PROPOSED ESTABLISHMENT OF THE NEW ANDERSON 400kV SUBSTATION IN BROEDERSTROOM NORTH WEST PROVINCE



FLORA AND FAUNA ASSESSMENT



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EXECUTIVE SUMMARY

Eskom Holdings Limited is proposing the new 400kV Substation as part of their Tshwane Strengthening Scheme Project. The proposed new Anderson Substation will be located to the north of the Nuclear Energy Corporation of South Africa (NECSA), located in Broederstroom on Portion 82 of the Farm Weldaba 567 JQ and Portions 25 and 65 of the Farm Welgedund 491 JQ. Two site alternatives are being investigated for the proposed construction of the Anderson Substation and are located within the Madibeng Local Municipality, North West Province.

The land uses surrounding the study sites includes NECSA, Pelindaba and the R104 to the south, and privately owned farm portions to the north, east and west. The foot of the Witwatersberg is located approximately 1km north of the study sites.

The proposed new substation, due to its close proximity to Hartbeespoort dam and also falling within the 5km buffer of the Pelindaba Nuclear Facility, is considered as one of the strategic important areas in North West province. The vegetation types associated with the new proposed Anderson substation are the Andesite Mountain Bushveld and Gauteng Shale Mountain Bushveld, which in terms of its conservation status are listed as Least Threatened and Vulnerable respectively.

In terms of avifauna, the study area falls within an Important Bird Area, namely the Magaliesberg and Witwatersberg (ZA018) Important Bird Area.

During the site visits, no Red Data plant or animal species were recorded but the Orange listed plant species, *Hypoxis hemerocallidea* (African potato) was observed in abundance. Gauteng Department of Agriculture and Rural Development have developed Plant and Rescue Policy which deals specifically with the management of the orange listed species and medicinal plants. Even though Hartbeespoort strategic environmental assessment regards the study area as high in terms of open space; rivers, slope and red data species, the results from the field observation suggest the contrary as the area is highly infested with alien invasive plant species. The conclusions of this report are then that there will be no significant adverse environmental impacts as a result of the new proposed development, and as such, there is no resulting ecological difficulty with the project being approved. The construction of this new proposed substation will aid in the eradication of the alien invasive species in the study area.

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QUALITY VERIFICATION

Verification	Name	Qualification
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1. INTRODUCTION

Eskom Holdings Limited is proposing the construction of a new 400kV Transmission Line, and a proposed new 400kV Substation as part of their Tshwane Strengthening Scheme Project. The proposed powerline will be approximately 40km in length and will run between the proposed new Anderson Substation, which will be located to the north of the Nuclear Energy Corporation of South Africa (NECSA), located in Broederstroom, to the existing Dinaledi Substation which is located approximately 8km North East of Brits. Nemai Consulting was appointed to undertake flora and fauna studies on the proposed new Anderson substation. Special attention was paid to the presence or possible presence of Red Data species, Orange Listed species, alien species and medicinal species. The current ecological status and the conservation priority of the vegetation on the site were assessed. The habitat for fauna was also assessed in the study area and all mammals, birds and reptiles occurring on site were recorded.

According to North West State of Environment Report (2003), The North West Province encloses two major biomes, viz. the Grassland Biome and the Savanna Biome. The vegetation types that are found in the study area is the Andesite Mountain Bushveld (SVcb 11) and Gauteng Shale Mountain Bushveld (SVcb 10) (Mucina & Rutherford, 2006).

In terms of the North West Province State of the Environment Report (2003), the North West Province is approximately 11,632,000 ha in extent. Land use in the North West Province mainly comprises of agriculture, mining, conservation, industrial, commercial, recreational and residential. The land uses of the affected properties and adjacent properties potentially include agriculture/game farming, industrial, conservation/tourism, business and residential.

The study area incorporates natural grassland, artificial dam, rocky areas, and Acacia woodlands and in terms of avifaunal, it falls within the Magaliesberg and Witwatersberg (ZA018) Important Bird Area and forms part of the Hartbeespoort Nature Reserve.

According to Hartbeespoort Strategic Environmental Assessment (2006), the study area falls within an areas of strategic importance, namely Pelindaba Nuclear Facility and its 5km Buffer, the immediate area around the Hartbeespoort Dam (1km from the shore line), and the Witwatersberg natural area and associated Cradle of Humankind world heritage site.

This document reports on the findings of a field surveys that were undertaken in October 2010 and February 2011.

1.1. Objectives of the survey

- To apply relevant literature to determine the diversity and eco-status of the plants, mammals, birds and reptiles at the new proposed Anderson substation;

- To carry out a field survey to gain an indication of the diversity and eco-status of the above-mentioned taxa which inhabit the new proposed Anderson substation, as well as the presence of unique habitats that might need further investigation or protection;
- To assess the possible impact of the new proposed Anderson substation on these taxa and/or habitats;
- To assess the current habitat and conservation status on the study site;
- To list the species on site and to recommend necessary actions in case of occurrence of endangered, vulnerable, rare or species of conservation importance; and
- To provide management recommendations to mitigate negative and enhance positive impacts of the new proposed Anderson substation.

2. RELEVANT LEGISLATION AND GUIDELINES

The following legislations are relevant to this project:

- Nature Conservation Ordinance, Ordinance 19 of 1974;
- National Parks Act, 1976 (Act 57 of 1976);
- Conservation of Agricultural Resources Act, Act 43 of 1983;
- The National Environmental Management Act, 1998 (Act 107 of 1998);
- Environment and Conservation Act, Act 73 of 1989;
- The Constitution, 1996 (Act 108 of 1996) – Section 24;
- National Environmental Management Biodiversity Act, Act 10 2004;
- GDARD Plant Rescue Scheme 2006, (amended 2008); and
- The White Paper on the Conservation and Sustainable Use of South Africa's biodiversity (1997).

3. STUDY AREA

The new proposed Anderson substation is located on Portion 82 of the Farm Weldaba 567 JQ and Portions 25 and 65 of the Farm Welgedund 491 JQ (**Figure 1**). Two alternative sites (**Table 1**) are being investigated and are located directly to the north of NECSA, in Broederstroom, within the Madibeng Local Municipality, North West Province.

The study site is situated within the 2527DD quarter degree grid cells (q.d.g.c) within the North West Province.

Table 1. Locality of the two alternative sites for the new proposed Anderson substation

Site	Affected Properties	Size

Site	Affected Properties	Size
Site 1	Portion 82 of the Farm Weldaba 567 JQ	Total Portion = 2737ha Size of Portion location north of the R104 which is earmarked for possible substation construction = 200ha
Site 2	Portion 82 of the Farm Weldaba 567 JQ	
	Portion 65 of the Farm Welgedund 491 JQ	42.82ha
	Portion 25 of the Farm Welgedund 491 JQ	168.3ha

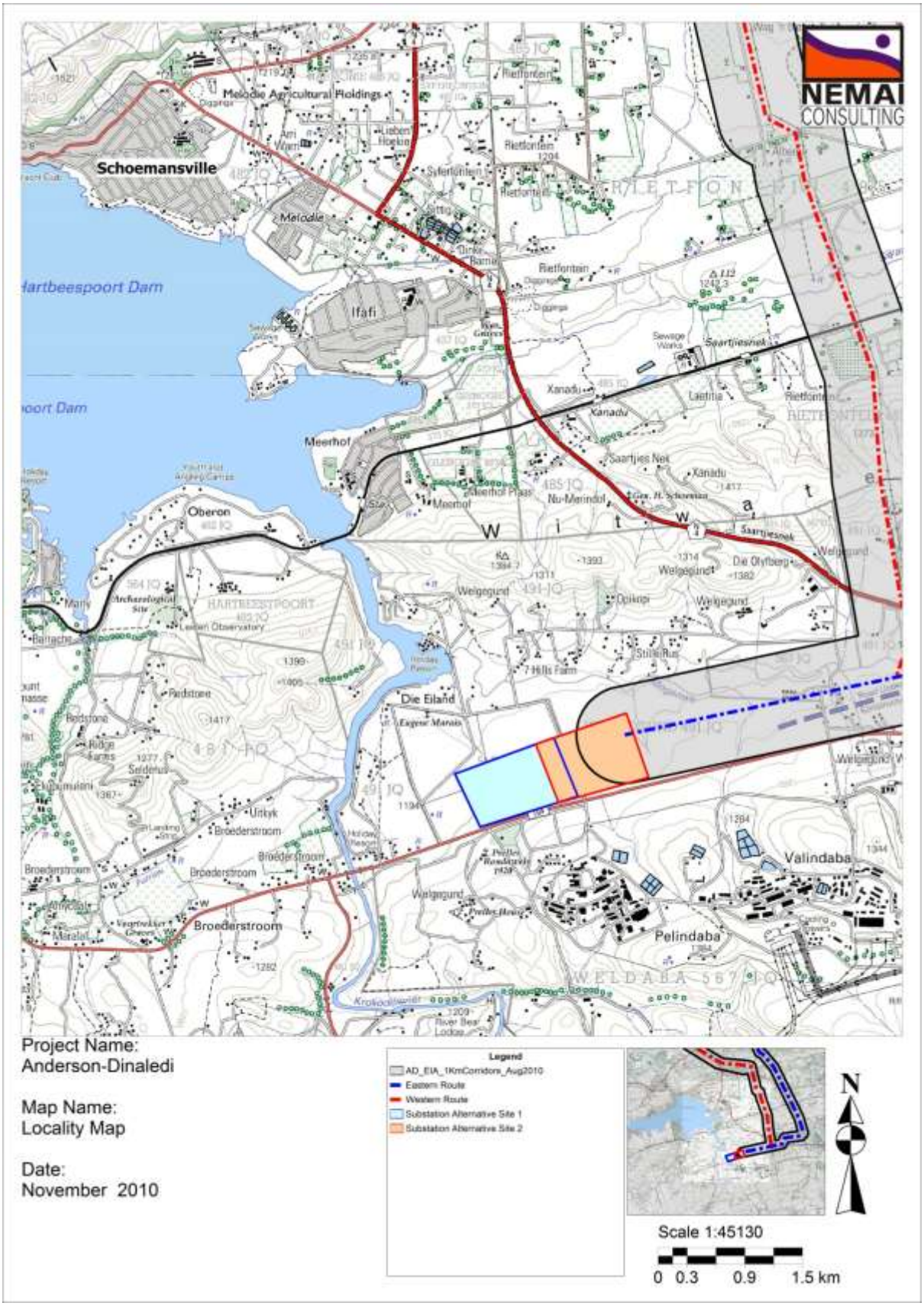

Figure 1. The study area

Mucina & Rutherford (2006) classified the study area as comprised of Andesite Mountain Bushveld and Gauteng Shale Mountain Bushveld, as indicated in **Figure 2**.

