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BOTANICAL IMPACT ASSESSMENT: SITE FOR NEW WATER RESERVOIRS, KOEBERG NUCLEAR POWER STATION.

Compiled for: Doug Jeffery Environmental Consultants, Cape Town

Client: Eskom Holdings (Pty) Ltd

10 October 2016

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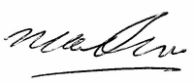
DECLARATION OF INDEPENDENCE

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:

Contact details as per letterhead.

Surname : HELME

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University of Cape Town, South Africa. BSc (Honours) – Botany (Ecology & Systematics), 1990.

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 the Sole Proprietor of Nick Helme Botanical Surveys, and have undertaken over 900 site assessments in this period.

Peninsula and Cape Flats botanical surveys include: De Grendel SDF inputs (Footprint 2015); Eersterivier erven baseline (dbas 2015); Eskom Ankerlig – Sterrekus powerline walkdown (Eskom 2015); Welbeloond survey (Headland 2015); Wolwerivier baseline (TEP 2014); De Mitchells Plain & Brentwood Park scans (TEP 2014); CoCT BioSolids Beneficiation IA, Vissershok (RMS; 2013); De Grendel 24G study (De Grendel; 2013); Koeberg Visitors Centre constraints study (Stauch Vorster; 2013); Protea Ridge IA, Kommetjie (Doug Jeffery; 2013); Delft Sand Mine (EnviorSci Africa; 2012); Atlantic Beach study (Kantey & Templer; 2012); Ocean View Erf 5144 updated baseline (GNEC; 2011); Ocean View infill housing BA (I. Terblanche & Associates; 2010), Oakhurst farm, Hout Bay (SEC 2010); Protea Ridge Corridor

study (Doug Jeffery; 2009); Oudekraal botanical constraints study (Doug Jeffery 2009); Mitchells Plain hospital site (Doug Jeffery; 2006, 2008); Eerste River Erf 5540 (CCA 2008); Eerste River Erf 5541 (EnviroDinamik 2008); Kommetjie Riverside IA (Doug Jeffery 2008); Strandfontein Road widening (CoCT 2008); Pelikan Park IA (CoCT 2008); Blue Downs Erf 1897 (Environmental Partnership 2008); Driftsands NR Sensitivity Study (CapeNature 2006); Assessment of Driftsands South (Environmental Partnership 2006); Woodgreen housing Mitchell's Plain (CCA; 2006); Assessment of new Eskom Briers Substation and new 66kV overhead powerline (Eskom 2006); Muizenberg erf 108161 (CndeV; 2005); Muizenberg erf 159848 (Headland; 2005); Muizenberg erf 159850 (Headland; 2005); Kommetjie Riverside Ext 2. (Headland; 2005); Ocean View Mountain View extension IA (Ecosense; 2005); Imhoffs farm (Headland; 2005); Rocklands, Simonstown (CCA; 2005); Erf 35069 and Ptn. Erf 3418, Kuils River (SEC; 2005); Erf 550 & 552, Phillippi (Amathemba Environmental; 2005); proposed Grand Prix site next to CT International, Belhar (EnviroDinamik; 2005; Environmental Partnership 2007); Dreamworld film studio survey and Impact Assessment (Environmental Partnership; 2004 & 2005); R300 Cape Flats Ring Road surveys (Ecosense and Ecosense/Chand jv; 2003-2007); survey of remaining areas of natural vegetation in the eastern portion of the Cape Flats (Botanical Society of SA; 1999 - 2000).

CONDITIONS RELATING TO THIS REPORT:

The methodology, findings, results, conclusions and recommendations in this report are based on the author's best scientific and professional knowledge, and on referenced material and available knowledge. Nick Helme Botanical Surveys and its staff reserve the right to modify aspects of the report, including the recommendations and conclusions, if and when additional relevant information becomes available.

This report may not be altered or added to without the prior written consent of the author, and this also applies to electronic copies of this report, which are supplied for purposes of inclusion in other reports, including in the report of EAPs. Any recommendations, statements or conclusions drawn from or based on this report must cite this report, and should not be taken out of context, and may not change, alter or distort the intended meaning of the original in any way. If these extracts or summaries form part of a main report relating to this study or investigation this report must be included in its entirety as an appendix or separate section to the main report.

