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Pri.Sci.Nat # 400045/08

CONSERVATION MANAGEMENT PLAN FOR MUNICIPAL LAND ON HARTENBOS HEUWELS, MOSSEL BAY, WESTERN CAPE.

Compiled for: CapeEAPrac, George

Client: Mossel Bay Municipality

18 October 2017

DECLARATION OF INDEPENDENCE

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 Vitae.

I, N.A. Helme, 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.

NA Helme

Abridged CV:

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University of Cape Town, South Africa. BSc (Honours) – Botany (Ecology & Systematics). 1990.
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Since 1997 I have been based in Cape Town, and have been working as a specialist botanical consultant, specialising in the diverse flora of the south-western Cape. Since the end of 2001 I have been working on my own and trade as Nick Helme Botanical Surveys.

A selection of work undertaken over the last few years is as follows:

- Botanical assessment of Highlands Estate, Hartenbos (Sharples Environmental 2017)
- Botanical baseline assessment of Aalwyndal erven 176 & 177, Mossel Bay (Sharples Environmental 2017)
- Botanical assessment of proposed expansion of De Keyser Bentonite Mine, Heidelberg (Eco Impact Legal Consulting 2016)
- Botanical assessment of proposed development of Erf 3122, Hartenbos Heuwels (Strategic Environmental Focus 2016)
- Botanical assessment of Klipfontein farm, Stilbaai (Wild Rescue 2016)
- Botanical assessment of proposed dam on Portion 1 of Farm Kampshoogte 138, Riversdale (Cederberg Environmental Assessment Practise 2015)

- Ecological assessment of proposed Arcelor Mittal power station, Saldanha (ERM 2015)
- Ecological assessment of proposed Globeleq power station, Saldanha (ERM 2015)
- Botanical assessment of proposed iGas pipeline Saldanha – Ankerlig (CES/ EOH 2015)
- Botanical baseline of Communicare land, Morningstar (mlh architects 2015)
- Ecological assessment of proposed refurbishment of 11kV powerline from Kleinmond to Arabella, Western Cape (Landscape Dynamics 2015)
- Botanical walkdown study of new Eskom 132kV powerline Ankerlig – Sterrekus (EIMSA 2015)
- Botanical assessment of Remainder of Farm Rietfontein 244, Piketberg (Cederberg Environmental Assessment Practise 2014)
- Botanical assessment of Remainder of Farm Draaihoek 293, Vredendal (Cederberg Environmental Assessment Practise 2013)
- Botanical assessment of Farm Gideonsooord 303, Klawer (Cederberg Environmental Assessment Practise 2013)
- Botanical assessment of Farm Patrysberg 344/1, Citrusdal (Cederberg Environmental Assessment Practise 2013)
- Scoping study of Proposed Wind and Solar Energy Facility near Laingsburg (CSIR 2011)
- Scoping and Impact Assessment of Proposed Wind Energy Facility near Swellendam (CSIR 2010 & 2011)
- Scoping and Impact Assessment for proposed development on Rheeboksfontein 142, Groot Brak (Sharples Environmental 2010)
- Assessment of proposed Buffelsfontein sand mine, Albertinia (Tiptrans Resources 2009)
- Botanical Assessment of proposed Eskom Gourikwa – Proteus transmission lines (Savannah Environmental 2008)
- Botanical Assessment for Eskom powerline Swellendam – Riviersonderend (SHE Cape 2006)
- Scoping and Impact Assessment of Eskom OCGT Mossel Bay site and powerline to Proteus substation (Ninham Shand 2005)

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1. INTRODUCTION

In terms of the Environmental Authorisation (dated 1 June 2015) for the Extension of Sonskynvallei Phase 3, Hartenbos, a Conservation Management Plan (CMP) needs to be drafted for all the remaining, undeveloped Municipal Land in the area. The required study area includes the following Municipal Land: a Remainder of Portion 59 of Farm 217, plus Erven 1852 and 1853, Mossel Bay, as per Figure 1. This total immediate study area is 166.5ha, but an additional area was looked at, as shown in Figure 2, which include an additional 190ha. The additional areas are a mix of private and possibly Municipally owned erven, and were included as they are adjacent to the study area, or are logical open space extensions to the core study area, and their eventual inclusion may facilitate ecological management of the area. One of these areas is a 30ha portion of Portion 4 of Farm 217 (see Figure 2), which the owners (ATKV) have recently decided (Sep 2017) they want to donate to form part of the greater Municipal conservation area.

Figure 1: Map showing the primary (core) study area (as provided by EAP), consisting of three municipal erven. The total core study area is 166.5ha.

Figure 2: Map showing the 370ha overall study area, as determined by the author. The recently proposed 30ha donation (Ptn of Ptn 4 of Farm 217) by the ATKV is also shown.

2. TERMS OF REFERENCE

The terms of reference for this study were as follows:

- undertake a site visit to survey any areas not previously visited in detail
- discuss the area and its management with the relevant Municipal official/s
- draft a Conservation Management Plan (CMP) for the site, which will include the following:
    - An overview of the vegetation on site, its key ecological drivers, and key ecological features, including any plant Species of Conservation Concern
    - Identification and mapping the invasive alien plant species on site, plus recommendations for control of these on a permanent basis
    - Discussion on activities that could be allowed within the conservation area, and those that should not be allowed, or allowed only under special circumstances
    - Discussion on the need for fire management, highlighting its ecological role
    - A suggested program for the key interventions required, including who should be responsible for these actions.
    - Discussion and identification (mapping) of key portions of remaining natural vegetation on all adjoining portions of land (including private

erven), with an emphasis on how these should be included in the CMP going forward.

