Vegetation and flora survey on Portions 44, 45 and 46 of the Farm Doornpoort 295 JR, Tshwane, Gauteng Province

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REGULATIONS GOVERNING THIS REPORT

This report has been prepared in terms the *National Environmental Management Act* No. 107 of 1998 (NEMA) and is compliant with Regulation 385 Section 33 - Specialist reports and reports on specialised processes under the Act. Relevant clauses of the above regulation are quoted below.

Regulation 33. (1): **An applicant or the EAP managing an application may appoint a person who is independent to carry out a specialist study or specialised process.**

Regulation 33. (2): **A specialist report or a report on a specialised process prepared in terms of these Regulations must contain:**

(a) details of (i) the person who prepared the report, and
(ii) the expertise of that person to carry out the specialist study or specialised process;
(b) a declaration that the person is independent in a form as may be specified by the competent authority;
(c) an indication of the scope of, and the purpose for which, the report was prepared;
(d) a description of the methodology adopted in preparing the report or carrying out the specialised process;
(e) a description of any assumptions made and any uncertainties or gaps in knowledge;
(f) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;
(g) recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;
(h) a description of any consultation process that was undertaken during the course of carrying out the study;
(i) a summary and copies of any comments that were received during any consultation process;
(j) any other information requested by the competent authority.

Appointment of specialist

David Hoare of David Hoare Consulting CC was commissioned by First Land Development to conduct a flora and vegetation survey for the study site as part of the Scoping process in support of an application to develop the site in terms of section 26 (5) of the Environmental Conservation Act (Act no 73 of 1989). The terms of reference were to undertake a specialist study to describe the vegetation and flora on site.

Details of specialist

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Summary of expertise

David Hoare:

- **Registered professional member of The South African Council for Natural Scientific Professions (Ecological Science), registration number 400221/05.**
- **Founded David Hoare Consulting CC, an independent consultancy, in 2001.**
- **Ecological consultant since 1995.**
- **Conducted, or co-conducted, over 120 specialist ecological surveys as an ecological consultant.**
- **Published six technical scientific reports, 15 scientific conference presentations, seven book chapters and eight refereed scientific papers.**
- **Attended 15 national and international congresses & 5 expert workshops, lectured vegetation science at 2 universities and referee for 2 international journals.**

Independence:

David Hoare Consulting CC and its Directors have no connection with First Land Development. David Hoare Consulting CC is not a subsidiary, legally or financially, of the proponent, remuneration for services by the proponent in relation to this proposal is not linked to approval by decision-making authorities responsible for permitting this proposal and the consultancy has no interest in secondary or downstream developments as a result of the authorisation of this project. The percentage work received directly or indirectly from the proponent in the last twelve months is 0%.

Scope and purpose of report

The scope and purpose of the report are reflected in the "Terms of reference" section of this report

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INTRODUCTION

Terms of reference

In March 2007 David Hoare Consulting cc was requested by First Land Development to conduct a flora and vegetation survey for the study site as part of the Scoping process in support of an application to develop the site in terms of section 26 (5) of the Environmental Conservation Act (Act no 73 of 1989).

The study was to be based on a combination of fieldwork and interpretation of aerial photographs as well as a review of literature information pertaining to the vegetation of the study area. As much existing information from previous studies in the surrounding area was to be used about the vegetation of the site in order to limit the amount of fieldwork time required. During fieldwork the entire site was to be studied with the aim of ground-verification of the vegetation and sensitivity map and to collect limited additional floristic information, but the intention is not to produce a detailed floristic survey of the current site.

The following was to be provided:

- **Review of available published and unpublished information about the vegetation of the study area.**
- **Identification of vegetation types which characterise the site;**
- **Description of the vegetation communities of the site using standard field-based vegetation survey techniques;**
- **Assessment of the potential for threatened plant species to occur in available habitats;**
- **Identify sensitive habitats and plant communities on site based on the conservation value of these at national and provincial level;**
- **Provide a list of all plant species recorded during the survey;**
- **Provide a list of naturalized plant species recorded on site, indicating which are declared weeds or alien invasive species, according to the Conservation of Agricultural Resources Act (Act No. 43 of 1983) as amended in 2001.**

Recommendations were also to be provided for the management of recorded and potentially occurring threatened plant species and the appropriate timing for brief, follow up field surveys aimed at searching for potentially occurring threatened plant species that were not in flower at the time of the initial field survey.

Limitations

All attempts were made to cover the entire study area at a similar degree of detail. However, due to the fact that the study constituted a single survey in one season it is unlikely that all species that occur on site were located. There may also have been localized variations in species composition that were overlooked. In addition, because rare and endemic species normally don't occur in great densities, only estimations of the potential presence of these species were made.

