) A. DC.	LC	+									1
<i>Cynodon</i> (L.) Pers.	LC	+									1
<i>Emex</i> Steinh.	NE	R									1
<i>Fallica aculeata</i> Gray	LC	+									1
<i>Festuca scabra</i> Vahl	LC	+									1
<i>Lagurus ovatus</i> L.	NE	1									1
<i>Palargonium myrtilloides</i> (L.) L'Hér.	LC	+									1
<i>Pennisetum villosum</i> R.Br. ex Fresen.	NE	+									1
<i>Solanum</i> Happer & Jaeger	LC	+									1
<i>Thesia</i> sp.	LC	+									1
<i>Trachyantha</i> (Adanson) Oberm.	LC	+									1
<i>Tridax</i> L.	LC	R									1
2. <i>Olea exasperata</i> - <i>Thamnochortus guthrieae</i> Coastal Dune Fynbos											
<i>Thamnochortus</i> Pillae	LC			2a	+		2a	+			5
<i>Passerina</i> Wikstr.	LC			1	+			+			3
<i>Brucea ornata</i> (L.) Alton ex Eckl.	LC				+			+			2
<i>Cassia nudicaulis</i> L. var. <i>rudicaulis</i>	LC					+	+				2
2.1 <i>Olea exasperata</i>-<i>Metastela muricata</i> Transitional Strandveld to Dune Fynbos											
<i>Metastela</i> (L.) D. Don	LC			1	+						2
2.1.1 <i>Olea exasperata</i>-<i>Moraea cordifolia</i> Transitional Strandveld to Dune Fynbos											
<i>Moraea</i> (L.) Klotz	LC			+							1
<i>Palargonium</i> Clifford ex D.A. Boucher subsp. <i>biguttatum</i> (Harv.) D.A. Boucher	LC			+							1
2.1.2 <i>Olea exasperata</i>-<i>Passerina corymbosa</i> Transitional Strandveld to Dune Fynbos											
<i>Passerina</i> Eckl. ex C.H. Wright	LC							+			1
<i>Lyonia</i> (L.) Druce	LC							R			1
2.3 <i>Olea exasperata</i> - <i>Helichrysum pulchellum</i> Dune Fynbos											
<i>Helichrysum pulchellum</i> DC.	LC						+				1
2.2 <i>Olea exasperata</i>-<i>Diosma subulata</i> Dune Fynbos											
<i>Diosma</i> J.G. Wendt	LC						4	R			2
<i>Thamnochortus</i> Mast.	LC						2a				1
2.4 <i>Olea exasperata</i> - <i>Erica plukenetii</i> Dune Fynbos											
<i>Erica plukenetii</i> O.B. Clark	VI							3			1
<i>Erica plukenetii</i> L. subsp. <i>plukenetii</i>	LC							+			1
<i>Trichosiphium stipularis</i> (L.) Brongn.	LC							+			1
3. <i>Olea exasperata</i> - <i>Agathosma geniculata</i> Proto-Limestone Fynbos											
<i>Agathosma</i> (L.) Wild	NT	+							2a		2
<i>Helichrysum</i> (L.) Wild	LC								+		1
<i>Koeleria</i> (L.) Sims	LC								+		1
<i>Crocosmia</i> Oudart subsp. <i>expansa</i>	LC								+		1
Widespread species common to the <i>Olea exasperata</i>-<i>Pteroclestrus</i> communities in the study area											
<i>Olea exasperata</i> Jacq.	LC	+	2a	3	+	4	2a	+	1	3	9
<i>Pteroclestrus</i> (Lam.) Walp.	LC	2a	2a	1	+	1	+	+	1	1	9
<i>Calopse viminea</i> (Roth) H.P. Linder	LC	+	+	2b	1	2a	2a	2a	2a	2a	9
<i>Phytolacca</i> (L.) Fernald	LC	+	+	+	1	+	+	+	+	+	9
<i>Phytolacca calocoma</i> H.P. Linder var. <i>brun</i> H.P. Linder	VI										0
<i>Phytolacca</i> (L.) var. <i>encolpe</i>	LC	+	+	1		2a	1	2a	2a	1	6
<i>Ischyrolophus elaeocharis</i> (Mast.) H.P. Linder	LC	+	+	1	1		2b	+	2a	1	6
<i>Passerina</i> Wikstr.	LC	+	+	2a			+	2b	+	2a	8
<i>Indigofera</i> (DC.) E. Mey	LC	+	+	+	+		2a	+		2b	7
<i>Euclea</i> Murray	LC	1	2b	1	+	+		1	1	1	7
<i>Cassia</i> L.	LC	+	+	+		2b		+	1	1	6
<i>Searsia</i> (Thunb.) Moffett	LC	+	1	1	1			1			6
<i>Sesago</i> L.	LC	+	+	+	1	+		+	+		6
<i>Otholobium</i> (Eckl. & Zeyh.) C.H. Schr.	LC	+	+		1			+		2a	5
<i>Acacia</i> A. Cunn. ex G. Don	NE	3	4				R				4
<i>Arthropemum</i> L.	LC	+		+					+		4
<i>Carpobrotus</i> (L.) L. Bolus	LC	+		+			+		+		4
<i>Cassipoula ciliolata</i> Naes	LC						+	+	+		4
<i>Chrysanthemoides monnifera</i> (L.) Nolt	LC	+	+		1						4
<i>Jamneirostris albanarginata</i> Hilliard	LC	R	+					+			4
<i>Koeleria</i> (Steud.) Nees	LC	+					1	+			4
<i>Tephrosia</i> (Jacq.) Pers.	LC	+	+		+			+			4
<i>Chironia</i> L.	LC			+				+			3
<i>Metastela dense</i> (Lam.) P.O. Karis	LC	+	+								3
<i>Searsia</i> (L.) F.A. Barkley var. <i>villos</i> (L.f.) Moffett	LC	+	+								3
<i>Rhus</i> L.	LC	+	+					+			3
<i>Cratogeomys</i> (Thunb.) Benth	LC	+		+							3
<i>Commersonia pugniformis</i> (L.) N.E. Br. subsp. <i>maif</i> Itenfi & Gerstaecker	LC	+					+				2
<i>Euphorbia</i> Boiss.	LC			+				+			3
<i>Palargonium berolinum</i> (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	<p>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.</p> <p>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.</p> <p>Low: The activity is localised and might have a negligible cumulative impact.</p> <p>None: No cumulative impact on the environment.</p>

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, Klipmuts, Lourens, Molenaars, Mosselbank, Olifants (WC), Palmiet, Riebeeck, Riviersonderend, Silvermine, Sir Lowry's Pass, Spoornekloof, Swart and Witels in the Fynbos Biome as well as Lower Orange in South Africa, Senqu, Senquyane, 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

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