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1. INTRODUCTION

This botanical assessment was commissioned in order to help inform the environmental authorisation process being followed for the construction of two new water tanks at Koeberg Nuclear Power Station, north of Cape Town. The initial report was completed in November 2015 and looked only at Alternative 2, and in 2016 an alternative site was identified, being Alternative 1 (see Figure 1).

Figure 1: Map of the two alternative study areas.

2. TERMS OF REFERENCE

The terms of reference for this study were as follows:

- undertake a desktop assessment of the vegetation on the two site alternatives, using the recent site photographs provided, and using my knowledge of the site
- produce a botanical report which describes the vegetation in the study areas and places it in a regional context, including its status in terms of the latest CoCT Biodiversity Network
- note any plant Species of Conservation Concern likely to occur in the study areas, and indicate the significance thereof
- provide an assessment of the ecological conservation significance (sensitivity) of the areas
- identify the preferred alternative from a botanical perspective

- identify any significant botanical constraints to the potential development of these areas, and provide a discussion of these, with recommendations for mitigation (if required).

3. LIMITATIONS, ASSUMPTIONS AND METHODOLOGY

No site visit was undertaken for this desktop assessment, and I have used the recent colour site photographs (provided by the EAP) as an informant, along with my experience of the study area (see Helme 2013), and the latest Google Earth imagery (dated July 2016). In spring 2013 I examined the patch of vegetation immediately adjacent to (south of) Alternative 2, which is in better condition than the vegetation in the current study area. The author has undertaken extensive work within the region, which facilitates the making of local and regional comparisons and inferences of habitat quality and conservation value. The fact that a site visit was not undertaken for this study does mean that confidence in the comprehensiveness of the botanical findings is lower than it would have been had a site visit been undertaken, as detailed botanical observations were not possible from the photographs provided. However, the overall conclusions are likely to be very similar, and confidence in the accuracy of the findings is deemed to be high.

The terms study area and site are used to mean both Alternatives 1 and 2, unless specified.

The botanical conservation value of a site is a product of plant species diversity, plant community composition, rarity of habitat, degree of habitat degradation, rarity of species, ecological viability and connectivity, restorability of habitat, vulnerability to impacts, and reversibility of threats.

Google Earth satellite imagery dated July 2016 and earlier was used to verify current vegetation patterns and distribution. The study areas are assumed to be as indicated in Figure 1.

4. REGIONAL CONTEXT OF THE VEGETATION

The study area is considered to be part of the West Strandveld bioregion (Mucina & Rutherford 2006), 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 project indicate 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 West Strandveld bioregion is characterised by relatively high winter rainfall, low altitude and poor, sandy soils, with large urban areas and high levels of alien invasive vegetation. Due to this combination of factors the loss of natural vegetation in this bioregion has been severe (>60% of original extent lost within the region), and the bioregion has a fairly high number of threatened plant species (Raimondo *et al* 2009). The lowland regions of the Cape metropole (stretching from Atlantis southeast to near Somerset West), generally known as the Cape Flats, are under enormous pressure, and the area has been described as a "conservation mega-disaster" (Rebelo *et al* 2011), in terms of the number of severely threatened plants (some already extinct) and habitats within the area.

The City of Cape Town regularly updates and revises its Biodiversity Network as sites are lost and new information becomes available (Holmes et al 2008), and the latest map (dated July 2015) indicates that the study area is excluded from the Biodiversity Network, and is thus not mapped as a Critical Biodiversity Area.

5. THE VEGETATION ON THE SITE ALTERNATIVES

According to the SA Vegetation Map the original natural vegetation on the site is all likely to have been **Cape Flats Dune Strandveld** (Mucina & Rutherford 2012). No copy of this vegetation map is hence provided.

Cape Flats Dune Strandveld is regarded as Endangered on a national (DEA 2011) and regional basis (Holmes *et al* 2008). Less than 60% of its total original extent remains intact, less than 5% is conserved, and the national conservation target is

24% (Mucina & Rutherford 2006). The unit is not known to support a large number of plant Species of Conservation Concern (Raimondo *et al* 2009).