DESCRIPTION OF STUDY AREA

Study area

Location

The site of the proposed residential development is situated on the Farm Doornpoort 295 JR located in the north-eastern side of the City of Tshwane metropolitan area. This is adjacent to the suburb of Doornpoort. The site is situated to the south of the N4 Rustenburg highway at the intersection with the N1 Pietersburg highway. These two highways form the northern and eastern boundaries of the site respectively. The southern and western boundaries are the suburb of Doornpoort. The study areas fall within the quarter degree square 2528 CB.

Topography

The study area is relatively flat and characterised by the presence of a shallow, wide drainage valley running through the centre in a south-north direction. This drainage valley contains seasonal to temporary wetlands that drain northwards under the N4 highway into the upper reaches of the Apies River. The drainage lines are therefore part of the source of the Apies River. The site is at an elevation of approximately 1218–1230m. The highest point is in the north-east against the N1 highway and the lowest in the north at the point where the drainage lines drains into the culvert passing under the highway.

Geology, soils and rainfall

The geology is Pyramid Gabbro-Norite from the Rustenburg Layered Suite, consisting primarily of gabbro and norite. Norite is a dark, coarse-grained, intrusive igneous rock chemically equivalent to basalt. It is a plutonic rock, formed when molten magma is trapped beneath the Earth's surface and cools into a crystalline mass. Gabbro is generally coarse grained, with crystals in the size range of 1 mm or greater. Norite is essentially indistinguishable from gabbro without thin section study under a petrographic microscope. It occurs with gabbro and other rocks in layered intrusions which are often associated with platinum orebodies such as is found in the general region between Brits and Rustenburg.

The soils on the site are almost uniformly composed of black turf soils (vertic black clays) that have high shrink-swell characteristics. The land type of the site, which is an area with largely uniform soils, topography and climate, is the Ae land type (Land Type Survey Staff, 1987). The rainfall in the study area is approximately 640 mm per annum and occurs mainly in the summer (Dent et al. 1989).

Landuse and landcover

Much of the site has been previously cultivated and there are also signs of degradation due to grazing by animals and trampling and littering by humans, especially due to vagrants on site. The previous cultivation is evident from patterns on the aerial photos as well as the species composition within the vegetation (see Results section below). There is no existing infrastructure on the site. The vegetation is therefore in a largely secondary state. The major land-use is cattle and game-farming. The broad classification of the vegetation on site is "Forest and woodland" (Fairbanks et al. 2000), based probably on the presence od secondary thornveld across portions of the site.

Vegetation, biogeography and conservation value

The study area falls within Clay Thorn Bushveld (Low & Rebelo 1998), which in turn comprises part of the Savanna Biome (Rutherford & Westfall 1986). According to the most recent and detailed description of the vegetation of South Africa (Mucina et al. 2005) the study area occurs within Marikana Thornveld. At a national level, the new vegetation types have been assessed according to the degree of transformation and conservation and thus the priority each should receive with respect to conservation value. Marikana Thornveld emerges as having high conservation priority (classified as Endangered) with less than 1% conserved of a

target of 19% and more than 48% transformed, mostly by cultivation, urbanization, which is spreading rapidly, and mining (Rutherford et al., 2006).

According to this publication (Rutherford et al., 2006), this is an open Acacia karroo woodland, occurring in valleys and slightly undulating plains. Shrubs are denser along drainage lines, on termitaria and rocky outcrops (Rutherford et al., 2006). The publication describes this vegetation as being characterized by the presence of the woody species *Acacia caffra*, *Acacia gerrardii*, *Acacia karroo*, *Combretum molle*, *Rhus lancea*, *Ziziphus mucronata*, *Acacia nilotica*, *Acacia tortilis*, *Euclea crispa*, *Olea europea* subsp. *africana*, *Rhus pyroides* and *Asparagus cooperi*, the grass species, *Elionurus muticus*, *Eragrostis lehmanniana*, *Setaria sphacelata* and *Themeda triandra*, the herbs, *Hermannia depressa*, *Ipomoea obscura*, *Barleria macrostegia*, *Dianthus mooiensis, Ipomoea oblongata*, *Vernonia oligocephala*, *Ledebouria revoluta* and *Ornithogalum tenuifolium*.

The vegetation in this region have been studied in some detail (Van der Meulen 1979; Panagos 1996; van Rooyen 1983, 1984), although data is not presented in a georeferenced format and it is difficult to ascertain whether the area immediately surrounding the study area has been studied. There have also been some unpublished studies done in the area adjacent to the current site, one as part of a PhD thesis (Smith 1988) and the other in support of a development application on an adjacent piece of land (Bathusi Environmental Consulting 2006). There is therefore some information that can be used to place the current study area in context (see Mucina et al. 2000), as well as the broad descriptions of Acocks (1953, 1988) and Low and Rebelo (1998) as well as the more-recently compiled national vegetation map (Mucina & Rutherford 2006).