3. LIMITATIONS, ASSUMPTIONS AND METHODOLOGY

The most recent site visit was undertaken on 7 August 2017, at a time when the vegetation was extremely dry and drought stricken. As a result almost no flowering was evident, and almost no bulbs or annuals were observed. Four previous site visits were undertaken in the period 2009 to 2016, in various seasons, and a good understanding of the vegetation in the area was obtained during these five site visits. On the latest site visit the author walked transects across representative portions of the study area, and walked around much of the perimeter of the core and greater study areas. All identifiable plant species were noted, and digital photographs of certain plants and various features were taken. Voucher specimens of significant plant species were made, and have been lodged in the Compton Herbarium at Kirstenbosch. GPS coordinates were taken at various points and were used together with habitat notes to groundtruth and interpret the available satellite imagery on Google Earth, the most recent of which is dated May 2016. Sufficient detail was evident to be able to assess the overall conservation value and plant community composition of the site, and confidence in the accuracy of the botanical findings is high.

Reference was made to the GIS based database of rare plant localities maintained by CREW (Custodians of Rare and Endangered Wildflowers, based at Kirstenbosch), to the Red List of South African plants (Raimondo *et al* 2009) and its annual online updates at redlist.sanbi.org, and to various other references noted in the following sections.

Conservation value of habitats are a product of species diversity, plant community composition, rarity of habitat, degree of habitat degradation, rarity of species, ecological viability and connectivity, vulnerability to impacts, and reversibility of threats.

Various municipal officials and Fire Protection Association representatives were emailed the study area maps and an outline of the work plan, with a request for any inputs, but replies were few, and lacking in any substance, and the author has thus proceeded on the basis that they have nothing to add.

4. STUDY AREA AND REGIONAL CONTEXT

The site is mapped as part of the Southern Fynbos bioregion (Mucina & Rutherford 2012), and is part of the Fynbos biome, located within what is now known as the Core Region of the Greater Cape Floristic Region (GCFR; Manning & Goldblatt 2012). The GCFR is one of only six Floristic Regions in the world, and is the only one largely confined to a single country (the Succulent Karoo component extends into southern Namibia). It is also by far the smallest floristic region, occupying only 0.2% of the world's land surface, and supporting about 11500 plant species, over half of all the plant species in South Africa (on 12% of the land area). At least 70% of all the species in the Cape region do not occur elsewhere, and many have very small home ranges (these are known as narrow endemics). Many of the lowland habitats are under pressure from agriculture, urbanisation and alien plants, and thus many of the range restricted species are also under severe threat of extinction, as habitat is reduced to extremely small fragments. Data from the nationwide plant Red Listing process undertaken is that 67% of the threatened plant species in the country occur only in the southwestern Cape, and these total over 1800 species (Raimondo *et al* 2009)! It should thus be clear that the southwestern Cape is a major national and global conservation priority, and is quite unlike anywhere else in the country in terms of the number of threatened plant species.

The original natural vegetation on the site is best classified as Mossel Bay Shale Renosterveld in terms of the SA Vegetation map categories (Mucina & Rutherford 2012). However, the SA Vegetation map is very inaccurate in this particular area and the actual map indicates that Great Brak Dune Strandveld is the vegetation type on site (Mucina & Rutherford 2012), which is clearly incorrect, as this is a thicket vegetation type restricted to coastal sands (which are not present at all in the study area). No extract of the SA vegetation map is thus included in the current report, and a more accurate vegetation map (the Riversdale Fine Scale vegetation map) is included as Figure 3, and is shown as a simplified version in Figure 4.

Mossel Bay Shale Renosterveld is listed as Endangered in terms of the national list of Threatened Terrestrial Ecosystems (DEA 2011), as only 49% of its original extent remains and the unit has a national conservation target of 36% of its original extent, with nothing (0%) formally protected (Rouget *et al* 2004). The vegetation type is thus very poorly conserved and is often vulnerable to further

loss, usually to agriculture, quarrying, and residential development (Rouget *et al* 2004).

The Fine Scale Vegetation Map for the Riversdale Plain (Vlok & de Villiers 2007) is significantly more accurate than the SA Vegetation Map, and shows that the primary vegetation type in the study area is Brandwag Fynbos Renoster Thicket (see Figure 3). This classification reflects the complex, composite nature of the vegetation in this unit – with Fynbos, Renosterveld and Thicket elements. PetroSA Fynbos Renosterveld is not present on site, and this unit occurs just to the west of the study area (Figure 3). It should be noted that this vegetation type has not yet officially adopted or reflected by the SA Vegetation Map.