Both alternatives are flat, a result of earthmoving machinery activity during the construction of Koeberg Nuclear Power Station, as can be seen by the Google Earth time series analysis from 2003 onwards. All (or at least 90%) of vegetation on site today is thus probably secondary, and has re-established since Koeberg power station construction. Most of Alternative 2 is used as a storage area for machinery (see Plate 1), and partly natural vegetation occurs on only 15% of this alternative site. Alternative 1 has more natural vegetation (about 75% cover) and has probably not been disturbed since construction of the power station.

There is no significant woody alien invasive vegetation on either of the alternatives, but various alien herbs and annuals are likely, given the soil disturbance, including *Senecio burchellii* (indigenous, but invasive in disturbed areas), *Brassica tournefortii, Raphanus rapistrum* (wildemostert), *Eucalyptus* spp. (gums), *Lolium* sp. (ryegrass), *Avena* sp. (wild oats), *Bromus diandrus* (ripgut brome), *Lupinus* spp (lupin), *Vicia* spp. (vetch), *Pennisetum clandestinum* (kikuyu), *Echium plantagineum* (Patterson's curse) and *Conyza bonariensis*.

Alternative 1

Indigenous plant species diversity and abundance on site is fairly low, being about 40% of what would be expected in a pristine example of this habitat. This is likely to be a result of the previous disturbance of the site, but indigenous plant cover is about 75%.

The primary indigenous species in the study area are likely to include *Carpobrotus edulis* (suurvy), *Metalasia muricata* (blombos), *Muraltia spinosa* (tortoise berry), *Morella cordifolia* (wasbessie)*, Osteospermum moniliferum* (bietou), *Osteospermum incanum (*dune bietou*), Searsia laevigata* (dune taaibos)*, Trachyandra divaricata* (duinekool)*, Helichrysum niveum, Ficinia dunensis, Senecio elegans, Gymnodiscus capillaris, Gazania maritima, Didelta carnosa, Cotula turbinata* (gansogies), *Arctotheca calendula* (Cape weed), *Otholobium bracteolatum, Pelargonium capitatum* (dune malva), and *Cynodon dactylon*.

No plant **Species of Conservation Concern** (SCC) are likely to occur on site, given the previous disturbance and the habitat concerned.

Alien invasive species include various annual grasses (*Bromus, Lolium* and *Briza*), and alien herbs include *Brassica tournefortii* (wildemostert), *Raphanus rapistrum* and *Erodium moschatum*.

Plate 1: View of Alternative 1 (photo provided).

Plate 2: Another view of Alternative 1 (photo provided).

Alternative 2

Indigenous plant species diversity and abundance on site is fairly low, being about 40% of what would be expected in a pristine example of this habitat. This is likely to be a result of the previous and ongoing disturbance of the site, and the fact that only about 15% of this area still has any natural vegetation, with the remainder being bare sand or hardened surface.

The primary indigenous species in the study area are likely to include *Carpobrotus edulis* (suurvy), *Metalasia muricata* (blombos), *Muraltia spinosa* (tortoise berry), *Morella cordifolia* (wasbessie), *Osteospermum moniliferum* (bietou), *Osteospermum incanum (*dune bietou*), Searsia laevigata* (dune taaibos), *Trachyandra divaricata* (duinekool), *Helichrysum niveum, Ficinia dunensis, Senecio elegans, Gymnodiscus capillaris, Gazania maritima, Didelta carnosa, Cotula turbinata* (gansogies), *Arctotheca calendula* (Cape weed), *Otholobium bracteolatum, Pelargonium capitatum* (dune malva), and *Cynodon dactylon*.