The study site is not close to any of the Centres of Plant Endemism (van Wyk & Smith 2001). The flora of this area is mainly Kalahari-Highveld (White 1983), but there may be strong Afromontane and Zambezian affinities, especially among woody plants. According to C-plan version 2 (GDACE 2006) the entire western half of the site is considered to contain important or sensitive features and ecological process surrogates and is considered to be irreplaceable due to the presence of these features. The important features are primary grassland, confirmed locations of threatened plant species and habitat suitable for threatened plant species meta-population dynamics. The ecological process surrogates are groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal in the drainage lines.

METHODOLOGY

Vegetation survey

The fieldwork component of this survey was conducted on the 27th of March and 19th of April 2007 and a follow-up survey was conducted on 2nd of November 2007. Vegetation mapping was done with the use of a hand-held GPS receiver to mark vegetation boundaries, 1:50 000 topographic maps and available aerial photograph data for the study area. Vegetation was first stratified into homogenous units on the basis of physiognomy (vegetation structure and texture) using aerial photography obtained from the Google Earth website (http://earth.google.com). The delineated units were surveyed in the field using vegetation sample plots in a Braun-Blanquet vegetation survey technique.

Quantitative data was collected in natural vegetation by undertaking vegetation sampling according to the Braun-Blanquet approach (Mueller-Dombois & Ellenberg 1974; Westhoff & van der Maarel 1978). In each sample site the following data was collected:

- **species present,**
- **cover estimation of each species according to the Braun-Blanquet scale,**
- **vegetation height,**
- **amount of bare soil and rock cover ,**
- **slope, aspect in degrees, latitude and longitude position (from GPS) in decimal degrees,**
- **presence of biotic disturbances, e.g. grazing, animal burrows, etc.**

The plant communities that were identified were then described using the vegetation sample data.

Additional checklists of plant species were compiled by traversing the study area on foot and recording species as they were encountered. Plant names follow Germishuizen et al. (2005). All exotic species categorised as alien invaders or weeds (as listed in amendments to Conservation of Agricultural Resources Act, 1983, Act No. 43 of 1983) were recorded. Due to the brief duration of the survey and the lack of seasonal coverage, the species list provided for the area can not be regarded as comprehensive, but is nevertheless likely to include the majority of the dominant and common species present.

Red Data plant species

Lists of historical occurrences of Threatened and Orange List plant species were obtained from the PRECIS Database of the South African National Biodiversity Institute and from GDACE for the site within the quarter degree square 2628 CB. For all threatened plants that occur in the general geographical area of the site, a rating of the likelihood of it occurring on site is given as follows:

- **LOW: no suitable habitats occur on site / habitats on site do not match habitat description for species;**
- **MEDIUM: habitats on site match general habitat description for species (e.g. grassland), but detailed microhabitat requirements (e.g. rocky grassland on shallow soils overlying dolomite) are absent on the site or are unknown from the descriptions given in the literature or from the authorities;**
- **HIGH: habitats found on site match very strongly the general and microhabitat description for the species (e.g. rocky grassland on shallow soils overlying dolomite);**
- **DEFINITE: species found on site.**

Those species for which there was a high chance of them occurring on site were searched for in the field.

Sensitivity assessment

Sensitivity is based on the concept of irreplaceability. For example, areas containing high diversity, Red List organisms, high habitat complexity or systems vital to sustaining ecological functions are considered sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to have low sensitivity. Information from GDACE's C-Plan version 2 was used to provide additional information on the conservation value of the study area as well relevant legislation, policies and Provincial guidelines.

RESULTS

The site currently consists of mostly secondary vegetation consisting primarily of open *Acacia* thornveld interspersed with areas of *Hyparrhenia hirta* grassland (Appendix 1). Geographically the site is marginally isolated by the presence of the urban areas to the south and west as well as the highways to the north and east. However, there are linkages via the drainage lines towards the south of the site going into the urban area, although these tend to be modified and impacted by urbanisation and canalization. There is little fragmentation within the study site itself and it represents a relatively contiguous unit of approximately 150 ha, albeit it primarily secondary grassland. The vegetation types and landcover classes on the site are described in more detail below. Exotic species are indicated with an asterisk.