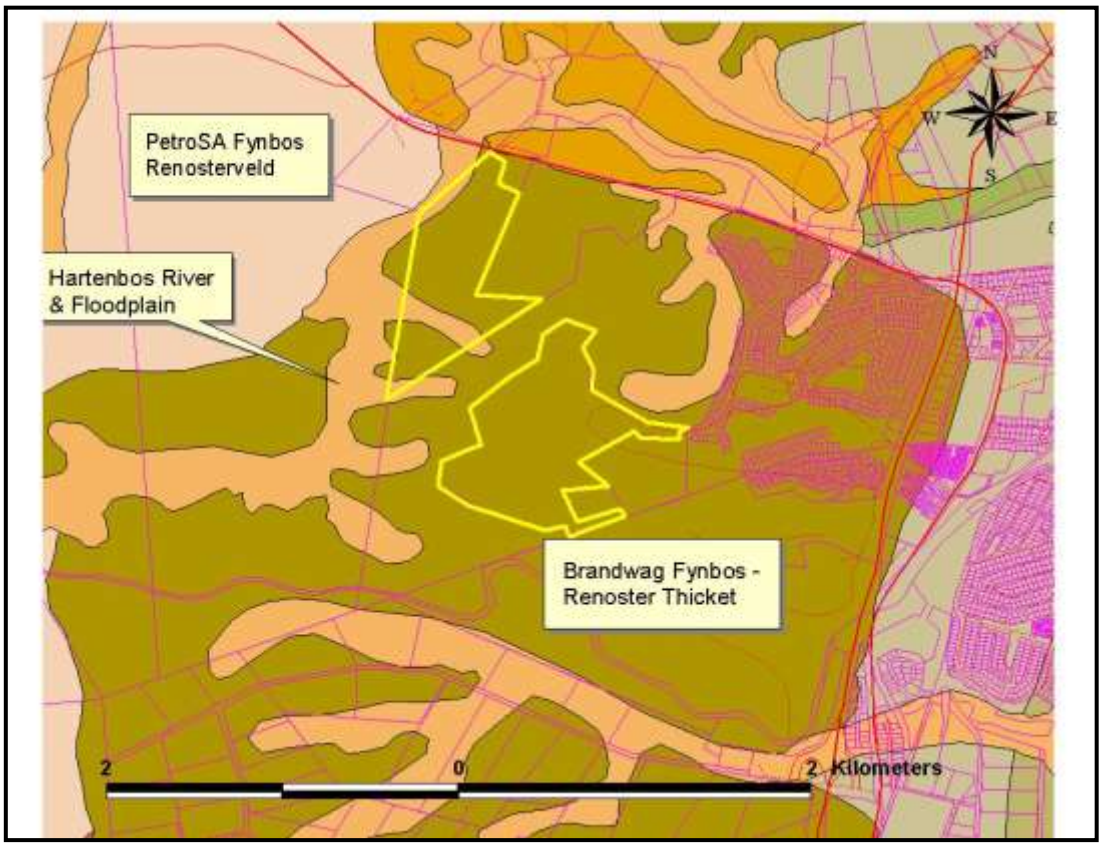

Figure 3: Extract of the Fine Scale Vegetation Map for the Riversdale Plain (Vlok & de Villiers 2007), showing the two ATKV properties (surveyed by Helme in 2012; yellow outline). Brandwag Fynbos Renoster Thicket is the primary vegetation type within the study area. It should be noted that this vegetation type has not yet officially adopted or reflected by the SA Vegetation Map.

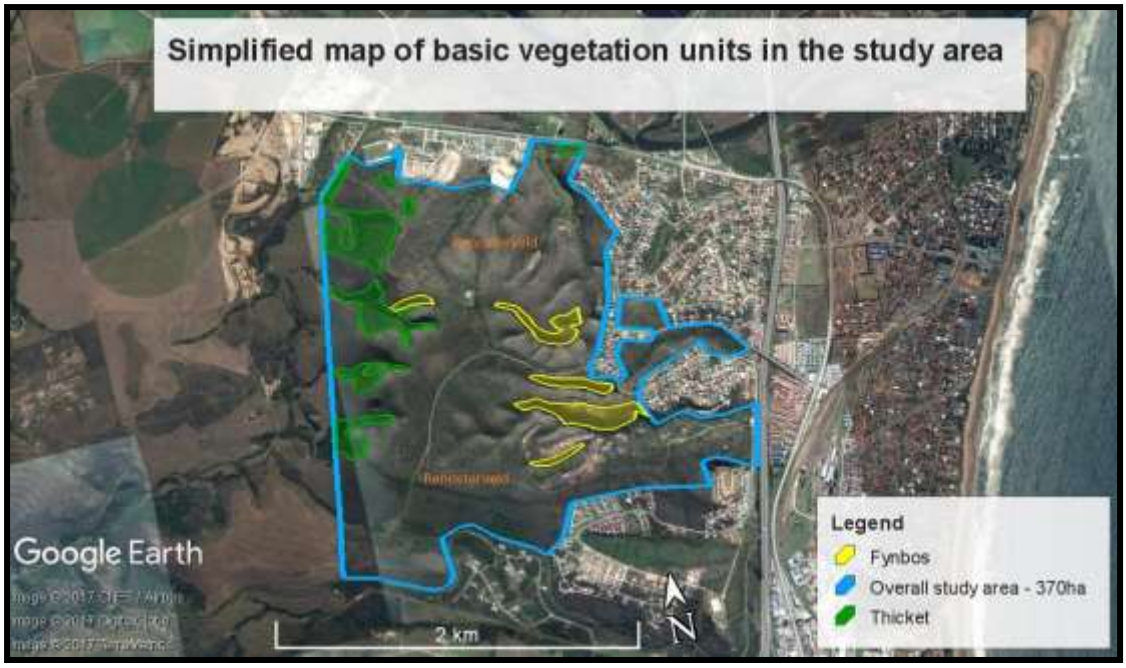

Figure 4: Simplified map of the basic vegetation units on the greater site. All unshaded areas are primarily Renosterveld. Riverine areas and drainage lines are not shown.

The CapeNature Spatial Biodiversity Plan (Pence 2017) indicates that most of Erf 3122 is a designated terrestrial Critical Biodiversity Area or Ecological Support Area (CBA or ESA; see Figure 5).

The soils on Erf 3122 are mostly sandy loams, with the underlying geology being Enon conglomerate. This characteristic formation consists of numerous rounded sandstone pebbles and stones, supported in a matrix of silt, clay and loamy sand, and was originally formed by river deposition. Most of the core study area (about 85%; or about 70% of the greater study area) was burned in a wildfire in about 2009, judging by historical imagery on Google Earth, and by vegetation patterns on site today. The unburnt vegetation is likely to be at least 25 or 30 years old.