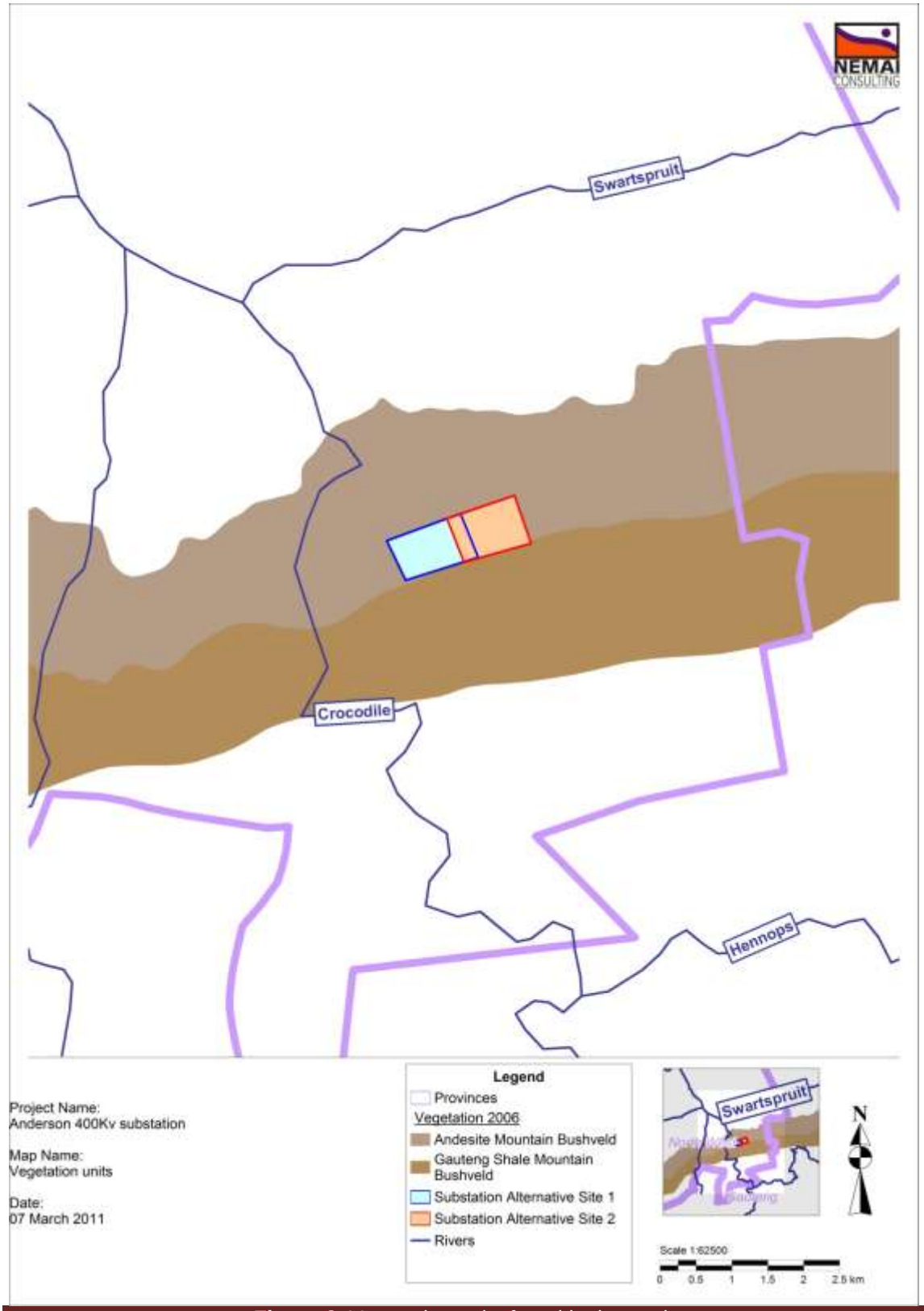

Figure 2. Vegetation units found in the study area

In terms of the South African National Biodiversity Institute (SANBI) data, summary of important plant species recorded in these vegetation types are in **Appendix A**. North West State of Environment Report (2003) described the study area as the one that falls within the Grassland biome. The surface topography of the area within which the proposed substation will be built is described by Mucina & Rutherford (2006) as valley bottom. The table below (**Table 2**) provides details on the conservation status, targets, percentage of areas already transformed, of the vegetation types found within the study area.

Table 2. Vegetation type found in the study area with associated landscape and conservation status

Vegetation Type	Associated Landscape Character	Conservation Status	Target	Transformed
Andesite Mountain Bushveld	Undulating landscape with hills and valleys.	Least Threatened	24%	15%
Gauteng Shale Mountain Bushveld	Low broken ridges varying in steepness with high surface rock cover.	Vulnerable	24%	21%

4. LIMITATIONS AND GAPS

The constraints or limitations to the survey included:

- Gauteng Department of Agriculture and Rural Development (GDARD) Conservation Plan (C-Plan) version 2 was used with caution as it is only applicable in Gauteng province and only covers 75% of the entire grid.

5. METHODOLOGY

The White Paper on the conservation and sustainable use of South Africa's biodiversity and the National Environmental Management Act (107 of 1998) specifies that due care be taken to conserve and avoid negative impacts on biodiversity, as well as the sustainable, equitable and efficient use of biological resources.

The following methods were used:

• A desktop analysis of literature review, photographs, topographical maps, and Google Earth imagery; and

• Site visits during October 2010 and February 2011.

○ 5.1. Vegetation

Satellite imagery of the area was obtained from Google Earth and was studied in order to get a three dimensional impression of the topography and land use.

The Pretoria Computerised Information System (PRECIS) list of plants recorded in the 2527DD quarter degree grid square was obtained from SANBI (http//posa.sanbi.org). This list was consulted to verify the record of occurrence of the plant species seen in the vicinity of the new proposed Anderson substation. The vegetation map published in Mucina & Rutherford (2006) was consulted regarding the vegetation types that occur in the study area. A desktop study of the habitats of the red-listed and orange-listed species known to occur in the area was undertaken before the site visits.

During the field surveys, all general observations were noted; trees, shrubs, grasses and herbs (forbs) were recorded using the Braun-Blanquet method (Braun-Blanquet, 1964). Field guides such as van Wyk & van Wyk (1997), Pooley (1998), van Oudtshoorn, (1999) and Bromilow (2010) were consulted during the field survey for identification of plant species. The site was scrutinised for Red Data and Orange Listed species that might occur in the different habitats. Attention was also paid to the occurrence of alien species and declared weeds.

The initial selection of sampling points considered various land uses, vegetation types and habitats. In instances where the area was homogenous, two or three representative samples were taken. The study area was dominated by natural grasslands, rocks, shrubs, blue gum and pine trees**.** A cover abundance value was then estimated for each of the identified species according to the Braun-Blanquet scale, as indicated in **Table 3**.

Table 3. Braun-Blanquet cover-abundance scale

Symbol	Qualitative Braun-Blanquet scale
r	One or few individual (rare) with less than 1% of total sample plot area
+	Occasional and less than 1% of total sample plot area
1	Abundant and with very low cover or less abundant, but with higher cover, 1-5% cover of total sample plot area
2a	Covering 5-12% of the sample plot area, irrespective of the number of individuals
2b	Covering 12-25% of the sample plot area, irrespective of the number of individuals
3	>25-50% cover of the total sample plot area, irrespective of the number of individuals
4	>50-75% cover of the total sample plot area, irrespective of the number of individuals
5	>75% cover of the total sample plot area, irrespective of the number of individuals

According to van Oudtshoorn, (1999), a grass species reacts to grazing in one of two ways: it can either become more or less abundant. **Table 4** describes the classification of grasses.

Table 4. Classification of grasses (van Oudtshoorn, 1999).

Class	Description	Examples

Class	Description	Examples
Decreasers	Grasses that are abundant in good veld, but that decrease in number when the veld is overgrazed or undergrazed.	*Themeda trianda, Digitaria eriantha*
Increaser 1	Grasses that are abundant in underutilised veld. These grasses are usually unpalatable, robust climax species that grow without any defoliation	*Hyperthelia dissoluta, Trachypogon spicatus*
Increaser 2	Grasses that are abundant in overgrazed veld. These grasses increase due to the disturbing effect of overgrazing and include mostly pioneer and subclimax species	*Aristida adscensionis, Eragrostis rigidor*
Increaser 3	Grasses that are commonly found in overgrazed veld. These are usually unpalatable, dense climax grasses	*Sporobolus africanus, Elionurus muticus*
Invaders	All plants that are not indigenous to an area. These plants are mostly pioneer plants and are difficult to eradicate	*Arundo donax*

The Conservation of Agricultural Resources Act (CARA, Act 43 of 1983) defines weeds as alien plants, with no known useful economic purpose that should be eradicated. Invader plants, also considered by the Act, can also be of alien origin but may serve useful purposes as ornamentals, as sources of timber, or may have other benefits (Henderson, 2001). These plants need to be managed and prevented from spreading.

Alien and invasive plant species are categorised according to CARA, Act 43 of 1983 into three categories, namely:

- Category 1 plants are weeds that serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment. These plants need to be eradicated using the control methods stipulated in Regulation 15.D of the CARA.
- Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas.
- Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.

The planting of Category 2 and 3 plants should be confined to demarcated areas under controlled conditions of cultivation (Bromilow, 1995 & 2010).

○ 5.2. Mammals

The majority of mammals are secretive, nocturnal, hibernators and/or seasonal, the distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on field guides, scientific literature, and databases. This can be done irrespective of season. GDARD C-Plan version 2 was used to ascertain the Red Data mammals that are expected to occur in the 2527DD grid.

Site visits were conducted during the months of October and February and during these visits the observed and derived presence of mammals associated with the recognized habitat types of the study site were recorded. This was done with due regard to the well recorded global distributions of Southern African mammals, coupled with the qualitative and quantitative nature of recognized habitats. The adjoining properties were also scanned for important fauna habitats. The survey covered the entire locale of new proposed Anderson substation.

During the site visits mammals were identified by visual sightings through random transect walks. Terrestrial and arboreal rats, mice, squirrels, and opossums (non-volant small mammals) were sampled using LFAHD-P Sherman large folding aluminium heavy duty perforated traps (23x7.5x9cm/250grams) (**Figure 3**) that were set approximately 20 m apart and baited with oats and butter and were left overnight. Placement of traps were either on the ground near areas of potential foraging activity such as logs and base of trees, or on vines and low branches situated above the ground. In addition, mammals were also identified by means of spoor, droppings, burrows or roosting sites. Locals were interviewed to confirm occurrences or absences of species.