Vegetation and landcover of the study area

Plant communities / vegetation types on site appear to be distributed according to local topography and hydrology (Figure 1) as well as management history. The site consists of plains intersected by wide, shallow drainage valleys. The plains are mostly vegetated by un-wooded secondary grassland, whereas the shallow floodplains are vegetated by open *Acacia* savanna vegetation. Within the drainage valleys there are drainage channels which vary according to the seasonality of surface water flow. Where the channels are deep and permanent, there tends to be an un-vegetated channel surrounded by tall grassland or else, where water may collect more permanently, there may be marsh wetland vegetation. In shallow, ephemeral drainage channels where the channel is poorly formed, the dominant vegetation is more likely to be a dense thicket of *Acacia* thorn trees. The major plant communities identified on site are as follows:

- **Secondary grassland**
- **Secondary Acacia thornveld**
- **Dense Acacia woodland**
- **Wetland**

These plant communities are described in more detail in the sections that follow. The approximate areas of the different plant communities is as follows:

Plant community	Area (ha)	Proportion of study area (%)
Secondary grassland	72.9	40.2
Secondary Acacia thornveld	68.6	37.8
Dense Acacia woodland	18.7	10.3
Wetland	20.1	11.1

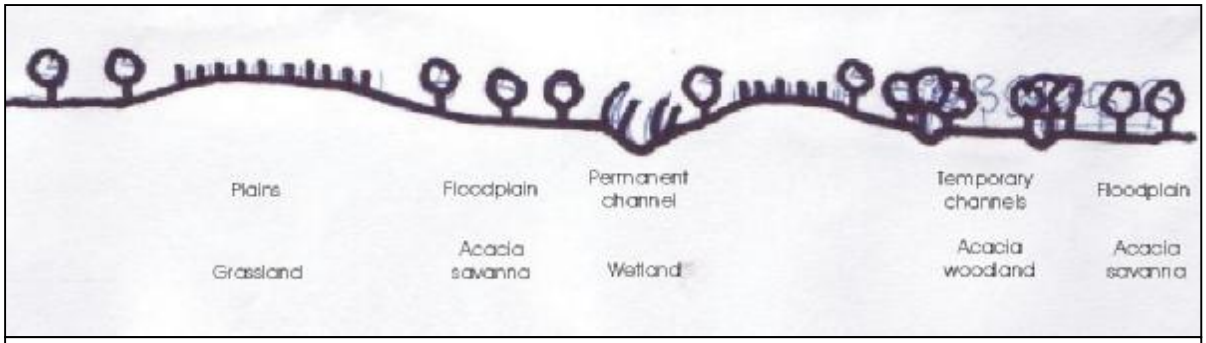

Figure 1: Profile across site to show ecological position of different plant communites.

Secondary grassland

Grassland on site was generally a medium to tall grassland (Figure 2) that occurred on the flat to undulating plains. This tended to be in the higher-lying parts of the landscape, taking the overall flatness of the site into account (Figure 1), although there may still be hydric indicators that suggest occasional flooding of these areas. The soils were mostly dark vertic clays that, at the time of the survey, contained deep fissures. The soil colour tended to be dark brown rather than the black colour usually attributed to the turf soils in this region.

Plant species occurring commonly in these areas include the grasses *Hyparrhenia hirta*, *Eragrostis chloromelas*, *Eragrostis curvula*, *Dichanthium annulatum* (Vlei finger grass), *Aristida bipartita* and *Cymbopogon plurinodis* and the forbs, *Tribulus terrestris*, *Hermannia depressa*, *Cucumis zeyheri*, *Kohautia virgata*, *Solanum panduriforme*, *Hibiscus trionum*, *Convolvulus sagittatus*, *Verbena bonariensis and *Sida rhombifolia*. Some of these species are commonly found in secondary and disturbed areas within this broad vegetation type, for example, *Aristida bipartita*, *Convolvulus sagittatus*, *Hibiscus trionum* and *Euphorbia helioscopia**, although these had low cover and importance within the grasslands on site.**

There are three Red or Orange List plant species that could occur within this habitat type, one of which (*Hypoxis hemerocallidea*) is confirmed to occur in this habitat on this property.

Secondary Acacia thornveld

The Acacia savanna is a relatively open to semi-closed low microphyllous woodland (Figure 3). It occurs on flat areas adjacent to the main drainage channel and is indicative of a wide floodplain area. This tends to be the lower-lying parts of the landscape (Figure 1) and there are hydric indicators that suggest seasonal flooding of these areas. The soils are black vertic clays that, at the time of the survey, contained deep fissures.

Figure 2: Grassland in areas away from drainage lines. *Acacia* thornveld can be seen in the background.