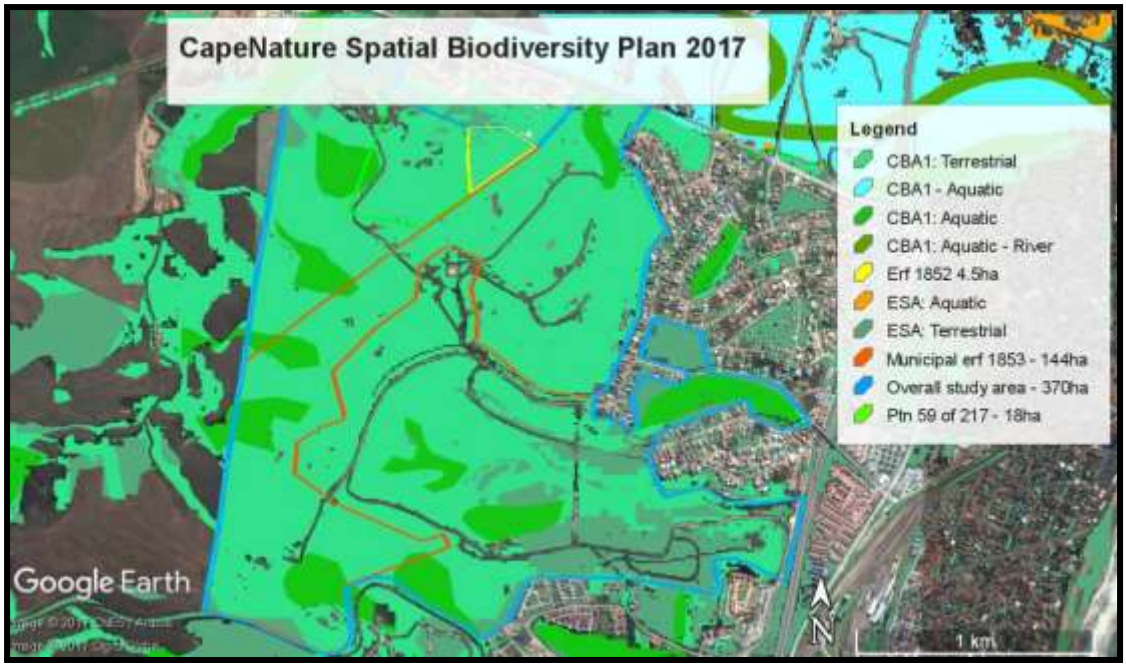

Figure 5: Extract of CapeNature Spatial Biodiversity Plan (Pence 2017), showing that most of the study area is a designated terrestrial Critical Biodiversity Area (CBA; light green shading) or Ecological Support Area (ESA; olive green).

5. OVERVIEW OF THE VEGETATION

The vegetation in the study area is basically a mix of three different types – Thicket, Renosterveld and Fynbos, as shown in Figure 4. The vegetation in the undisturbed areas is species rich, with a diversity of life forms.

Thicket occurs in some of the kloofs and on some of the warmer (north and northwest facing) slopes, often on stony soils (see Plate 1). The primary factor limiting the spread of the Thicket is probably fire, and in the long term absence of fire the Thicket is likely to spread into the Fynbos and Renosterveld areas. As its name implies the unit is typically dense, and often spiny. Common Thicket elements here include *Searsia pallens, S. lucida, Euclea undulata, Carissa bispinosa, Schotia latifolia, Asparagus lignosus, A. striatus, A. mucronatus, Gymnosporia buxifolia, Gasteria carinata, Carpobrotus acinaciformis, Euphorbia burmanii* and *Aloe ferox.*

Fynbos typically occurs on the cooler, south and southeast facing slopes (Plate 2), or where there is a higher quartzite component to the soils (rather than clays). Typical species include *Protea lanceolata, Leucadendron salignum, Bobartia robusta, Erica peltata*, *Restio helenae, R. capensis* and *Tritoniopsis antholyza.*

Renosterveld is the dominant vegetation type in the study area, and is characterised by species such as *Elytropappus rhinocerotis, Oedera genistiifolia, Metalasia acuta*, *M. pungens, Eriocephalus africanus, Hyparrhenia hirta*, *Falkia repens, Selago glutinosa, Hermannia saccifera* and *Hermannia lavandulifolia.* Geophytes (bulbs) are a notable feature of this unit, and quite a number of succulents are present.

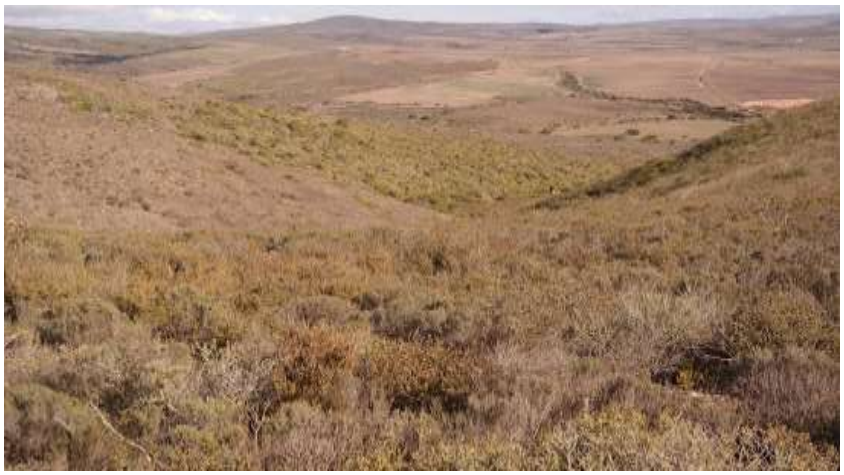

Plate 1: View of Renosterveld (foreground) on the western slopes, with darker green Thicket in the valley below.

Plate 2: View of Fynbos dominated southeast facing slopes (foreground), with Renosterveld on the drier north facing slopes (background). Scattered alien rooikrans (*Acacia cyclops*) is evident in the background.

Plate 3: View showing heavy drought related mortality of *Protea lanceolata* on site (dead shrubs in foreground), with a Fynbos plant community. There is a dense patch of alien rooikrans (*Acacia cyclops*) in the background, at right.

The vegetation within the previously disturbed areas is characteristically different from that found in the undisturbed areas. Firstly, species diversity is significantly lower, being about 15-30% of that which one finds in the undisturbed areas. Secondly, the disturbed areas are heavily dominated by a few species, such as *Elytropappus rhinocerotis* (renosterbos), *Hyparrhenia hirta* (thatching grass), *Falkia repens, Selago glutinosa, Hermannia saccifera* and *Hermannia lavandulifolia*, all of which are typical indicators of disturbance (pers. obs.). Thirdly, plant community composition is very different, with very few succulents or bulbs in the disturbed areas (these are common in undisturbed areas), and an almost total absence of large woody shrubs such as *Searsia, Euclea* and *Diospyros*, all of which are common in the undisturbed areas. No rare or threatened plant species were found in significant numbers within the disturbed areas. The old municipal dump site in the northeastern part of the study area is heavily dominated by alien invasive kikuyu grass (*Pennisetum clandestinum*).