Figure 3. Sherman traps used for small mammals such as rats and mice

The grassland on site offer suitable foraging habitat for numerous small mammals such as *Lepus saxatalis* (Scrub Hare), *Rhabdomys pumilio* (Four-striped Mouse) and *Mastomys coucha* (Southern Multimammate Mouse). During the field visits, the study area was surveyed and assessed for the potential occurrence of Red Data species associated with the study area such Spotted-necked otter (*Lutra maculicollis*) and Southern African hedgehog (*Atelerix frontalis*).

○ 5.3. Birds

The presence of suitable habitat was used to deduce the likelihood of presence or absence of species, based on scientific literature, field guides, and databases.

The likely occurrence of key bird species was verified according to Southern African Bird Atlas Project 2 from the University of Cape Town's Animal Demographic Unit for the grid 2527DD). However, the specific habitat(s) found on site may not suit the particular Red Data species, even though it has been recorded for the quarter degree. For example, the Cape Vulture occurs along the Magaliesberg but will not favour the habitat found within the Pretoria CBD, both of which are in the same grid. Red Data bird species were selected and categorised according to Barnes (2000).

Site visits were conducted to record the presence of bird species associated with the habitat systems on the study sites and to identify possible sensitive areas. Birds were identified visually by call and feathers and by also using a 10X42 Bushnell Waterproof binocular and where necessary verified from *Sasol Birds of Southern Africa* (Sinclair *et al*., 2005) and *The Chamberlain guide to birding Gauteng* (Marais & Peacock, 2008). The properties were surveyed on foot and in the process sightings were recorded through random transect walks. The adjoining properties were also scanned for important bird habitats.

○ 5.4. Reptiles

The majority of reptiles are secretive, or seasonal, and as such distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on scientific literature, field guides, atlases and databases.

A list of reptile species that could possibly occur within the study area was adopted from the South African Reptile Conservation Assessment (SARCA), within the Avian Demographic Unit (ADU) in University of Cape Town. The list includes the entire reptile species recorded in grid cell 2527DD.

Reptile assessments were conducted during the day and during the field visits, the observed and derived presence of reptiles associated with the recognised habitat types of the study site, were recorded. This was done with due regard to the known distributions of Southern African reptiles. Reptiles were identified by sightings during random transect walks. Possible burrows or other reptile retreats (stumps or rocks) were inspected for any inhabitants. Locals were interviewed to confirm occurrences or absences of species and the adjoining properties were also scanned for important reptiles' habitats.

6. RESULTS AND DISCUSSIONS

6.1 Vegetation

According to Rutherford & Westfall (1994), the study area falls within the grassland biome. Grasslands host a very high diversity of plant species, second only to the Cape Floral Kingdom (O' Connor & Bredenkamp, 1997).The proposed substation is located within the following quarter degree squares in terms of the 1:50 000 grid of South Africa, namely 2527DD. The SANBI used this grid system as a point of reference to determine sensitive, vulnerable, Orange and Red Data plant species which occurs in South Africa, or which could potentially occur within an area. The table below (**Table 5**) provides details on the Red Data plant species which has been recorded for the quarter degree squares.

Table 5. Red data plant species recorded in grid 2527DD.

Family	*Species*	Conservation Status	Form
Amaryllidaceae	*Boophone disticha*	Declining	Geophyte
Aquifoliaceae	*Ilex mitis var. mitis*	Declining	Shrub
Asteraceae	*Callilepis leptophylla.*	Declining	Herb
Capparaceae	*Cleome conrathii*	Near Threatened	Herb
Fabaceae	*Melolobium subspicatum*	Vulnerable	Dwarf shrub
Gunneraceae	*Gunnera perpensa.*	Declining	Herb
Hyacinthaceae	*Bowiea volubilis. subsp. volubilis*	Vulnerable	Climber
Hyacinthaceae	*Drimia elata.*	Data Deficient Taxon	Geophyte
Hyacinthaceae	*Drimia sanguinea*	Near Threatened	Geophyte
Hypoxidaceae	*Hypoxis hemerocallidea*	Declining	Geophyte
Myrothamnaceae	*Myrothamnus flabellifolius.*	Data Deficient Taxon	Dwarf shrub
Orchidaceae	*Habenaria mossii*	Endangered	Geophyte

6.1.1. Plant communities recorded in the study area

The following plant communities were identified during the field visits and are described below.

Acacia woodlands

This community is represented by the dominance of *Acacia karroo* as indicated in **Figure 4** below. However, a large number of grasses such as *Aloe zebrina* (previously known as *Aloe transvaalensis*), *Aristida congesta* and *Melia azedarach,* associated with this plant community, are prominent.

Figure 4. Dense stands of *Acacia karroo* woodlands on site

Weeds and alien invasive species are present on site, mostly near the main road and buildings. There is an artificial dam in the study area which provides aquatic species such as *Cyperus* and *Typha*. Species of conservation importance such as *Hypoxis hemerocallidea* was also recorded on this plant community. **Table 6** provides the list of plant species recorded in this community.

Table 6. Species found in the stand of Acacia woodlands community

Scientific name	Common name	Ecological status	Form
Acacia karoo	Sweet thorn		Tree
Aloe zebrina		Medicinal	Succulent
Berkheya setifera	Buffalo-tongue	Medicinal	Herb

Scientific name	Common name	Ecological status	Form
	Berkheya		
Campuloclinium macrocephalum	Pom pom weed	Declared Weed (Category 1)	Herb
Celtis africana	White Stinkwood		Tree
Cirsium vulgare	Spear thistle	Declared Weed (Category 1)	Shrub
Cyperus longus		Medicinal	Sedge
Datura ferox	Large thorn-apple	Declared Weed (Category 1)	Herb
Eucalyptus camaldulensis	Red River Gum	Declared Invader (Category 2)	Tree
Gomphocarpus fruticosus			Herb
Hypoxis rigidula	Silver-leaved star-flower		Herb
Hypoxis hemerocallidea	Star-flower	Medicinal	Herb
Melia azedarach	Syringa	Declared Invader (Category 3)	Tree
Opuntia ficus-indica	Prickly pear	Declared Weed (Category 1)	Shrub
Pinus patula	Patula pine	Declared Invader (Category 2)	Tree
Paspalum dilatum	Dallis grass	Exotic	Grass
Pseudognaphalium luteo-album	Jersey Cudweed	Medicinal	Herb
Peucedanum caffrum	Wild parsley	Medicinal	Herb
Richardia brasiliensis	Tropical Richardia	Weed	Herb
Searsia lancea	Karee		Tree
Sesbania punicea.	Red sesbania	Declared Invader (Category 3)	Tree
Setaria sphacelata var. Sphacelata	Common Bristle Grass	Decreaser	Grass
Themeda triandra	Red Grass	Decreaser	Grass
Stoebe vulgaris	Bankrupt bush		Shrub
Tristachya leucothrix	Hairy Trident Grass	Increaser 1	Grass
Typha capensis	Bulrush		Aquatic herb
Urochloa mossambicensis	Bushveld signal grass	Increaser 2	Grass
Verbena bonariensis	Tall Verbena	Weed	Herb
Verbena officionalis	European verbena	Weed	Herb
Zinnia peruviana	Redstar Zinnia	weed	herb

Stands of Exotic Trees

Natural vegetation in some parts of the study area has been displaced by stands of exotic trees, most often *Eucalyptus camaldulensis* (Blue gum) and *Pinus patula* (Patula pine), as indicated in **Figure 5**. These trees occur mostly as localised stands.

Figure 5. Invasion of *Eucalyptus camaldulensis* (Blue gum) and *Pinus patula* (Patula pine) on natural grassland

The vegetation is dominated by the declared blue gum invader and patula pine species which are up to 20 m high. Grasses present were *Aristida junciformis, Setaria sphacelata var. sphacelata* and *Cortadelia selloana.* The herbaceous component comprises species of the *Solanum mauritianum*, *Tagetes minuta*, and *Sporobolus africanus* (**Table 7**).

Table 7. Species found in the stand of exotic trees community.

Scientific name	Common name	Ecological status	Form
Aloe zebrina		Medicinal	Succulent
Argyrolobium stipulaceum			Herb
Aristida junciformis	Ngongoni Three-awn	Exotic	Grass
Asparagus aethiopicus			Shrub
Asparagus laricinus	Cluster-leaved Asparagus		Tree
Berkheya setifera	Buffalo-tongue Berkheya	Medicinal	Herb
Celtis africana	White Stinkwood		Tree
Campuloclinium macrocephalum	Pom pom weed	Declared Weed (Category 1)	Herb
Conyza bonariensis		Weed	Herb
Cortaderia selloana	Pampas grass	Declared Weed (Category 1)	Grass
Cymbopogon excavatus	Broad-leaved Turpentine Grass	Increaser 1	Grass
Cyperus longus		Medicinal	Sedge
Datura ferox	Large thorn-apple	Declared Weed (Category 1)	Herb
Eucalyptus camaldulensis	Red River Gum	Declared Invader (Category 2)	Tree
Gerbera piloselloides.	Small yellow gerbera	Medicinal	Herb
Gomphrena celosioides	Batchelor's Button	Weed	Herb
Gomphocarpus fruticosus			Herb
Grewia flava		Medicinal	Shrub

Scientific name	Common name	Ecological status	Form
Haplocarpha scaposa	False gerbera	Medicinal	Herb
Harpochloa falx	Caterpillar Grass	Increaser 1	Grass
Helichrysum aureum	Yellow Everlasting		Herb
Hibiscus trionum	Bladder Hibiscus	Medicinal	Herb
Hyparrhenia hirta	Common Thatching Grass	Increaser 1	Grass
Hypochaeris radicata	Hairy wild lettuce	Weed	Herb
Hypoxis rigidula	Silver-leaved star-flower		Herb
Hypoxis hemerocallidea	Star-flower	Medicinal	Herb
Ledebouria ovatifolia		Medicinal	Herb
Melia azedarach	Persian Lilac/Syringa	Declared Invader (Category 3	Tree
Melinis repens	Natal Red Top	Increaser 2	Grass
Oxalis obliquifolia	Oblique-leaved Sorrel		Herb
Pseudognaphalium luteo-album	Jersey Cudweed	Medicinal	Herb
Searsia lancea	Karee		Tree
Senecio venosus			Herb
Setaria sphacelata var. sphacelata	Common Bristle Grass	Decreaser	Grass
Solanum panduriforme	Bitter Apple	Medicinal	Shrub
Stoebe vulgaris	Bankrupt bush		Shrub
Strychnos spinosa	Spiny Monkey Orange	Medicinal	Tree
Tagetes minuta	Tall Khaki Weed	Weed	Herb
Themeda triandra	Red Grass	Decreaser	Grass
Tragus berteronianus	Small carrot-seed grass	weed	Grass
Tristachya leucothrix	Hairy Trident Grass	Increaser 1	Grass
Urochloa mossambicensis	Bushveld signal grass	Increaser 2	Grass
Verbena bonariensis	Tall Verbena	Weed	Herb

Natural grassland

These areas comprise terrestrial grassland that is representative of the regional vegetation types. The likelihood of encountering flora species of importance in these areas was estimated as high.