Plant species occurring commonly in these areas are similar to the grasslands and include the woody species, *Acacia karroo*, *Acacia nilotica* and *Ehretia rigida*, the grasses *Hyparrhenia hirta*, *Eragrostis chloromelas*, *Cynodon dactylon*, *Eleusine coracana*, *Themeda triandra*, *Heteropogon contortus*, *Eragrostis curvula*, *Dichanthium annulatum* (Vlei finger grass), *Aristida bipartita* and *Cymbopogon plurinodis* and the forbs, *Pachycarpus vexillaris*, *Aloe zebrina*, *Ledebouria revoluta*, *Vernonia oligocephala*, *Cucumis zeyheri*, *Kohautia virgata*, *Solanum panduriforme*, *Hibiscus trionum*, *Convolvulus sagittatus*, *Verbena bonariensis and *Senecio pentactinus*.**

There are four Red or Orange List plant species that could occur within this habitat type, one of which is confirmed to occur in this habitat on another section of this property (to the north of the N4 highway, i.e. *Schizoglossum umbelliferum*). These species are *Schizoglossum umbelliferum*, *Eulophia leachii*, *Hypoxis hemerocallidea* and *Trachyandra erythrorrhiza*. Only *Hypoxis hemerocallidea* was found on site.

Closed Acacia woodland

Dense Acacia woodland occurs along many of the drainage channels of the site where no active channel is found (see Figure 1). These are generally the secondary to tertiary drainage areas on site and tend to occur in the areas to the east nearer to the N1 highway. These drainage channels are mostly quite narrow, approximately 2 to 5 m wide, shallow and unchannelled and represent valley bottom wetland systems. The *Acacia* trees are the most dominant structural feature and often form a closed canopy, but the ground is well-covered with a grassy layer. The soils are dark, black vertic clays.

Common and dominant species include the small trees and shrubs, *Acacia karroo* and *Rhus pyroides*, and the grasses and forbs, *Eragrostis chloromelas*, *Setaria sphacelata* var *sphacelata*, *Andropogon schirensis*, *Dichanthium annulatum*, *Aristida bipartita*, *Verbena bonariensis, *Bidens pilosa*, *Conyza podocephala*, *Hermannia* species, *Ipomoea* species,**

Figure 3: *Acacia* thornveld.

***Sutera aurantiaca*, *Pseudognaphalium oligandrum*, *Tagetes minuta*, *Asparagus suaveolens* and *Rubia horrida*. The bulbous plant, *Crinum macowanii*, was a sparse but common species in this habitat. This plant, commonly called the river lily, is usually found close to rivers and in vleis.**

There are three Red or Orange List plant species that could occur within this habitat type (*Schizoglossum umbelliferum*, *Eulophia leachii* and *Trachyandra erythrorrhiza*).

Wetlands

There are some areas of permanent wetlands in the main drainage channel that runs through the study area. These consist mostly of unvegetated channels with fringing tall grasses (Figure 4), but, where water-flow is impeded, a vegetated wetland has developed. Species that occur in these areas include *Leersia hexandra*, *Persicaria lapathifolia, *Paspalum distichum*, *Typha capensis*, *Schoenoplectus corymbosus*, *Cyperus sexangularis*, *Imperata cylindrica* and *Hemarthria altissima*. These species indicate relatively permanent wet conditions, although it was dry at the time of sampling.**

The permanent wetlands are regarded as being of significant conservation value and of HIGH sensitivity for the following reasons:

- **Such wetlands constitute an important and restricted habitat type for a variety of plants and animals.**
- **The indigenous riparian vegetation, including the marsh vegetation of drainage lines such as those occurring in the study area, throughout the highveld region is under great threat from factors such as alien invasive plant species (Henderson & Musil, 1987), altered hydrological patterns, reduced water quality, ploughing and overgrazing. Any remaining area of untransformed wetland must therefore be regarded as of elevated conservation importance.**
- **A river or drainage line is a 'longitudinal ecosystem', and its condition at any point is a reflection not only of all upstream activities within the river/drainage line, but also of all**

Figure 4: Wetland vegetation in drainage lines within the study area.

activities in the adjacent and upstream parts of the catchment (O'Keefe, 1986).

There are two threatened plant species that could occur within this habitat type.

Flora of the study area

All plant species found during the survey in remaining natural areas are listed in Appendix 2. Due to the fact that the fieldwork component of this survey lacked seasonal coverage, the species list provided is unlikely to be comprehensive, but nevertheless provide a good indication of the species diversity and composition of the study area. In the species list (Appendix 2) all exotic species are indicated by an asterisk.