Plate 4: Garden refuse is being regularly dumped here, in the southern part of the study area (Erf 1853), evidently by the Municipality. As a result numerous alien invasive plants, brought in with the refuse, are establishing a foothold here, and this practise should thus be stopped.

Plate 5: Alien invasive *Hakea sericea* in the northeastern part of the study area on the ATKV erf. This dense stand over about 1ha has not yet spread, but should be removed as a priority, as it has the potential to spread throughout the area.

Woody alien invasive vegetation is common on parts of the study area, notably in areas where previous soil disturbance has taken place, such as along roads and pipelines, within old or current dump sites, and around reservoirs. The most densely invaded areas on site are mapped in Figure 6, and these are the areas where alien plant cover is greater than 50%. The most common invasive is rooikrans (*Acacia cyclops;* makes up 80% of the alien cover on site; covering an estimated 10ha in total), but other invasives less common on site include *Hakea sericea* (silky hakea; covering <1ha), *Acacia mearnsii* (black wattle; <0.5ha) and *Acacia saligna* (Port Jackson; <1ha). *Plantago lanceolata* is the commonest alien herb on site, and the alien *Pennisetum clandestinum* (kikuyu grass) is the most

common invasive grass (especially around and on dump sites). Fortunately both *Acacia saligna* and *Acacia cyclops* have been infected with biocontrol agents, and seedset has consequently been much reduced. In the case of the former, seedset is now virtually zero, and for the latter it is probably down to about 25-30% of what it would have been in the absence of biocontrol. It should however be noted that there is likely to be a very large and still viable soil stored seedbank for both these species, which will typically germinate after a fire.

Figure 6: Simplified map showing High alien invasive plant density (>50% cover) on site. All unshaded areas within the greater study area support Low (<10% cover) or Medium (10-40%) alien plant density.

5.1 Plant Species of Conservation Concern

Various rare and/or localised plant species (Species of Conservation Concern; SCC) have been recorded within the greater study area over the years, and there is a low – moderate of other SCC being present in parts of the site (but as yet unrecorded).

Mossel Bay Shale Renosterveld is known to support a number of rare and threatened *Haworthia* species (Bayer 1999; Mucina & Rutherford 2006), and these small, highly cryptic succulent plants could well be present on the undisturbed parts of the site. *Ruschia leptocalyx* (Plate 6) is a rare succulent Red Listed as Endangered (Klak *et al* 2012), and was recorded along the edges of

thicket patches in the northern parts of the study area. *Polygala pubiflora* is a small shrub Red Listed as Vulnerable (Helme & van der Colff 2016), and was also recorded along the edges of thicket patches in the northern parts of the study area. A still unidentified *Lotononi*s (Fabaceae) was recorded on Erf 1853, and may prove to be a localised, undescribed species (Dr. S. Boatwright – pers. comm.). *Ruellia pilosa* is a regional endemic (Swellendam to Mossel Bay) and is Red Listed as Vulnerable (Raimondo *et al* 2009), and may be present in low numbers on the undisturbed parts of the site.

Plate 6: *Ruschia leptocalyx* is a rare vygie only known from 5 localities in the southern Cape, and is Red Listed as Endangered, and was recorded in low numbers in the northern party of the study area.

5.2 Ecological Drivers

Fire is acknowledged to be one of the primary drivers within Renosterveld (Helme & Rebelo 2016a) and Lowland Fynbos (Helme et al 2016) habitats. About 70% of the greater study area burned in 2009/2010, including much of the Fynbos and Renosterveld. In the absence of fire for longer than 15 years the Fynbos and Renosterveld vegetation is likely to become senescent, meaning increased woodiness, lack of flowering opportunities for smaller, faster growing species, and general suboptimal ecological dynamics. The increased fuel load that develops over a long period also makes the risk of a runaway wildfire in these units much higher.

Fire is however generally not a major driver of Thicket dynamics, and is not essential for maintaining optimal ecological health in this unit (Euston Brown 2016). Thicket will burn under extreme conditions (such as strong bergwinds), but fire typically burns up to the edges of dense Thicket and does not penetrate

the main patches of Thicket. Thicket recovery after fire is often slow, and may take ten years for full recovery.

Soil moisture and soil type also influence the vegetation patterns on site. Soil moisture on slopes is also related to aspect, with northern aspects being much drier than southern aspects. The drier north facing slopes typically support Renosterveld or Thicket, and Fynbos is generally restricted to the cooler, southern aspects (see Plates 1 & 2). Stonier slopes tend to support more thicket, which is better adapted to the drier conditions, and Thicket is also supported by the reduced incidence of fire in these stonier habitats.

Ecological connectivity is important for the maintenance of ecological integrity in all natural habitats (Helme & Rebelo 2016), and as much open space connectivity should be maintained on this site as possible.

6. ECOLOGICAL MANAGEMENT ISSUES

The primary ecological/conservation management issues on the greater site are the following, and are addressed in more detail in Section 7:

1. Alien invasive plant management
2. Fire management
3. Control of offroad vehicles / unauthorised access
4. Dumping of garden refuse (both municipal and informal)
5. Management of the urban edge *i.e.* the area bordering on development.

7. CONSERVATION MANAGEMENT PLAN

Three issues need to be tackled as immediate priorities, in order to improve and safeguard the natural habitat on site:

1. alien invasive plant management,
2. control of offroad vehicles / unauthorised access, and
3. dumping of garden refuse on site.

Once these issues have been dealt with management will need to focus on fire management, as much of the vegetation on site needs to be burnt once every 10-15 years, and much of it was last burnt about 7 years ago.

By far the biggest and most important management task is Task 1 - alien invasive plant management.