This community primarily comprises grass with a few scattered single dwarf shrubs. The natural grassland is highly infested with the invasive weed such as Pom pom weed (**Figure 6**).

Figure 6. Invasion of Pom pom weed on natural grasslands

According to Bromilow (2010), once this species has established in an area, it lowers the biodiversity and reduces grazing capacity as it is unpalatable to herbivores.

The natural vegetation is dominated by grass species reaching a height of ~2.5 m tall (*Cymbopogon excavates* and *Hyparrhenia hirta*) while the herbaceous component comprises a cover of about 5%, with very few shrubs and trees. Dominant grass species are *Themeda triandra, Sporobolus africanus*, and *Melinis repens.* The herbaceous and shrub layers are dominated by *Aloe zebrina, Alternanthera pungens, Hypoxis rigidula, Hypoxis hemerocallidea, Oxalis obliquifolia* and *Verbena bonariensis,* as indicated in **Table 8.** According to Bromilow (2010), the presence of the following undesirable and unpalatable species, namely *Sporobolus africanus, Tragus berteronianus, Aristida* spp and *Eragrostis* species, indicate the mismanagement of the veld and also indicate that the severe damage has already occurred on this site.

Table 8. Species found in the natural grassland community.

Scientific name	Common name	Ecological status	Form
Agave sisalana	sisal	Declared Invader (Category 2)	Shrub
Aloe zebrina		Medicinal	Succulent
Alternanthera pungens	khakiweed	exotic	Herb
Andropogon eucomus	Snowflake grass	Increaser 2	Grass
Argyrolobium stipulaceum			Herb
Aristida junciformis	Ngongoni Three-awn	Exotic	Grass
Asparagus aethiopicus			Shrub
Berkheya setifera	Buffalo-tongue Berkheya	Medicinal	Herb
Campuloclinium macrocephalum	Pom pom weed	Declared Weed (Category 1)	Herb

Scientific name	Common name	Ecological status	Form
Conyza bonariensis		Weed	Herb
Cortaderia selloana	Pampas grass	Declared Weed (Category 1)	Grass
Ctenium concinnum	Sickle grass	Increaser 1	Grass
Cymbopogon excavatus	Broad-leaved Turpentine Grass	Increaser 1	Grass
Cynodon dactylon	Couch Grass	Increaser 2	Grass
Digitaria eriantha	Common Finger Grass	Decreaser	Grass
Datura stramonium	Common thorn apple	Declared Weed (Category 1	shrub
Eragrostis curvula	Weepong Love Grass	Increaser 2	Grass
Eragrostis gummiflua	Gum Grass	Increaser 2	Grass
Eragrostis racemosa	Narrow Heart Love Grass	Increaser 2	Grass
Eragrostis superba	Saw-tooth love grass	Increaser 2	Grass
Gerbera piloselloides.	Small yellow gerbera	Medicinal	Herb
Gomphrena celosioides	Batchelor's Button	Weed	Herb
Harpochloa falx	Caterpillar Grass	Increaser 1	Grass
Helichrysum aureonitens	Golden everlasting	Medicinal	Herb
H.inornatum		Medicinal	Herb
Hyparrhenia hirta	Common Thatching Grass	Increaser 1	Grass
Hypochaeris radicata	Hairy wild lettuce	Weed	Herb
Hypoxis hemerocallidea	Star-flower	Medicinal	Herb
Hypoxis rigidula	Silver-leaved star-flower	Medicinal	Herb
Imperata cylindrica	Cotton Wool Grass	Increaser 1	Grass
Ledebouria ovatifolia		Medicinal	Herb
Melinis repens	Natal Red Top	Increaser 2	Grass
Oxalis obliquifolia	Oblique-leaved Sorrel		Herb
Panicum maximum	Guinea Grass	Decreaser	Grass
Pogonarthria squarrosa	Herringbone Grass	Increaser 2	Grass
Richardia brasiliensis	Tropical Richardia	Weed	Herb
Setaria sphacelata var. Sphacelata	Common Bristle Grass	Decreaser	Grass
Sporobolus africanus	Ratstail Dropseed	Increaser 3	Grass
Tagetes minuta	Tall Khaki Weed	Weed	Herb
Themeda triandra	Red Grass	Decreaser	Grass
Tragus berteronianus	Small carrot-seed grass	weed	Grass
Tristachya leucothrix	Hairy Trident Grass	Increaser 1	Grass
Turbina oblongata	Oblong Turbina		Herb
Urochloa mossambicensis	Bushveld signal grass	Increaser 2	Grass
Verbena bonariensis	Tall Verbena	Weed	Herb

6.1.2. Plant species of conservation importance recorded in the study area.

In terms of the SANBI plant species list of conservation importance that could be found in the area (**Table 5**), only one species was recorded, namely African potato (*Hypoxis hemerocallidea)* (**Figure 7).** According to Raimondo *et.al.* (2009), this plant species is listed as Declining. Other *Hypoxis* species recorded in the study area was Silver-leaved star-flower (*Hypoxis rigidula).*

According to Pooley (1998), the traditional healers use African potato in traditional medicine to treat dizziness, headaches, and mental disorders and in western medicine, this species is used to treat cancers, inflammation and HIV (Pooley, 1998). Due to its medicinal usage, this species is known to

be harvested illegally throughout the country. **Table 9** indicates the co-ordinates of where African potato species were recorded.

Figure 7. *Hypoxis hemerocallidea* growing in natural grasslands

Table 9. GPS co-ordinates of the Orange Listed Plant Species recorded in the study area.

Species	Common name	Longitude	Latitude
Hypoxis hemerocallidea	Star-flower	25° 47' 04.4"	27° 55' 19.9"
		25° 47' 06.7"	27° 55' 18.9"
		25° 47' 05.4"	27° 55' 19.1"
		25° 47' 08.7"	27° 55' 24.2"

6.1.3. Plant rescue and recovery

As previously mentioned, the study area falls within the North West province but since North West Department of Agriculture, Conservation and Environment has not developed the plant and rescue programme, it was sensible to utilise the existing GDARD Plant Rescue Scheme, which has been developed for the removal of plants of horticultural and medicinal value from any development site. According to National Environmental Management Biodiversity Act, 10 of 2004, there is a dire need to conserve biodiversity in each province and as such, natural or indigenous resources must be utilised sustainably. Recovery plans are designed to reverse the decline of a threatened or endangered species and eventually bring the population to a self-sustaining level. The identified Orange listed species should be removed on site during construction.

6.1.4. Red-listed species

No Red Data species were found on the study site as indicated on the list of Red-listed species supplied by SANBI. The list refers to plant species that have been recorded from the quarter degree grid in which the study site is situated.

6.2 Fauna

This faunal survey focused mainly on mammals, birds, and reptiles of the study area. The survey focused on the current status of threatened animal species occurring, or likely to occur within the study area, describing the available and sensitive habitats. Faunal data was obtained during field surveys of the proposed new Anderson substation site carried out on foot during October 2010 and February 2011. The data was supplemented by previous surveys conducted in similar habitats, literature investigations, and historic data. Different habitats were explored to identify any sensitive or specialised species. Mammal names are as used by Stuart & Stuart, (1998), Skinner & Chimimba (2005), bird names by Hockey *et al.* (2006); and reptile names by Branch (1998, 2001).

6.2.1 Mammals

According to GDARD Conservation Plan 2, the following species (**Table 10**) are known to occur on grid 2527DD. The conservation statuses of these species were based on Friedmann & Daly (2004). The likelihood of species" presence in the study areas were estimated based on known ecological requirements of species; these requirements were compared to the ecological conditions found in the study areas and surrounding faunal habitat. Smaller mammals (rodents, etc.) are more likely to inhabit the site.

Table 10. Red data Mammal species recorded in grid 2527DD.

Common name	Scientific name	Conservation Status	Assessment of probabilities
Southern African hedgehog	*Atelerix frontalis*	Near Threatened	High
Spotted-necked otter	*Lutra maculicollis*	Near Threatened	High
Hildebrandt's horseshoe bat	Rhinolophus hildebrandti	Near Threatened	Low
Blasius's horseshoe bat	*R. blasii*	Vulnerable	Low
Geoffroy's horseshoe bat	*R. clivosus*	Near Threatened	Low
Schreiber's long-fingered bat	*Miniopterus schreibersii*	Near Threatened	Low
Temminck's hairy bat	*Myotis tricolor*	Near Threatened	Low

Mammals recorded on site

Table 11 indicates nine mammals observed in the study area. The species marked with an asterix (*****) were based on the information provided by the land owners of the properties. Larger mammals such as Kudu were observed on Portion 25 of the Farm Welgedund 491 JQ, which is a nature reserve. No sensitive or endangered mammals were recorded during the site visits.

Table 11. Mammals recorded on the proposed new Anderson substation.

Common name	Species
Impala	*Aepyceros melampus*
Kudu	*Tragelaphus strepsiceros*
Jackal*	
Scrub Hare	*Lepus saxatilis*
African Mole-rat	*Cryptomys hottentotus*
Springhare	*Pedetes capensis*
Bushveld Gerbil	*Tatera leucogaster*
Yellow Mongoose	*Cynictis penicillata*
Common Duiker	*Sylvicapra grimmia*

Global mammal distributions correlate well with biomes as defined by Acocks (1998), Low & Rebelo (1996), Knobel & Bredenkamp (2005) and as well as Mucina & Rutherford (2006). However, the local occurrences of mammals are more closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupiculous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges. Sight records and information from residents or knowledgeable locals audit such deductions.

From a mammal habitat perspective, it should thus be reported that all major habitats mentioned above are present on site or general area. The construction of new proposed substation (either Site 1 or Site 2) will destroy the habitats of the mammals recorded on site but mitigation measures should be put in place to restore the loss vegetation.

6.2.2 Avifauna

Observations regarding the number and diversity of birds will provide valuable input to sound management practices for the fast changing environment. According to Collar, *et al,* (1994), 16 species occurring in South Africa are considered to be threatened on a global scale by BirdLife International, and 11 (69%) are either entirely restricted to the Grassland Biome or have a substantial proportion of their local population reliant on this biome and the 9 of the 30 near-threatened species occur in this biome. Rudd's and Botha's Larks, Southern Bald Ibis and Yellow-breasted Pipit, which are considered to be globally threatened, are the four of the twelve bird species which are commonly found in grasslands. Another five, namely Blue Korhaan, Mountain Pipit, Orange-breasted Rockjumper, Buffstreaked Chat and Drakensberg Siskin are listed as Near Threatened. The country's most threatened bird is the Rudd's Lark, which is the only bird species listed as Critically Threatened in South Africa.