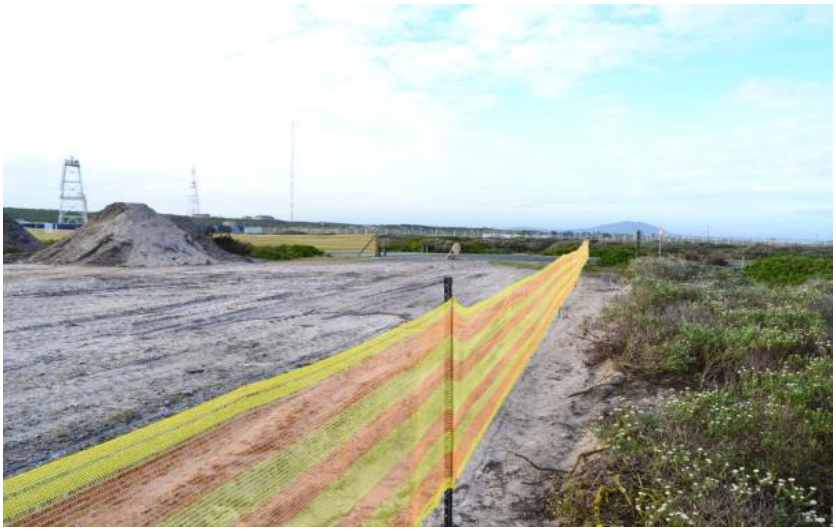

Plate 1: Photo of Alternative 2, looking south (provided, June 2016). Note the remnant patch of partly natural vegetation to the right (west) of the recent development screening.

Plate 2: Another photo of Alternative 2, looking southeast (provided, June 2016).

No plant **Species of Conservation Concern** (SCC) are likely to occur on site, given the previous and ongoing disturbance and the habitat concerned.

6.0 BOTANICAL CONSERVATION VALUE (SENSITIVITY)

The botanical conservation value (also known as sensitivity) of Alternative 1 is Medium, while for Alternative 2 most of the study area is deemed to be of Low sensitivity, with about 15% being of Medium sensitivity (see Figure 2). This assessment is informed by:

- the fact that the study area is not mapped as a CBA in the City of Cape Town Biodiversity Network
- the low indigenous plant species diversity in the study area (about 40% of a pristine example of this habitat)
- no likely plant Species of Conservation Concern
- a complete lack of any significant indigenous vegetation in about 75% of the Alternative 2 study area, suggesting low rehabilitation potential
- the heavily disturbed soils on about 75% of the study area, suggesting low rehabilitation potential
- the almost complete lack of ecological connectivity (connected only to the south in the case of Alternative 2, and to the north in the case of Alternative 1).