Species richness in the vegetation of the study area is moderate. A total of 90 species were recorded during the brief survey, 14 of which are exotic and an additional 4 of which are declared weeds or invader plants. The proportion of naturalized exotic and invader species is moderate (20%), despite the moderate levels of disturbance in the natural vegetation in some parts of the site. There were 21 species in the list (excluding declared weeds or invader plants) that are usually restricted to or associated with wetlands, as well as 21 species that are commonly found in disturbed areas. The remaining 44 species represent terrestrial grassland and savanna vegetation. The declared weeds or alien invader species, according to the Conservation of Agricultural Resources Act (Act No.43 of 1983) are *Datura stramonium** and *Xanthium strumarium* (Declared weeds category 1) and *Morus alba** and *Melia azeradach** (Declared invaders category 3).

Red List Plant Species

Lists of plant species previously recorded in the quarter degree grid in which the study area is situated were obtained from the South African National Biodiversity Institute and GDACE. This list contains 10 species, listed in Appendix 3 together with their conservation status categories according to the IUCN Version 3.1 criteria (IUCN, 2001). Relevant information, such as habitat, flowering time, etc., is given for all species listed. Three of these species are considered to be Vulnerable, four as Near Threatened and two as Declining (see Table 1 for explanation of categories). One species (*Eulophia leachii*) was listed as Near Threatened at the time of the field assessment, but has since been classified as Least Concern.

Table 1: Explanation of IUCN Ver. 3.1 categories (IUCN, 2001), and Orange List categories (Victor & Keith, 2004).

IUCN category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Threatened
EN	Endangered	Threatened
VU	Vulnerable	Threatened
NT	Near Threatened	Orange List
LC (Declining)	Least Concern, declining taxa	Orange List
LC (Rare)	Least Concern, rare	Orange List
LC (Critically Rare)	Least Concern, rare: only one subpopulation	Orange List
LC (Rare-Sparse)	Least Concern, rare: widesly distributed but rare	Orange List
DDD	Data Deficient: well known but not enough information for assessment	Orange List
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient
LC	Least Concern	Least Concern

One Near Threatened and two Declining plant species have a high chance of occurring in the available habitats on site and one Near Threatened and one Declining plant species have a

medium chance of occurring in the available habitats on site. One plant species, listed as Near Threatened (*Stenostelma umbelliferum*), has been previously recorded on the northern side of the highway within a seasonal wetland in a shallow drainage line (not on the site). Within Gauteng, this species is listed as a Priority A2 species. The Declining species, *Hypoxis hemerocallidea*, was recorded within secondary grassland on site. Following careful searches for the remaining species in the field in which none of these other species were found, it is considered unlikely that they occur on site.

According to the GDACE Threatened Species Policy, there are three basic rules of conservation that apply to populations of Red List Plant Species, as follows:

1. **All populations of Near Threatened and Threatened plant taxa must be conserved *in situ*.**
2. **All populations of Near Threatened and Threatened plant taxa must be protected with a buffer zone in accordance with guidelines as set out in below.**
    a. **In urban areas, a minimum buffer zone of 200 (two hundred) meters is required from the edge of a Red List Plant Species population.**
    b. **In rural areas, a larger buffer zone width is required to protect populations of Red List Plant Species from detrimental edge effects that are active over distances greater than 200 meters, in accordance with their priority grouping, as follows –**
        i. **in respect of an A1 priority grouping, a buffer zone of at least 600 (six hundred) meters from the edge of the Red List Plant Species population must be allowed;**
        ii. **in respect of an A2 priority grouping, a buffer zone of at least 500 (five hundred) meters from the edge of the Red List Plant Species population must be allowed;**
        iii. **in respect of an A3 priority grouping, a buffer zone of at least 400 (four hundred) meters from the edge of the Red List Plant Species population must be allowed;**
        iv. **in respect of a B priority grouping, a buffer zone of at least 300 (three hundred) meters from the edge of the Red List Plant Species population must be allowed.**
3. **An Ecological Management Plan must be compiled in respect of all actions that affect populations of Red List Plant Species, and such Ecological Management Plans must conform with the Guidelines set out below.**

Should any Red List plant species be recorded on site then these guidelines would apply. Currently, this is not the case.

Sensitivity assessment

The sensitivity assessment is an attempt to identify those parts of the study area that may have high conservation value or that may be sensitive to disturbance. Areas containing untransformed natural vegetation, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to have low sensitivity. Information from GDACE's C-Plan version 2 in conjunction with observations made in the field was used to provide information on the location of sensitive features.