A list of bird species that could possibly occur within the study area is included in **Appendix B**. This list was adopted from the South African Bird Atlas Project (SABAP) from the Avian Demographic Unit (ADU), University of Cape Town. This list includes all bird species recorded in grid cell 2527DD.

In terms of Avifauna, the study area falls within the Magaliesberg and Witwatersberg (ZA018) Important Bird Area (IBA) (Barnes, 1988), as indicated in **Figure 8**.

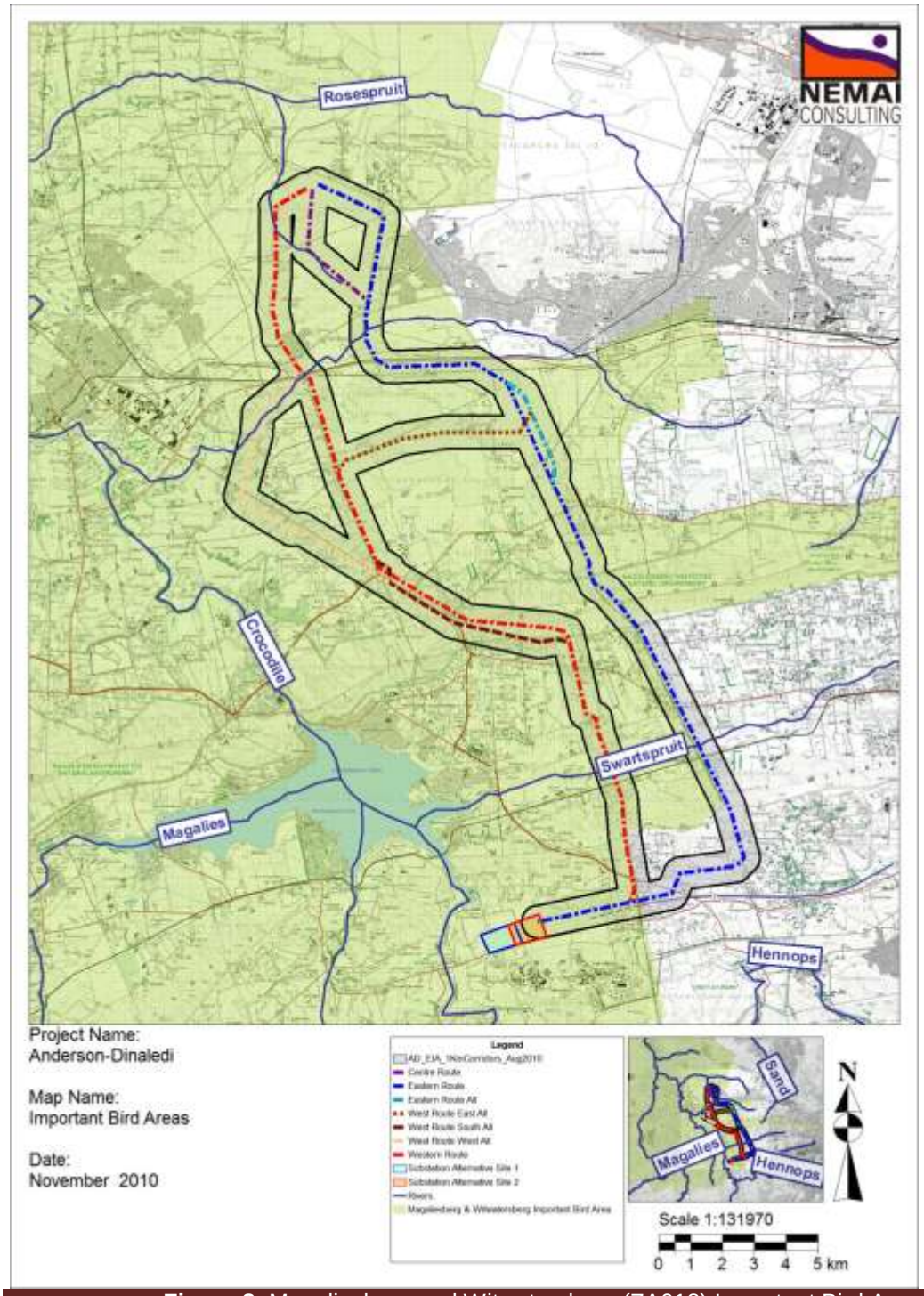

Figure 8. Magaliesberg and Witwatersberg (ZA018) Important Bird Area

Field work results

It is widely accepted that vegetation structure, rather than the actual plant species, influences bird species' distribution and abundance (Harrison *et al.,* 1997). Therefore, the vegetation description used in the Bird Atlas does not focus on lists of plant species, but rather on factors which are relevant to bird distribution. Within the vegetation types found in the study area and immediate surrounding areas, three major bird habitat systems were identified. The following distinct bird microhabitats were identified in the study area during the field visits.

Artificial dam

This habitat is represented in the study area by the artificial dam. The dam provides habitat for species such as ducks (**Figure 9**).

Figure 9. Artificial dam providing habitat for ducks

This dam has undoubtedly benefit the colonisation and range expansion of many waterbird species that favours open water habitat and provides a refuge for waterbird species during prolonged periods of drought. The data from the Co-ordinated Road Count project (CAR) of the Avian Demography Unit shows that the rivers are extensively used by Spurwing Goose *Plectropterus gambensis*, Black-headed Heron *Ardea melanocephala* and Grey Crowned Crane *Balearica regulorum*. Flamingos were recorded in the 2527DD Quarter degree grid cell (Harrison *et al*. 1997) (**Appendix B**). Non-threatened species that may from time to time occur near rivers include Little Bittern *Ixobrychus minutus*, Black Crake *Amaurornis flavirostris*, Common Moorhen *Gallinula chloropus*, Green-backed Heron *Butorides striata*, African Snipe *Gallinago nigripennis* and various kingfishers (Marais & Peacock 2008). Open water may attract grebes, cormorants, darters and various species of ducks, as well as Red-knobbed Coot *Fulica cristata*. Areas with reeds, sedges or grassy tangles are suitable for Common Waxbills *Estrilda astrilda* and various warblers (Marais & Peacock, 2008).

Grasslands

Areas of natural grassland have remained in the study area. The CAR data indicate that natural grassland remains the preferred habitat of large terrestrial birds (Young *et al*. 2003). Several typical Red Data grassland species were recorded in the square grid by SABAP2, White-bellied Korhaan *Eupodotis senegalensis*, Secretarybird *Sagittarius serpentarius*, Lesser Kestrel *Falco naumanni,* and African Grass Owl *Tyto capensis.* It is therefore likely that these species could occur in the grassland remaining on the site. A Red Data species that could also occur in this habitat from time to time is the Black-winged Lapwing *Vanellus melanopterus* – they prefer short burnt or cropped grassland and Cape vultures *Gyps coprotheres*. Non-threatened species that may from time to time frequent the grassland habitat in the study area are Swainson's Spurfowl *Pternistis swainsonii*, African Pipit *Anthus cinnamomeus*, Cape Longclaw *Macronyx capensis*, several cisticola species, Long-tailed Widowbird *Euplectes progne*, Rufous-naped Lark *Mirafra africana,* and Black-shouldered Kite *Elanus caeruleus* (Harrison *et al.* 1997).

Woodlands

The new proposed substation will traverse through woodland habitat, which varies between broadleaved woodland, *Acacia*-dominated woodland, and open woodland with small scattered *Acacia* trees. The bird species within this habitat generally include a great variety of arboreal passerines, such as drongos, warblers, flycatchers, shrikes, sunbirds, waxbills and weavers, as well as arboreal non-passerines such as doves, cuckoos and woodpeckers. Many of these species make use of the thorny nature of these trees to build their nests (**Figure 10**). Acacia trees generally attract many insects and in turn attract a good diversity of typical *Acacia* savanna bird species.

Figure 10. Thorny trees provide habitats for bird species

Bird species observed in the study area

A comprehensive bird species list requires intensive surveys compiled over several years. Twenty four (24) bird species (**Table 12**) were recorded during the field survey. Species recorded were common and widespread and typical of both grassland and savanna environments.

Table 12. Bird species recorded during the survey

Species	Common name
Anas undulata	Yellow-billed duck
Bubulcus ibis	Cattle Egret
Bostrychia hagedash	Hadeda ibis
Cercomela familiaris	Familiar Chat
Charadrius pallidus	Three-banded plover
Cisticola juncidis	Zitting Cisticola
Columba guinea	(Speckled) Rock pigeon
Corythaixoides concolor	Grey go-away-Bird (Lourie)
Corvus albus	Pied Crow
Elanus caeruleus	Black-shouldered Kite
Euplectes orix	Southern Red Bishop
Hirundo cucullata	Greater Striped Swallow
Lanius collaris	Common Fiscal
Lamprotornis nitens	Cape Glossy Starling
Mirafra africana	Rufous-naped Lark
Phylloscopus trochilus	Willow Warbler
Numida meleagris	Helmeted Guineafowl
Ploceus velatus	Southern masked-Weaver
Pycnonotus tricolor	Dark-capped (Blackeyed) Bulbul
Sigelus silens	Fiscal Flycatcher
Struthio camelus	Common Ostrich
Streptopelia senegalensis	Laughing Dove
Streptopelia capicola	Cape Turtle-Dove
Streptopelia semitorquata	Red-eyed Dove

Even though bird species such as Owls and Red-listed Cape vultures (*Gyps coprotheres*) (Vulnerable) were not observed during field visits, these species have been previously sighted on Portion 25 of the Farm Welgedund 491 JQ. Cape vulture is known to forage over open grassland and woodland and is dependent on tall cliffs for breeding.

6.2.3 Reptiles

According to Branch (1998), 93 threatened reptiles and amphibian species are found in South Africa, of which 13 (14%) occur within the Grassland Biome, and of which 11 (85%) are endemic to the biome. A total of 195 reptiles species are endemic to South Africa of which 42 (22%) are found within the Grassland Biome.

A list of reptile species that could possibly occur within the study area is included in **Table 13**. This list was adopted from the South African Reptile Conservation Assessment (SARCA), from the Avian Demographic Unit (ADU), University of Cape Town. This list includes the entire reptile species recorded in grid cell 2527DD.

Table 13. Reptile species that could potential occur in the study which were previously recorded in grid cell 2527DD (SARCA).