7.1 Alien invasive plant management

Approximately 22ha of the core study area, and a further 49ha within the greater study area, are mapped as supporting high density alien invasive vegetation. The majority of the latter is within private erven owned by the ATKV and by Joao do Nova Beleggings (Pty) Ltd., and both are currently going through the environmental authorisation process for urban development, and both should thus be required to remove and manage all invasive vegetation on the open space on their properties, which is what is here assumed will happen. For purposes of this management plan only the 166ha Core Area is discussed in any further detail.

Target 1: Total removal of all woody invasive alien vegetation within the 166ha Core Area by December 2020.

Responsibility: Municipality (landowner)

Justification: Woody alien invasive vegetation is the primary threat to the natural vegetation on the site, and is actively spreading. Landowners are legally obliged (in terms of the Conservation of Agricultural Resources Act and NEMBA) to manage and remove all listed alien invasive species from their land. Dense woody alien invasive vegetation also increases the fuel load, and can burn substantially hotter than indigenous vegetation, leading to biodiversity loss, soil damage and resultant erosion, and potentially uncontrollable veld fires that threaten private property.

Methodology: Initial clearing of all woody alien invasive vegetation (including *Hakea sericea, Acacia mearnsii*, *Acacia cyclops, Acacia saligna, Ricinis communis* (castor oil bush)*, Opuntia ficus-indica* (prickly pear), *Lantana camara, Cassia sp., Myoporum sp* (manitoka). and *Agave* spp.) must be undertaken throughout the site by December 2020, and thereafter annual follow-up will be required, in order to deal with seedlings and possible resprouts, plus re-invasion. No heavy machinery (such as bulldozers or loaders) should be used for the clearing (as soil disturbance facilitates spread of alien vegetation), and a properly trained and equipped, local alien clearing team should undertake the work. Stems should be cut with chainsaws, saws or loppers (depending on size) at or close to ground level. Cut material should be transported off site to a suitable organic dump, or else all seed capsules must be collected in bags and burnt, to prevent them setting seed on site, and stems can then be stacked on site. Appropriate herbicide (such as Garlon), treated with dye (to indicate which stems have been treated), should be hand painted on to all cut stems (except for *Acacia cyclops*, which seldom resprouts) within ten minutes of felling, in order to prevent resprouting.

No herbicide should be sprayed anywhere within the study area, due to negative impacts on adjacent, indigenous plants.

Alien clearing should be undertaken in convenient blocks of about 5-20ha, depending on the density of the aliens therein, and depending on the topography. The size and position of the blocks should be decided by the Municipal site manager, in conjunction with the clearing contractor.

Primary alien clearing should be undertaken first in areas of Low and Medium density, and the High density areas should be left for last, as this is the most cost effective strategy – rather clear larger, sparsely invaded areas first.
Timing: Initial clearing of entire site to be done prior to December 2020.
From January 2021, once all primary clearing has been done, annual follow-up work must be done, using the same methodology.
Estimated Cost: Initial clearing of dense woody alien is costly – in the vicinity of R10 000/ha. Light and moderately invaded areas could cost from R1000 – R7000/ha to clear. Follow-up costs may be in the order of R200 – R2000/ha. Labour is the primary costs, followed by transport and materials.

Target 2: Control of alien invasive grass and herbs within the 166ha Core Area by December 2020.
Responsibility: Municipality (landowner)
Justification: Although generally less noticeable than the woody aliens some of these grasses and herbs are also listed as category 1 (NEMBA) invasives, and invade and replace the indigenous biodiversity.
Methodology: The primary areas that need to be focussed on are the two dumps on Erf 1853 – the old one in the northeast, and the current one in the south (see Figure 7). In addition, areas bordering on existing development also need to be managed, as homeowners often dump garden cuttings over their walls into the conservation area, and some of these establish as invasives. The primary focus species should probably be *Pennisetum clandestinum* (kikuyu grass), which is an aggressive invasive in disturbed areas with reduced cover. The northern dump is largely covered with kikuyu, and because of its size (2.4ha) it is probably not feasible to consider removing all the kikuyu from this area, as it is simply likely to take over again in due course, and become and ongoing expense. However, the southern dump is more recent and less heavily disturbed, and could quite easily be rehabilitated, as could the areas bordering on the existing urban development. The potential list of invasive herbs is long, but may include

Tropoaelum sp. (nasturtium), *Echium* spp (Patterson's curse), *Lavatera* spp. (hollyhocks), *Plantago lanceolata* (ribwort), *Lolium* (ryegrass), *Bromus diandrus* (ripgut brome), *Senecio pterophorus, Plectranthus neochilus* and *Trifolium angustifolium*.

Manual removal of the invasive herbs is usually the best method. Plants should be placed directly into refuse bags and taken to an authorised organic dump for disposal.

Removal of kikuyu grass is more difficult, as the species has a strong underground stem, and hence needs to be sprayed with an appropriate herbicide. Spraying should only be undertaken by trained personnel, on a windless day without rain, and should not be undertaken within about 2m of extensive indigenous vegetation.

Timing: Ongoing, annually.

As many of these plants are annuals they should be removed when they are visible above ground, but before they set seed (so as to avoid spreading seed). The timing of this is dependent on the local rains – they normally mature two to three months after the first good rains.

The best time to spray kikuyu is typically autumn (April) and spring (September).

Estimated Cost: Initial clearing of dense woody alien is costly – in the vicinity of R10 000/ha. Light and moderately invaded areas could cost from R1000 – R7000/ha to clear. Follow-up costs may be in the order of R200 – R2000/ha. Labour is the primary costs, followed by transport and materials.

Figure 7: Map showing the position of the two dump sites on Erf 1853, plus two offroad vehicle tracks accessing the site.

Target 3: Closing of garden refuse (southern) dump on Erf 1853 and site rehabilitation

Responsibility: Municipality (landowner)

Justification: This dump, in the middle of otherwise largely pristine Renosterveld, is inappropriate, as it leads to direct habitat loss and is a source of alien invasive plant material.