According to C-Plan version 2 there are a number of natural features within the study area that may be considered to have high conservation value and ecological process surrogates that have led to these areas being classified as irreplaceable. This includes the following:

1. **primary grassland: this includes the entire western portion of the site from the main drainage line westwards (fieldwork and aerial photography indicates that this is secondary grassland in previously cultivated areas);**
2. **a perennial river, part of the upper reaches of the Apies River system: this represents a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal;**
3. **confirmed locations of threatened plant species and habitat suitable for threatened plant species meta-population dynamics.**

In addition to these features identified in C-Plan version 2 there are also a number of additional features that need to be taken into account in order to evaluate sensitivity of the site. These include the following:

1. **identification of the vegetation on site as belonging to a highly threatened ecosystem; Marikana Thornveld emerges as having high conservation priority (classified as Endangered) with less than 1% conserved of a target of 19% and more than 48% transformed;**
2. **occurrence of a number of wetlands and wetland-related habitats.**

Additional requirements, as per GDACE Departmental policies and other environmental legislation are as follows:

1. **The GDACE "Requirements for Biodiversity Assessments" stipulate that all untransformed grasslands have to be classified as having high sensitivity;**
2. **According to the National Water Act water-bodies, wetlands and riparian areas may not be impacted upon without a license from the Department. Taking into account the spirit of this legislation and the national interest in preserving water resources, wetlands and hydrological processes, these features are classified here as sensitive.**

This information was used to compile the sensitivity map (see Appendix 1). On the basis of current information and the requirements of all the above guidelines, policies and Acts, some portions of the site are classified as having High sensitivity. There is evidence to suggest that large parts of the site have been previously transformed (e.g. by cultivation), but these have not been degraded to any extent sufficiently to impair ecological functioning. A summary of the factors used to classify the different habitats is given in Table 2.

Table 2: Factors contributing to sensitivity classification of different habitats on site.

Vegetation / habitat type	Sensitivity	Reason
Secondary grassland	Low	• secondary grassland in previously cultivated area, • endangered vegetation type (Marikana Thornveld), • potential habitat for 3 Red or Orange List plant species (1 species classified as "Declining" confirmed nearby).
Secondary Acacia thornveld	Low	• endangered vegetation type (Marikana Thornveld), • potential habitat for 4 Red or Orange List species (1 species classified as "Declining" confirmed nearby).
Dense Acacia woodland (wetland)	High	• seasonal wetland, • ecological and hydrological process surrogate (perennial river), • endangered vegetation type (Marikana Thornveld), • potential habitat for 3 Red or Orange List plant species.
Wetland	High	• permanent wetland, • ecological and hydrological process surrogate (perennial river), • endangered vegetation type (Marikana Thornveld), • potential habitat for 2 Red or Orange List plant species.

DISCUSSION AND CONCLUSIONS

The requirements of this study were to undertake a specialist study to describe the vegetation and flora on site. The vegetation study identified four vegetation communities on site, namely secondary grassland in higher-lying areas, secondary *Acacia* thornveld on wide floodplains, dense *Acacia* woodland of drainage lines, and wetlands. The two secondary plant communities make up the majority of the site (78.0%). Although the site occurs within the Endangered vegetation type, Marikana Thornveld, no untransformed remnants of this vegetation type occur on the site. It is therefore unlikely that the proposed development of the site would lead to impacts on any threatened vegetation types.

Total species richness in the vegetation of the study area is moderate with a total of 90 species recorded during the survey for the entire site. The proportion of naturalized exotic and invader species in combination with indigenous species indicative of disturbance is high (43%), indicating high levels of disturbance in the vegetation of the site. A large proportion of the remaining species are usually associated with wetlands. This assessment will be improved by additional data collection that would lead to a more complete listing of plant species composition of the site, but it is unlikely to lead to a major change in conclusions about the floristics of the site. It is therefore unlikely that the proposed development of the site would lead to impacts resulting in irretrievable loss of species richness.

Two Near Threatened and one Declining plant species were assessed, on the basis of habitat requirements, as having a high chance of occurring in the available habitats on site and one Near Threatened and one Declining plant species were assessed as having a medium chance of occurring in the available habitats on site. The Near Threatened plant species, *Stenostelma umbelliferum*, has been previously recorded on the northern side of the highway within a seasonal wetland in a shallow drainage line (GDACE data). A Declining species, *Hypoxis hemerocallidea*, was recorded within secondary grassland on site. On the basis of the IUCN categorisation of this species as "Least Concern", it is unlikely that the loss of any individuals occurring on this portion of the farm would lead to a change in conservation status of the species. Searches for the other species that could occur on the property were unsuccessful. No threatened or near threatened plant species were therefore recorded within the study area during the field survey and it is considered unlikely that they occur on site given the small size of the remaining natural vegetation patches within the study area and the detailed search undertaken of all parts of the site. It is therefore unlikely that the proposed development of the site would lead to impacts resulting in irretrievable loss of plant species of conservation concern.