Family	Common name	Species	Picture
Colubridae	Rhombic Egg-eater	*Dasypeltis scabra*	
Viperidae	Rhombic Night Adder	*Causus rhombeatus*	
Gekkonidae	Transvaal Gecko	*Pachydactylus affinis*	
Testudinidae	Speke's Hinged Tortoise	*Kinixys spekii*	

Reptiles recorded on study area

Reptile lists require intensive surveys conducted for several years. Reptiles are extremely secretive and difficult to observe during field surveys. The majority reptile species are sensitive to severe habitat alteration and fragmentation. No reptile diversity was observed on the site, even though species such as Rinkhals, Puff adder, Boomslang and Cape cobra were previously observed by land owner on Portion 25 of the Farm Welgedund 491 JQ. Many tall trees such as *Searsia lancea, Eucalyptus camaldulensis* and *Pinus patula* were recorded on the site. Trees including stumps, bark and holes are vital habitats for numerous arboreal reptiles (chameleons, snakes, agamas, geckos and monitors). Limited suitable habitat for any arboreal species but suitable habitat for terrestrial reptile species such as Ground Agama, Yellow throated Plated Lizard, Montane Speckled or Striped Skink as well as snake species (Rinkhals, Mole Snake, and Black-headed Centipede Eater). The indiscriminate killing of all snake species as well as the illegal collecting of certain species for private and the commercial pet industry reduces reptile populations especially snake populations drastically (Jacobsen, 2005). The frequent burning of the site will have a high impact on reptiles. Fires during the winter months will severely impact on the hibernating species, which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks (Jacobsen, 2005).

6.3 Sensitivity mapping.

According to Hartbeestpoort Strategic Environmental Assessment (2006), the proposed new substation falls within the following areas of strategic importance, namely the Pelindaba Nuclear Facility and its 5km buffer, the immediate area around the dam (1 km from the shore line) and the Witwatersberg natural area and associated Cradle of Humankind world heritage site. The two proposed sites falls within the Magaliesberg Natural Area, which forms part of the greater Magaliesberg Protected Environment.

During the field survey, no Red data plant or animal species were observed but the orange listed species such as African potato were found in abundance. **Figure 11** shows the distribution of this species in the study area. The dot/point on the map represents five or more species of the African potato. The species was only distributed on Site 1 and not Site 2.

Even though Cape vultures were not observed, they have been sighted previously in the study area on grasslands

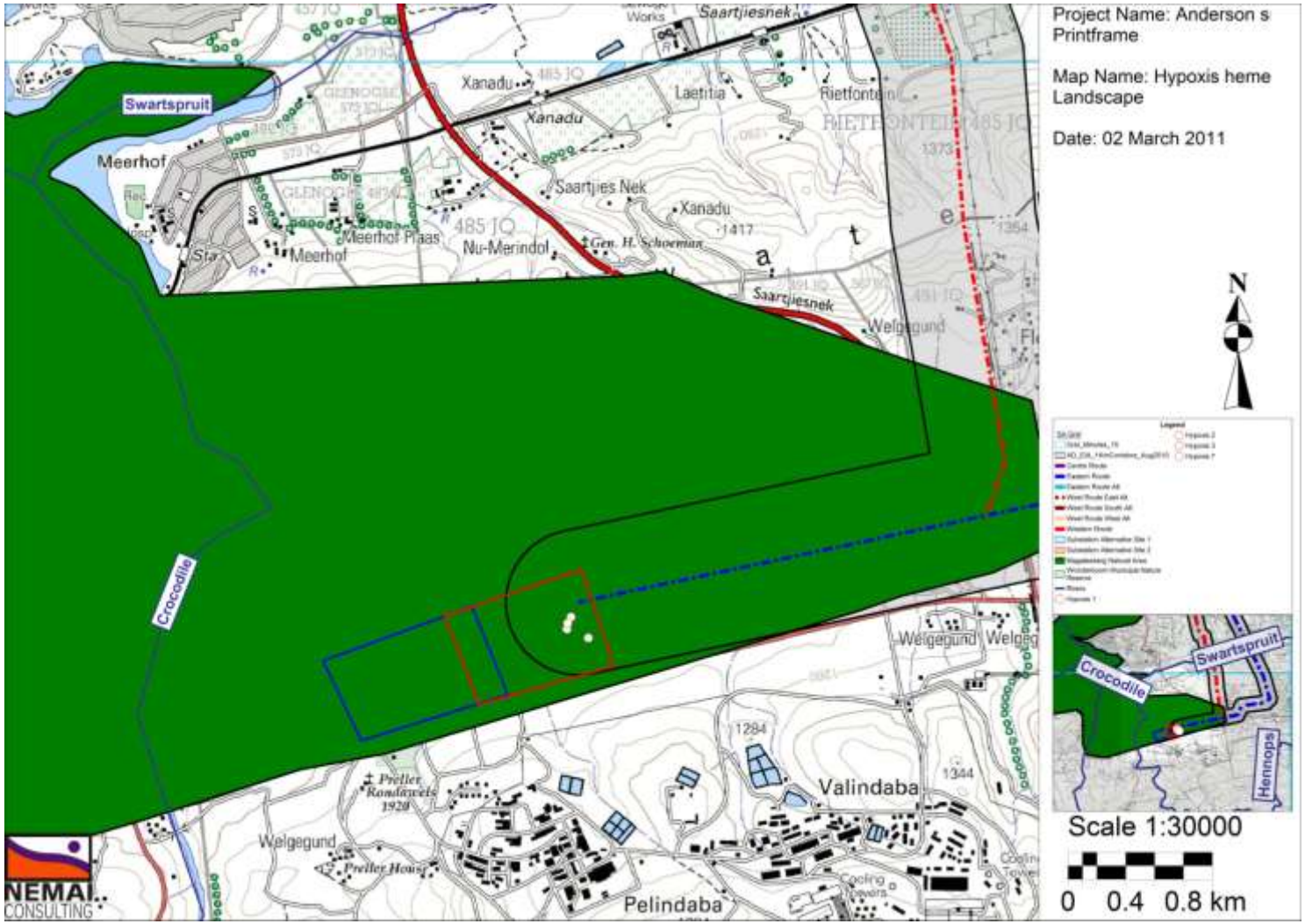

Figure 11. The distribution of *Hypoxis hemerocallidea* in the study area

7. ENVIRONMENTAL IMPACT ASSESSMENT

7.1 Methodology

Potential environmental impacts are analysed with regard to their nature, extent, magnitude, duration, probability and significance. The following definitions and scoring system apply:

Nature (/Status)
The project could have a positive, negative or neutral impact on the environment.

Extent
- Local – extend to the site and its immediate surroundings.
- Regional – impact on the region but within the province.
- National – impact on an interprovincial scale.
- International – impact outside of South Africa.

Magnitude
Degree to which impact may cause irreplaceable loss of resources.
- Low – natural and social functions and processes are not affected or minimally affected.
- Medium – affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.
- High – natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.

Duration
- Short term – 0-5 years.
- Medium term – 5-11 years.
- Long term – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.
- Permanent – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Probability
- Almost certain – the event is expected to occur in most circumstances.
- Likely – the event will probably occur in most circumstances.
- Moderate – the event should occur at some time.
- Unlikely – the event could occur at some time.
- Rare/Remote – the event may occur only in exceptional circumstances.

Significance
Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows-
0 – Impact will not affect the environment. No mitigation necessary.
1 – No impact after mitigation.
2 – Residual impact after mitigation.
3 – Impact cannot be mitigated.

7.2 Impact Scoring

7.2.1 Environmental Feature	Flora
Relevant Alternatives & Activities	Site 1 and Site 2
Project life-cycle	Pre-construction & construction phase

Potential Impact	Proposed Management Objectives / Mitigation Measures
1. Removal of topsoil	Removal of vegetation during stripping and construction will be minimised to reduce the erosion potential. Topsoil will only be removed off areas proposed for new substation. All soils should be stored and managed correctly for rehabilitation
2. Vegetation removal and soil disturbance caused by the construction and use of access roads	1. Restrict construction of access roads by utilizing existing roads. 2. Do careful planning of access roads in order to prevent excessive removal of trees and prevent soil erosion. 3. Construct proper spill ways to divert runoff water to prevent erosion. 4. Rehabilitate all temporary access roads.
3. Vegetation and soil disturbance around construction sites due to general construction activities	1. Minimise topsoil disturbance as far as possible. 2. Level and landscape disturbed topsoil areas to facilitate plant succession. 3. Erosion control measures, such as stone packing, brush packing and reseeding, should be included on disturbed areas. 4. •Limited movement of personnel or machinery to take place within the proposed new substation in order for this habitat unit to retain its features.
4. Soil contamination, vegetation loss and vegetation disturbance due to fuel and chemical spills	1. Employ on site personnel responsible for preventing and controlling potential soil pollution through fuel and oil leaks and spills. 2. Make sure construction vehicles do not leak oil and fuel. 3. Have equipment ready to deal with soil pollution and littering.
5. Vegetation disturbance in and around construction camps	1. Fencing off of construction camps. 2. Level and landscape disturbed topsoil areas to facilitate plant succession. 3. Erect construction camps on level surfaces only.
6. Vegetation and habitat disturbance due to the accidental introduction of alien species.	1. Promote awareness to all personnel. 2. After construction monitoring and control of alien weeds and invaders through hand removal, slashing (annuals) or chemical control (perennials) is important.
7. Vegetation and habitat disturbance due to pollution and littering during construction phase.	1. Employ personnel on site responsible for preventing and controlling of litter. 2. Institude a waste management procedure during the construction phase.
8. Vegetation disturbance due to increased dust during construction phase.	1. To decrease the effect of dust, construction should take place during the rainy season when there is less expected wind and more often rain to clear vegetation from dust. 2. Cultivate awareness among personnel to limit excessive and unnecessary dust.
9. Loss of Orange Listed Plant species on Site 2	Rescue and recovery policy, as adopted from GDARD should be implemented to minimise the risks associated with these species.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Long-term	Likely	2
After Mitigation	Negative	Local	Medium	Long-term	Likely	2

7.2.2 Environmental Feature	Fauna
Relevant Alternatives & Activities	Site 1 and Site 2
Project life-cycle	Pre-construction & construction phase

Potential Impact	Proposed Management Objectives / Mitigation Measures
Habitat destruction and fragmentation	Government regulated control of development and the creation of green belts and undisturbed areas within the area of development in order to maintain some form of ecological integrity
Removal of topsoil	Removal of vegetation during stripping and substation construction will be minimised to reduce the erosion potential. Topsoil will only be removed off areas proposed new substation. All soils should be stored and managed correctly for rehabilitation to create natural habitats for plants and animals
Transportation of machinery	Trucks should travel on a minimum speed to avoid unnecessary killings of natural animals found on site

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Long-term	Likely	2
After Mitigation	Negative	Local	Medium	Long-term	Likely	2

7.2.3 Environmental Feature	Flora
Relevant Alternatives & Activities	Site 1 and Site 2
Project life-cycle	Operational

Potential Impact	Proposed Management Objectives / Mitigation Measures
1. A construction of substation may affect biodiversity through the encroachment of exotic vegetation following soil disturbance.	The encroachment of alien vegetation should be monitored regularly and controlled; the substation must be kept clear of all invader plants as per the Conservation of Agricultural Resources Act, 1983.
2. Damage to plant life outside of the substation area	1. Workers and machinery to remain inside construction footprint. All labourers to be informed of disciplinary actions for the unlawful damage to vegetation; 2. Any plant accidentally removed outside the proposed substation should be replaced or rehabilitated.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Long-term	Likely	2
After Mitigation	Negative	Local	Medium	Long-term	Likely	1

7.2.4 Environmental Feature	Fauna
Relevant Alternatives & Activities	Site 1 and Site 2
Project life-cycle	Operational

Potential Impact	Proposed Management Objectives / Mitigation Measures
Maintenance of substation	Use the existing road and look out for animals on the road

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance

Before Mitigation	Negative	Local	High	Long-term	Likely	2
After Mitigation	Negative	Local	Medium	Long-term	Likely	1

8. CONCLUSION

According to Hartbeestpoort Strategic Environmental Assessment (2006), the proposed new substation falls within the following areas of strategic importance, namely the Pelindaba Nuclear Facility and its 5km buffer, the immediate area around the dam (1 km from the shore line) and the Witwatersberg natural area and associated Cradle of Humankind world heritage site. The two proposed sites falls within the Magaliesberg Natural Area, which forms part of the greater Magaliesberg Protected Environment.