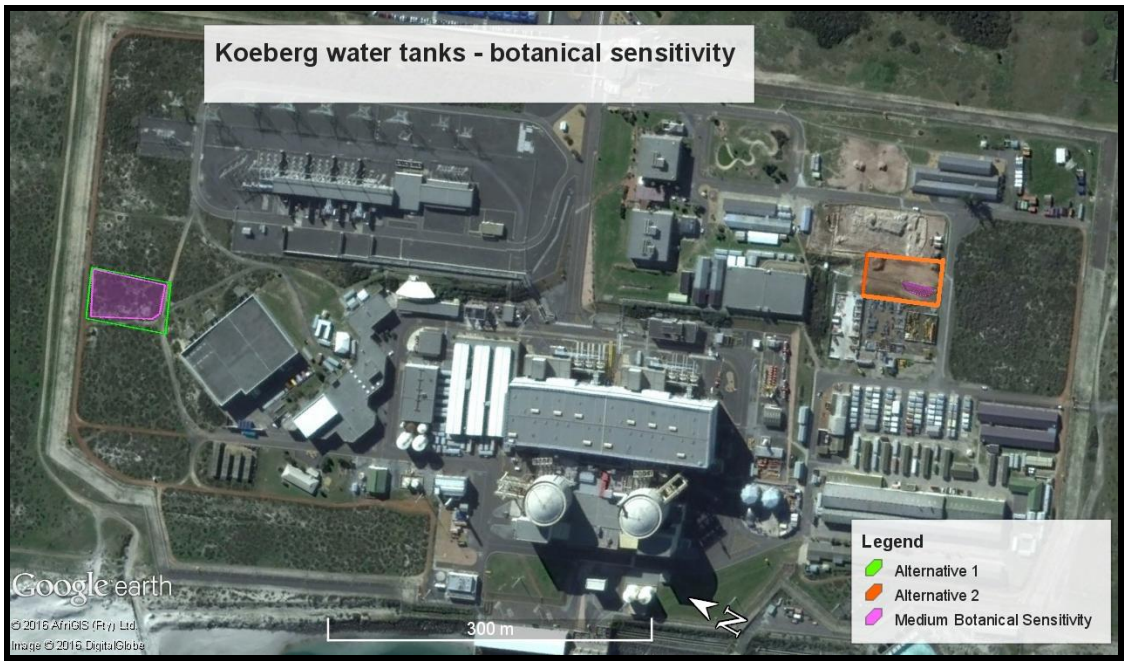

Figure 2: Botanical sensitivity map of the two alternative areas. The unshaded areas within the study area are of Low botanical sensitivity.

7. IMPACT ASSESSMENT

The botanical impacts of a particular project may be both direct and indirect, although the latter (habitat fragmentation, loss of ecological connectivity) are likely to be less significant for this project than the direct impacts. Construction phase impacts will be both permanent (>15 years) and long term (5-15 years).

In the case of this project the primary construction phase impact is loss of natural and partly natural vegetation within the development footprint, which will be less than 0.3ha in total. All development located within natural or partly natural vegetation (of Low and Medium sensitivity) will result in the permanent loss of that vegetation. It is assumed that the disturbance will be restricted to the footprint areas shown in Figure 1, and that is what is here assessed.

7.1 Assessment of Construction Phase Botanical Impacts

Most habitat loss is deemed to be permanent (>15 years).

About 85% of the likely Alternative 1 footprint is in Medium sensitivity habit, with about 15% being of Low sensitivity.

About 15% of the likely Alternative 2 footprint is in Medium sensitivity habit, with about 85% being of Low sensitivity.

The loss of the Low sensitivity habitat in the study area is likely to be of **Very Low negative** significance, with the duration being permanent and the magnitude very low. The underlying vegetation type is Endangered Cape Flats Dune Strandveld, and this loss of habitat cannot be easily mitigated, except by improving the quality of the surrounding, remaining habitat.

The loss of up the Medium sensitivity vegetation in the study area is likely to be of **Low** (Alt 1) and **Very Low** (Alt 2) negative significance, with the duration being permanent and the magnitude low – medium for Alternative 1 and low for Alternative 2. The underlying vegetation type is Endangered Cape Flats Dune Strandveld, and this loss of habitat cannot be easily mitigated, except by improving the quality of the surrounding, remaining habitat.

No loss of high sensitivity habitat or plant Species of Conservation Concern will take place as a result of this proposed development.

Potential impacts on biological aspects:	**Alternative 1**	**Alternative 2**	**No-go option**
Nature of impact:	Loss of Medium sensitivity vegetation on site (about 85% of site)	Loss of Medium sensitivity vegetation on site (about 15% of site)	None, or random construction related clearing of vegetation
Extent and duration of impact:	Site scale; mostly permanent	Site scale; mostly permanent	Site scale; variable
Magnitude of the impact:	Medium; destructive	Low; destructive	Variable and unknown
Probability of occurrence:	Definite	Definite	Unknown
Degree to which the impact can be reversed:	Could only be reversed by rehabilitation after removal of tanks	Could only be reversed by rehabilitation after removal of tanks	Depends on impact
Degree to which the impact may cause irreplaceable loss of resources:	Minor	Very minor	Depends on impact
Cumulative impact prior to mitigation:	Low negative	Negligible	Variable; negligible
Significance rating of impact **prior to mitigation** (Low, Medium, Medium-High, High, or Very-High)	Low -ve	Very Low -ve	Neutral to Low -ve
Degree to which the impact can be mitigated:	Minor	Minor	NA
Proposed mitigation:	Alien invasive vegetation management around site	Alien invasive vegetation management around site	NA
Cumulative impact post mitigation:	Low negative	Negligible	NA
Significance rating of impact **after mitigation** (Low, Medium, Medium-High, High, or Very-High)	Low -ve	Very Low -ve	NA

Table 1: Summary table for construction phase botanical impacts associated with the proposed development.

7.2 Assessment of Operational Phase Botanical Impacts

The primary operational phase botanical impacts are likely to be the spread of alien invasive vegetation associated with the soil disturbance caused by construction, plus reductions in the current levels of ecological connectivity across the sites.