Methodology: Due to the large amount of concrete and soil dumped on site it is probably not feasible to remove and rehabilitate the northern dump on Erf 1853, but the southern dump is smaller and consists mostly of organic refuse from Hartenbos and surrounds (see Plate 4), and can be relatively easily rehabilitated. The Municipality should stop dumping here as a matter of urgency, and should commission an appropriate alternative site that is not in the middle of a high conservation priority natural area, nor within w wetland buffer area. The existing plant material on the dump site could be burned, which should obviously be undertaken only under appropriate and well controlled conditions. Once burned, ongoing alien invasive plant management will be required on a six monthly basis, and provided this is done the site should rehabilitation naturally over a period of about ten years, as there is ample surrounding natural vegetation to provide source material for the rehabilitation.

Timing: Municipal dumping at the southern site should cease by 1 January 2018. The material should be burned by end March 2018, and alien invasive plant

management needs to be undertaken on site every six months on an ongoing basis.

7.2 Control of offroad vehicles / unauthorised access

It is clear that offroad vehicles currently and increasingly use the area, as can be seen in Plates 7 and 8. There are currently at least three tracks that provide access to the core study area, two of which are shown in Plates 7 and 8 and in Figure 7. The track shown in Plate 7 is exceptionally steep, and was created in early 2017, as it is not visible in November 2016 satellite imagery. The track crosses a sensitive drainage line and then heads straight up a long slope. Because it heads straight up the slope it could rapidly become heavily eroded, which may be difficult to control due to the stony ground.

Plate 7: This offroad vehicle track on Erf 1853 is recently created (early 2017), and should be closed down and rehabilitated, as it is very steep and will lead to long term erosion problems. The track is shown in Figure 7 as New Track 1. The lower gradient western portion of this track (not in picture) is on the Portion of Portion 4 of Farm 217 that the ATKV wishes to donate.

Target 4: Prevention of unauthorised offroad vehicle access, and rehabilitation of certain existing illegal access tracks.

Responsibility: Municipality (landowner)

Justification: A proliferation of illegal offroad vehicle tracks is not only visually unappealing, but will lead to long term soil erosion problems, which could facilitate possible alien plant invasion.

Methodology: Close off existing tracks (including the two shown in Figure 7) with appropriate steel roadside barrier, or similar. In the case of the track shown

in Plate 7 care should be taken to minimise soil and vegetation disturbance when undertaking this work, as this is an otherwise pristine area that is highly sensitive (part of which is a wetland).

Timing: To be completed by 14 December 2017.

Estimated Cost: Unknown, but should not be costly (<R5000).

Plate 8: Steep and eroded access to the area, caused by offroad vehicles, going west, off Kameeldoring Avenue.

7.3 Fire Management

Once the previously discussed issues have been largely dealt with the primary ongoing management task will be fire management. As noted, all the vegetation units (Fynbos & Renosterveld) on site, other than the Thicket, are fire driven systems, meaning that they are adapted to regular fire, and require regular fire for optimal ecological functioning (Helme & Rebelo 2016, Helme & Rebelo 2016a). Optimal fire frequency in these sorts of Fynbos and Renosterveld systems is anywhere from once every 10 years to once every 15 years (Helme & Rebelo 2016, Helme & Rebelo 2016a). The last fire in most of the study area was in late 2010 or early 2011, so these areas do not need to burn again until after 2020. The 2011 fire is estimated to have covered about 90% of the core study area, and about 60% of the greater study area (see Figure 8). The only part of the core study area that did not burn in 2011, and which would benefit from a burn, is the northeast corner of Erf 1853. The pockets of Thicket vegetation in the western parts of Erf 1853 and Ptn 59 of 217 that did not burn in 2011 do not require fire for optimal ecological functioning, and thus do not need to burn.

The Core Area has been divided up, for purposes of this plan, into eleven fire management zones (see Figure 9). The map includes the main Thicket patches, but it should be noted that these do not require fire, and no attempt should be made to burn them. The smallest of these zones is 10ha, and the largest is 26ha. Zones should not be less than 6 or 7 hectares in extent, as then seed dropped into the burnt area (some species drop their seed only after fire) can be badly impacted by rodents moving in from surrounding unburnt areas. The zones typically extend from a drainage line or valley up the slope to a ridgetop, and in some cases down into the next valley, or to the nearest access track. Fires usually burn fastest upslope, and may struggle to burn downslope in the absence of wind, and management fires are thus usually started in the valleys.

Before any controlled fires are undertaken on site the appropriate firebreaks should be prepared. Firebreaks should not be necessary everywhere and are most important in areas adjacent to existing development, and along ridge tops where there are fire management boundaries and/or access tracks. The proposed burning sequence would be to burn just one of the management units every year, starting with Unit 1, in 2019.