From a mammalian view there is no compelling reason why the proposed new substation should not be developed in both alternatives Site 1 or Site 2 even though in Site 1, cape vultures were previously sighted on the area, there was no evidence to suggest that the species nest in the area. The vegetation study revealed that the Site 2 is highly dominated with the African potato. The challenge would be when these species are removed, even during rehabilitation; they would not be replanted on site. Site 1 is infested with the pom pom weed and according to Bromilow (2010), once this species has established in an area, it lowers the biodiversity and reduces grazing capacity as it is unpalatable to herbivores.

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Appendix A. Summary of important plant species recorded in the Andesite Mountain Bushveld (SVcb 11), and Gauteng Shale Mountain Bushveld (SVcb 10 (Mucina & Rutherford, 2006).

Species	Afrikaans name	English name	Ecological Status	SVcb 11	SVcb 10
Gramminoids					
Cymbopogon caesius					√
Cymbopogon pospischilli	Smalblaarterpentyngras	Narrow-leaved Turpentine Grass	Increaser III	√	√
Digitaria eriantha subsp *eriantha*		Common Finger Grass	Decreaser	√	√
Elionurus muticus	Koperdraad	Wire Grass	Increaser IIb/III	√	
Eragrostis curvula	Oulandsgras	Weeping Love Grass	Increaser Iib/II	√	√
Eragrostis racemosa	Smalhartjiesgras	Narrow Heart Love Grass	Increaser Iic/II	√	
Eragrostis superba	Weeluisgras	Saw-tooth Love Grass	Increaser II	√	
Hyparrhenia dregeana					√
Hyparrhenia hirta	Dekgras	Common Thatching Grass	Increaser I	√	
Panicum maximum		Guinea Grass	Decreaser	√	
Themeda triandra	Rooigras	Red Grass	Decreaser	√	
Setaria sphacelata var *sericea*	Goue-mannagras	Golden Bristle Grass	Decreaser	√	
Herbs					
Commelina africana	Geeleendagsblom	Yellow Commelina	Medicinal	√	
Dicoma zeyheri	Jakkalsbossie	Doll's Protea			√
Helichrysum nudifolium	Hottentotstee	Hottentot's Tea			√
H. rugulosum					√
Hermannia lancifolia					√
Hibiscus pusillus		Dwarf Hibiscus			√
Selaginella dregei					√
Senecio venosus					√
Vernonia galpinii	Bloukwasbossie			√	

Vernonia natalensis		Silver Vernonia			√
Vernonia obligocephala	Bitterbossie	Bicoloured-leaved Vernonia	Medicinal	√	√
Succulent herbs					
Aloe greatheadii var *greatheadii*			Medicinal	√	
Kalanchoe rotundifolia		Common Kalanchoe			√
Woody climbers					
Ancylobotrys capensis					√
Rhynchosia totta		Snoutbean	-	√	
Geoxylic Suffrutex					
Elephantorrhiza elephantina	Baswortel	Elephant's foot	Medicinal		√
Geophytic Herbs					
Cheilanthes hirta					√
Hypoxis hemerocallidea				√	√
Pellaea calomelanos					√
Scadoxus puniceus					√
Low Shrubs					
Acalypha africana					√
Aptosimum elongatum					
Asparagus suaveolens	Katdoring	Bushveld asparagus		√	√
Athrixia elata					√
Felicia muricata	Blouheuning Karooblommetjie	White Felicia			√
Indigofera comosa					√
Rhus magalismontana subsp *magalismontana*					√
Rhus rigida var margaretae	Roossenekal			√	

Teucrium trifidum				√	
Soft shrub					
Isoglossa grantii				√	
Tall shrubs					
Asparagus laricinus		Wild asparagus		√	√
Canthium gilfillanii					√
Chrysanthemoides monilifera					√
Dichrostachys cinerea	Sekelbos	Sickle bush			√
Diospyros austro-africana					√
D. lycioides subsp. *Lycioides*		Bushveld bluebush			√
Ehretia rigida subsp *rigida*					√
Euclea crispa subsp *crispa*		Blue guarri		√	√
Grewia occidentalis	Kruisbessie	Cross-berry			√
Gymnosporia polycantha				√	√
Lippia javanica		Fever tea		√	
Olea europaea subsp *africana*	Olienhout	Wild Olive			√
Tephrosia capensis					√
R. longipes					√
Rhamnus prinoides		Dogwood		√	
Rhus pyroides var *pyroides*	Gewone taaibos	Common wild currant		√	
Small Trees					
Acacia caffra	Gewone haakdoring	Common hook thorn		√	√
Acacia karroo	Soetdoring	Sweet thorn		√	√
Celtis africana	Witstinkhout	White stinkwood		√	√
Combretum molle	Fluweelboswilg	Velvet bushwillow			√

Cussonia spicata	Gewone kiepersol	Common cabbage tree			√
Dombeya rotundifolia	Gewone drolpeer	Common wild pear			√
Englerophytum magalismontanum					√
Protea caffra		Common sugarbush		√	√
Rhus leptodictya	Bergkaree	Mountain karree			√
Vanguria infausta	Wildemispel	Wild medlar			√
Zanthoxylum capense		Small knobwood		√	√
Ziziphus mucronata	Blinkblaarwag-'n-bietjie	Buffalothorn		√	√

Appendix B. Bird species that could be found in the study area which were recorded in grid cells 2527DB and 2527DD (SABAP)

Species Code	Common name	Conservation Status
1	Common Ostrich	
6	Great Crested Grebe	
8	Little Grebe (Dabchick)	
50	Pink-backed Pelican	Vulnerable
55	White-breasted (Great) Cormorant	
58	Reed (Long-tailed) Cormorant	
60	African Darter	
62	Grey Heron	
63	Black-headed Heron	
64	Goliath Heron	
65	Purple Heron	
66	Great Egret	
67	Little Egret	
68	Yellow-billed (Intermediate) Egret	
69	Black Heron	
71	Cattle Egret	
72	Squacco Heron	
74	Green-backed (Striated) Heron	
75	Rufous-bellied Heron	
76	Black-crowned Night-Heron	
78	Little Bittern	
81	Hamerkop	
83	White Stork	
84	Black Stork	Near Threatened
85	Abdim's Stork	
89	Marabou Stork	Near Threatened
90	Yellow-billed Stork	Near Threatened
91	African Sacred (Sacred) Ibis	
93	Glossy Ibis	
94	Hadeda Ibis	
95	African Spoonbill	
96	Greater Flamingo	Near Threatened
97	Lesser Flamingo	Near Threatened
99	White-faced (Whistling-) Duck	
100	Fulvous (Whistling) Duck	
101	White-backed Duck	
102	Egyptian Goose	

Species Code	Common name	Conservation Status
104	Yellow-billed Duck	
105	African Black Duck	
106	Cape Teal	
107	Hottentot Teal	
108	Red-billed Teal (Duck)	
112	Cape Shoveler	
113	Southern Pochard	
115	Comb (Knob-billed) Duck	
116	Spur-winged Goose	
117	Maccoa Duck	
118	Secretarybird	Near Threatened
122	Cape Vulture (Griffon)	Vulnerable
123	White-backed Vulture	Vulnerable
127	Black-shouldered (Winged) Kite	
128	African Cuckoo Hawk	
131	Verreaux's (Black) Eagle	
135	Wahlberg's Eagle	
136	Booted Eagle	
137	African Hawk Eagle	
139	Long-crested Eagle	
140	Martial Eagle	Vulnerable
142	Brown Snake-Eagle	
143	Black-chested (Breasted) Snake-Eagle	
148	African Fish-Eagle	
149	Steppe (Common) Buzzard	
152	Jackal Buzzard	
154	Lizard Buzzard	
156	Ovambo Sparrowhawk	
157	Little Sparrowhawk	
158	Black Sparrowhawk (Goshawk)	
159	Shikra (Little Banded Goshawk)	
161	Gabar Goshawk	
162	Southern Pale Chanting Goshawk	
165	African Marsh-Harrier	Vulnerable
169	African Harrier-Hawk (Gymnogene)	
170	Osprey	
171	Peregrine Falcon	Near Threatened
172	Lanner Falcon	Near Threatened
173	Eurasian Hobby	

Species Code	Common name	Conservation Status
179	Red-footed (Western Red-footed) Falcon (Kestrel	
180	Amur (Eastern Red-footed) Falcon (Kestrel)	
181	Rock Kestrel	
182	Greater Kestrel	
183	Lesser Kestrel	Vulnerable
188	Coqui Francolin	
189	Crested Francolin	
191	Shelley's Francolin	
192	Red-winged Francolin	
193	Orange River Francolin	
196	Natal Spurfowl (Francolin)	
199	Swainson's Spurfowl (Francolin)	
200	Common Quail	
201	Harlequin Quail	
203	Helmeted Guineafowl	
205	Kurrichane (Small) Buttonquail	
208	Blue Crane	Vulnerable
210	African Rail	
212	African Crake	
213	Black Crake	
217	Red-chested Flufftail	
223	African Purple (Purple) Swamphen (Gallinule)	
226	Common Moorhen	
228	Red-knobbed Coot	
229	African Finfoot	Vulnerable
233	White-bellied Korhaan	Vulnerable
237	Red-crested Korhaan	
239	Black Korhaan (pre-split)	
240	African Jacana	
242	Greater Painted-snipe	Near Threatened
245	Common Ringed Plover	
248	Kittlitz's Plover	
249	Three-banded Plover	
255	Crowned Lapwing (Plover)	
258	Blacksmith Lapwing (Plover)	
260	African Wattled Lapwing (Plover)	
264	Common Sandpiper	
266	Wood Sandpiper	