The impact of both these is assessed as Low negative, for both sites. Loss of ecological connectivity cannot be easily mitigated, but the proliferation of alien invasive vegetation can be relatively easily mitigated, by means of ongoing alien

invasive vegetation management in the area. The significance of the impact would be Very Low negative after mitigation, for both sites.

Potential impacts on biological aspects:	**Alternative 1**	**Alternative 2**	**No-go option**
Nature of impact:	Spread of alien invasive vegetation associated with the soil disturbance caused by construction	Spread of alien invasive vegetation associated with the soil disturbance caused by construction	Variable; unknown
Extent and duration of impact:	Site; ongoing	Site; ongoing	Possibly ongoing
Magnitude of the impact:	Low	Low	Low
Probability of occurrence:			
Degree to which the impact can be reversed:	Can be reversed	Can be reversed	Can be reversed
Degree to which the impact may cause irreplaceable loss of resources:	Unlikely	Unlikely	Unlikely
Cumulative impact prior to mitigation:	Very Low -ve	Very Low -ve	Very Low -ve
Significance rating of impact **prior to mitigation** (Low, Medium, Medium-High, High, or Very-High)	Low -ve	Low-ve	Low -ve
Degree to which the impact can be mitigated:	Fully	Fully	Fully; depends on management
Proposed mitigation:	Ongoing alien invasive vegetation management	Ongoing alien invasive vegetation management	NA
Cumulative impact post mitigation:	Very Low -ve	Very Low -ve	NA
Significance rating of impact **after mitigation** (Low, Medium, Medium-High, High, or Very-High)	Very Low -ve	Very Low -ve	NA

Table 2: Summary table for operational phase botanical impacts associated with the proposed development.

7.3 The No Go Alternative

The status quo would appear to range from no current impacts (Alternative 1 area) to active loss of habitat (Alternative 2). Sequential satellite imagery of Alternative 2 shows that there has been an approximately 50% loss of the remaining natural vegetation on site over the last three years, due to expansion of existing storage areas on site.

Given this variability it is thus difficult to generalise about the No Go impact, and to infer likely future impacts. On balance, assuming continuation of the status quo, it is likely that the No Go alternative will have a Neutral to Low negative botanical impact.

7.4 Cumulative Impacts

The cumulative botanical impacts are equivalent to the regional botanical impacts, in that the vegetation type to be impacted by the proposed development has been, and will continue to be, impacted by numerous developments and other factors (the cumulative impacts) within the region. The impacts in Tables 1 and 2 can thus be viewed as cumulative impacts as well. The overall cumulative botanical impacts are expected to be Low negative for Alternative 1 and Very Low negative for Alternative 2.

7.5 Positive Impacts

No positive botanical impacts are expected.

8. RECOMMENDED AND REQUIRED MITIGATION

No specific botanical mitigation is required for this project, other than ongoing alien invasive vegetation management and removal in the disturbed areas around the development footprints.

9. CONCLUSIONS AND RECOMMENDATIONS

- About 85% of site Alternative 1 supports secondary Cape Flats Dune Strandveld, which has re-established since disturbance associated with the original powerstation construction. This vegetation is of Medium sensitivity, and is not particularly diverse, and neither does it support any plant Species of Conservation Concern.
- About 85% of the site Alternative 2 has been heavily disturbed and supports negligible natural vegetation, and is hence of Low botanical sensitivity, presenting no constraints to the proposed development. Loss of this area would be of negligible botanical significance at a regional scale. The remaining 15% of the site alternative supports secondary Cape Flats Dune Strandveld of Medium sensitivity, with no plant Species of Conservation Concern.

- The loss of up the Medium sensitivity vegetation in the study area is likely to be of **Low** (Alt 1) and **Very Low** (Alt 2) negative significance at a regional scale, before and after mitigation.
- Operational phase impacts for both site alternatives are likely to be of **Low** negative significance before mitigation, and **Very Low** negative significance after mitigation.
- The proposed development, at either of the proposed alternative sites, could hence be authorised without significant negative botanical impacts. On balance the preferred site from a botanical perspective is Alternative 2.

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