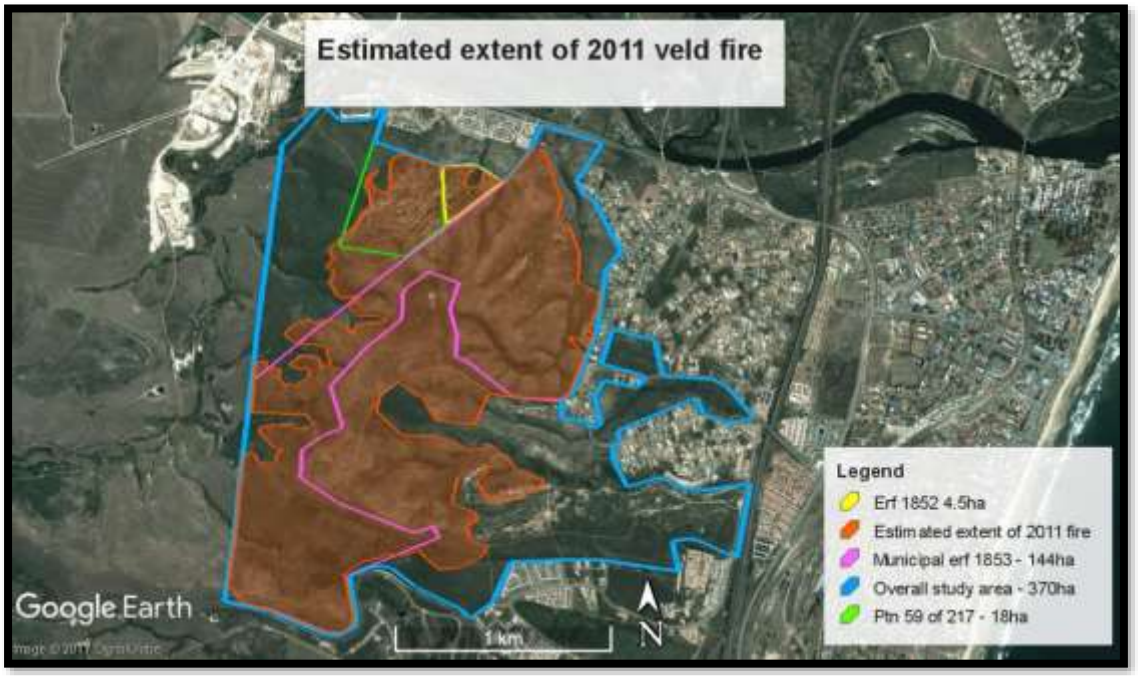

Figure 8: Map showing estimated extent of fire in early 2011. This is based on interpretation of March 2011 satellite imagery and may not be totally accurate.

Figure 9: Map of the eleven proposed fire management zones in the Core Area.

Target 5: Managed burning of all Fynbos and Renosterveld in the Core Area on a rotation of approximately 11 years duration.
Responsibility: Municipality (landowner), in conjunction with local FPA
Justification: Fynbos and Renosterveld vegetation units are adapted to regular fire and should be burnt once every 10-15 years for optimal ecological functioning, and to limit build-up of dry fuel load that could facilitate the spread of runaway wildfires.
Methodology: The Core Area has been divided up into 11 proposed fire management units. The demarcation of these units (and indeed this entire fire plan) is open to input from the local Fire Department and the local Fire Protection Association (FPS), of which the Municipality should be a signed-up member.

The Municipality should secure all relevant permission to undertake controlled burns on site on an annual basis, and should inform neighbouring landowners beforehand. They should also secure the help of the local Fire Department and the local Fire Protection Association (FPS) to actually undertake the controlled burning, perhaps assisted by CapeNature, if they have capacity.

Firebreaks at least 5m wide should be brushcut along the upper edges of the fire management units prior to any controlled burns in that unit, and especially where these border on developed areas. No firebreaks should be necessary along

drainage lines, where these form the lower edge of the management units. Soil should not be disturbed in these operations, and hence firebreaks should not be ripped, skoffeled or graded, as this will facilitate the spread of alien invasive plants. All woody alien invasive plants must be removed from areas to be burnt at least one year prior to any controlled burns, so that seed falls to the ground and is eaten by rodents prior to the fire, rather than germinating in the post-fire environment (which would be free of rodents for a while).

The season of the controlled burns is an important issue, and is a variable that can be controlled to achieve different outcomes. Vegetation recovery is usually best when the fire occurs at the end of the dry season, just before the rainy season – so as to minimise the time that seed lies around before germinating. This is a year round rainfall area, with peaks in March and October/November, and a good time to burn may thus be in mid to late winter (July – August), so that germination can begin with the early summer rainfall peak.

A suggested block burn sequence is as follows, with the corresponding years in which the block burn should take place (refer to Figure 9 for a map of the blocks):
Block 1 – 2018
Block 2 – 2019
Block 3 – 2020
Block 4 – 2021
Block 5 - 2022
Block 7 – 2023
Block 6 – 2024
Block 11 – 2025
Block 10 – 2026
Block 9 – 2027
Block 8 – 2028

There is a degree of flexibility in terms of which block should be burned in which year, but the above serves as a proposal. It is not essential that 100% of each block be burned whenever the controlled fire is undertaken, but at least 70% of each block should ideally be burned, although this percentage may be lower for those blocks that contain significant Thicket areas (such as blocks 6, 8, 9 and 10). If any of the proposed areas have burnt accidentally within the preceding 11 years then these areas need not be burnt again until most of the vegetation in

the block is about 15 years old, at which point the block burning schedule will have to be recalculated, or in some cases the blocks themselves may have to be redrawn.

Timing: Annually, commencing in 2018, and thereafter on a similar 11 year cycle. Ideally to be undertaken in July or August, which are relatively dry, cool months.

Estimated Cost: Unknown, but should not be costly (<R20 000) as minimal material is required. Costs will be incurred primarily for firebreak clearing, and for staffing during the block burns.

8. CONCLUSIONS AND RECOMMENDATIONS

- The Municipality must ensure that there is adequate funding to implement all required management outlined in this CMP, and must ensure that the management is timeously undertaken, and as outlined herein.
- If an environmental auditing component is required to ensure compliance with the CMP CapeNature could potentially undertake this.
- Supplementary or partial funding for the CMP could potentially be sourced from the various adjacent large property developments that are planned and/or approved.
- It is strongly recommended that all private development (at least three large ones are known to this author) on large properties within the greater study area shown in Figure 2 be included within the overall CMP area, and that all Open Space within these areas thus be managed according to the guidelines in the CMP. The CMP could in time be expanded to include these areas should the HoAs be willing.
- The recent proposed donation by the ATKV of a 30ha portion of Portion 4 of Farm 217 is strongly supported, as this supports pristine vegetation of High conservation value, including two of the best Thicket patches in the study area.
- The additional Municipal open space outside the Core Area (Figure 1), but within the greater study area (Figure 2; such as the areas bounded by Boekenhout and Geelhout Avenues) should also be included within the CMP area and managed according to the same guidelines.

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