Species Code	Common name	Conservation Status
269	Marsh Sandpiper	
270	Common Greenshank	
272	Curlew Sandpiper	
274	Little Stint	
284	Ruff	
286	African (Ethiopian) Snipe	
294	Pied (Avocet) Avocet	
295	Black-winged Stilt	
297	Spotted Thick-knee (Dikkop)	
300	Temminck's Courser	
315	Grey-headed Gull	
322	Caspian Tern	Near Threatened
338	Whiskered Tern	
339	White-winged Tern	
346	Yellow-throated Sandgrouse	Near Threatened
347	Double-banded Sandgrouse	
348	Rock (Feral) Dove (Pigeon)	
349	Speckled (Rock) Pigeon	
350	African Olive- (Rameron) Pigeon	
352	Red-eyed Dove	
354	Cape Turtle (Ring-necked) Dove	
355	Laughing (Palm) Dove	
356	Namaqua Dove	
358	Emerald-spotted Wood-Dove	
361	African Green-Pigeon	
364	Meyer's Parrot	
373	Grey Go-away-bird (Lourie)	
375	African Cuckoo	
377	Red-chested Cuckoo	
378	Black Cuckoo	
380	Great Spotted Cuckoo	
381	Levaillant's (African Striped) Cuckoo	
382	Jacobin (Pied) Cuckoo	
385	Klaas's Cuckoo	
386	Dideric (Diederik) Cuckoo	
391	Burchell's Coucal (pre-split)	
392	Barn Owl	
393	African Grass-Owl	Vulnerable
395	Marsh Owl	

Species Code	Common name	Conservation Status
396	African Scops-Owl	
397	Southern White-faced (Scops-) Owl	
398	Pearl-spotted Owlet (Owl)	
400	Cape Eagle-Owl	
401	Spotted Eagle-Owl	
402	Verreaux's (Giant) Eagle-Owl	
405	Fiery-necked Nightjar	
406	Rufous-cheeked Nightjar	
408	Freckled Nightjar	
411	Common (European) Swift	
412	African Black (Black) Swift	
415	White-rumped Swift	
416	Horus Swift	
417	Little Swift	
418	Alpine Swift	
421	African Palm-Swift	
424	Speckled Mousebird	
425	White-backed Mousebird	
426	Red-faced Mousebird	
428	Pied Kingfisher	
429	Giant Kingfisher	
430	Half-collared Kingfisher NT	
431	Malachite Kingfisher	
433	Woodland Kingfisher	
435	Brown-hooded Kingfisher	
437	Striped Kingfisher	
438	European Bee-eater	
443	White-fronted Bee-eater	
444	Little Bee-eater	
445	Swallow-tailed Bee-eater	
446	European Roller	
447	Lilac-breasted Roller	
449	Purple (Rufous-crowned) Roller	
451	African Hoopoe	
452	Green (Red-billed) Wood-hoopoe	
454	Common Scimitarbill	
457	African Grey Hornbill	
458	Redbilled Hornbill (pre-split)	
459	Southern Yellow-billed Hornbill	

Species Code	Common name	Conservation Status
464	Black-collared Barbet	
465	Acacia Pied (Pied) Barbet	
470	Yellow-fronted Tinkerbird (Tinker Barbet)	
473	Crested Barbet	
474	Greater Honeyguide	
476	Lesser Honeyguide	
478	Brown-backed (Sharp-billed) Honeybird (Honeyguide)	
481	Bennett's Woodpecker	
483	Golden-tailed Woodpecker	
486	Cardinal Woodpecker	
487	Bearded Woodpecker	
489	Red-throated Wryneck	
492	Melodious (Latakoo) Lark NT	
493	Monotonous Lark	
494	Rufous-naped Lark	
495	Clapper Lark (pre-split)	
498	Sabota Lark	
500	Longbilled Lark (pre-split)	
506	Spike-heeled Lark	
507	Red-capped Lark	
508	Pink-billed Lark	
515	Chestnut-backed Sparrowlark (Finchlark)	
518	Barn (European) Swallow	
520	White-throated Swallow	
523	Pearl-breasted Swallow	
524	Red-breasted (Rufous-chested) Swallow	
526	Greater Striped-Swallow	
527	Lesser Striped-Swallow	
528	South African Cliff-Swallow	
529	Rock Martin	
530	Common House-Martin	
532	Sand Martin (Bank Swallow)	
533	Brown-throated (Plain) Martin	
534	Banded Martin	
538	Black Cuckooshrike	
541	Fork-tailed Drongo	
543	Eurasian Golden-Oriole	
545	Black-headed (Eastern) Oriole	

Species Code	Common name	Conservation Status
547	Cape (Black) Crow	
548	Pied Crow	
552	Ashy Tit	
554	Southern Black Tit	
557	Cape (Southern) Penduline-Tit	
558	Grey (African) Penduline-Tit	
560	Arrow-marked Babbler	
563	Southern Pied-Babbler	
567	African Red-eyed Bulbul	
568	Dark-capped (Black-eyed) Bulbul	
576	Kurrichane Thrush	
577	Olive Thrush (pre-split)	
580	Groundscraper Thrush	
581	Cape Rock-Thrush	
582	Sentinel Rock-Thrush	
583	Short-toed Rock-Thrush	
586	Mountain Chat (Wheatear)	
587	Capped Wheatear	
589	Familiar Chat	
593	Mocking Cliff-Chat	
595	Ant-eating Chat	
596	African (Common) Stonechat	
601	Cape Robin-Chat	
602	White-throated Robin-Chat	
613	White-browed (Red-backed) Scrub-Robin	
615	Kalahari Scrub-Robin	
619	Garden Warbler	
621	Chestnut-vented Tit-Babbler	
625	Icterine Warbler	
628	Great Reed-Warbler	
631	African (African Marsh-Warbler) Reed-Warbler	
633	Marsh (European Marsh) Warbler	
634	Sedge Warbler	
635	Lesser Swamp- (Cape Reed) Warbler	
638	Little Rush- (African Sedge) Warbler	
643	Willow Warbler	
645	Bar-throated Apalis	
651	Long-billed (Cape) Crombec	

Species Code	Common name	Conservation Status
653	Yellow-bellied Eremomela	
656	Burnt-necked Eremomela	
657	Bleating Warbler (pre-split)	
661	Cape Grassbird	
664	Zitting (Fan-tailed) Cisticola	
665	Desert Cisticola	
666	Cloud (Tink-tink) Cisticola	
667	Wing-snapping (Ayre's) Cisticola	
670	Wailing Cisticola	
672	Rattling Cisticola	
677	Le Vaillant's (Tinkling) Cisticola	
679	Lazy Cisticola	
681	Neddicky (Piping Cisticola)	
683	Tawny-flanked Prinia	
685	Black-chested Prinia	
689	Spotted Flycatcher	
694	Southern Black-Flycatcher	
695	Marico Flycatcher	
696	Pale (Mouse-coloured/Pallid) Flycatcher	
698	Fiscal Flycatcher	
701	Chinspot Batis	
706	Fairy Flycatcher (Warbler)	
710	African Paradise-Flycatcher	
711	African Pied Wagtail	
713	Cape Wagtail	
714	Yellow Wagtail	
716	African (Grassveld/Grassland) Pipit	
717	Long-billed Pipit	
718	Plain-backed Pipit	
719	Buffy Pipit	
720	Striped Pipit	
723	Bushveld Pipit	
727	Cape (Orange-throated) Longclaw	
731	Lesser Grey Shrike	
732	Common Fiscal	
733	Red-backed Shrike	
735	Magpie (Long-tailed) Shrike	
736	Southern Boubou	
739	Crimson-breasted Shrike	

Species Code	Common name	Conservation Status
740	Black-backed (Southern) Puffback	
741	Brubru	
743	Brown-crowned (headed) Tchagra	
744	Black-crowned Tchagra	
746	Bokmakierie	
748	Orange-breasted Bush-Shrike	
751	Grey-headed Bush-Shrike	
753	White-crested Helmet-Shrike	
758	Common Myna	
759	Pied (African Pied) Starling	
760	Wattled Starling	
761	Violet-backed (Plum-coloured, Amethyst) Starling	
762	Burchell's Starling	
764	Cape Glossy (Glossy) Starling	
769	Red-winged Starling	
772	Red-billed Oxpecker	Near Threatened
775	Malachite Sunbird	
779	Marico Sunbird	
785	Greater Double-collared Sunbird	
787	White-bellied (breasted) Sunbird	
792	Amethyst (Black) Sunbird	
796	Cape White-eye (pre-split)	
798	Red-billed Buffalo-Weaver	
799	White-browed Sparrow-Weaver	
801	House Sparrow	
802	Great (Southern Rufous) Sparrow	
803	Cape Sparrow	
804	Greyheaded Sparrow (pre-split)	
805	Yellow-throated Petronia (Sparrow)	
806	Scaly-feathered Finch	
811	Village (Spotted-backed) Weaver	
813	Cape Weaver	
814	Southern Masked-Weaver	
815	Lesser Masked Weaver	
819	Red-headed Weaver	
820	Cuckoo Finch (Parasitic Weaver)	
821	Red-billed Quelea	
824	Southern Red (Red) Bishop	

Species Code	Common name	Conservation Status
826	Yellow-crowned (Golden) Bishop	
827	Yellow (Yellow-rumped) Bishop (Widow)	
829	White-winged Widowbird	
831	Red-collared Widowbird	
832	Long-tailed Widowbird	
834	Green-winged (Melba) Pytilia (Finch)	
840	African (Blue-billed) Firefinch	
841	Jameson's Firefinch	
842	Red-billed Firefinch	
844	Blue Waxbill	
845	Violet-eared Waxbill	
846	Common Waxbill	
847	Black-faced Waxbill	
850	Swee (Black-faced) Waxbill (Swee)	
852	African Quailfinch	
854	Orange-breasted (Zebra) Waxbill	
855	Cut-throat Finch	
856	Red-headed Finch	
857	Bronze Mannikin	
860	Pin-tailed Whydah	
861	Shaft-tailed Whydah	
862	Long-tailed (Paradise) Paradise-Whydah	
864	Dusky Indigobird	
865	Purple Indigobird	
867	Village Indigobird	
869	Yellow-fronted (eyed) Canary	
870	Black-throated Canary	
872	Cape (Yellow-crowned) Canary	
881	Streaky-headed Seedeater (Canary)	
884	Golden-breasted Bunting	
885	Cape Bunting	
886	Cinnamon-breasted (Rock) Bunting	
888	Yellow-billed Kite	
889	Black Kite	
891	Mallard	