The sensitivity assessment is an attempt to identify those parts of the study area that may have high conservation value or that may be sensitive to disturbance. Taking a number of factors into account, including the requirements of various Departmental guidelines and policies and National Acts, some portions of the site are classified as having High sensitivity and the remainder as having Medium sensitivity. The proposed development of the site may lead to impacts on areas classified as having high sensitivity unless the following potential mitigation measures are employed:

1. **the habitats classified as having high sensitivity should not be developed;**
2. **suitable buffer zones, as recommended by various national and provincial acts and policies (e.g. National Water Act), should be adhered to. According to GDACE requirements, this is 30 m within an urban area.**

Due to the sensitive nature of parts of the site (the wetland areas), the proposed development of the site may have some negative impacts on vegetation, conservation-worthy plants and

ecological function of the landscape, but these are not considered to be significant (see the above discussion).

RECOMMENDATIONS

The following is recommended:

- **It is recommended that detailed wetland delineation be undertaken to confirm the existence of wetlands on the site and to determine the type and distribution of these. It will also assist in accurately identifying the boundary between wetland and terrestrial habitats.**
- **The sensitive plant communities should not be developed and suitable buffer zones should be maintained around these. If development is permitted, then it is recommended that an Environmental Officer be present during construction to ensure potential impacts are minimised.**
- **According to the Conservation of Agricultural Resources Act (Act No. 43 of 1983), all declared aliens must be effectively controlled. In terms of this Act 198 alien species were listed as declared weeds and invaders and ascribed to one of the following categories:**
    - **Category 1: Prohibited and must be controlled.**
    - **Category 2 (commercially used plants): May be grown in demarcated areas provided that there is a permit and that steps are taken to prevent their spread.**
    - **Category 3 (ornamentally used plants): May no longer be planted. Existing plants may be retained as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.**

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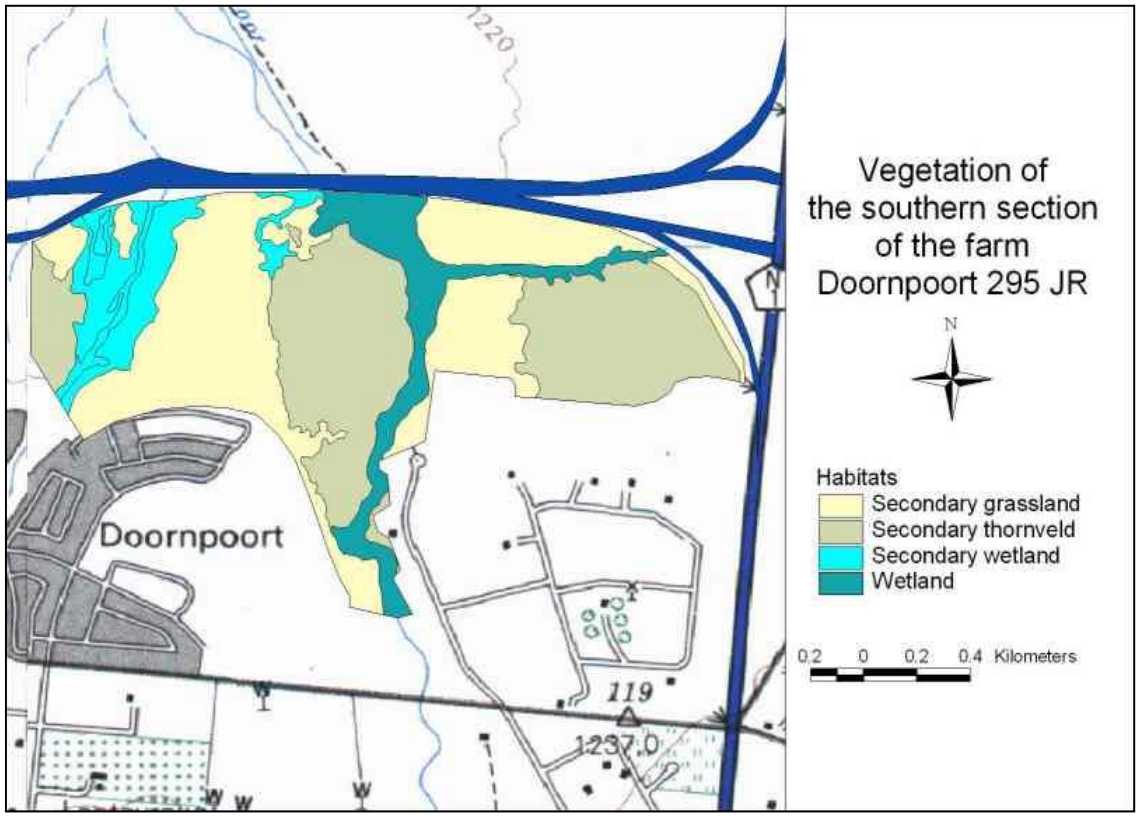
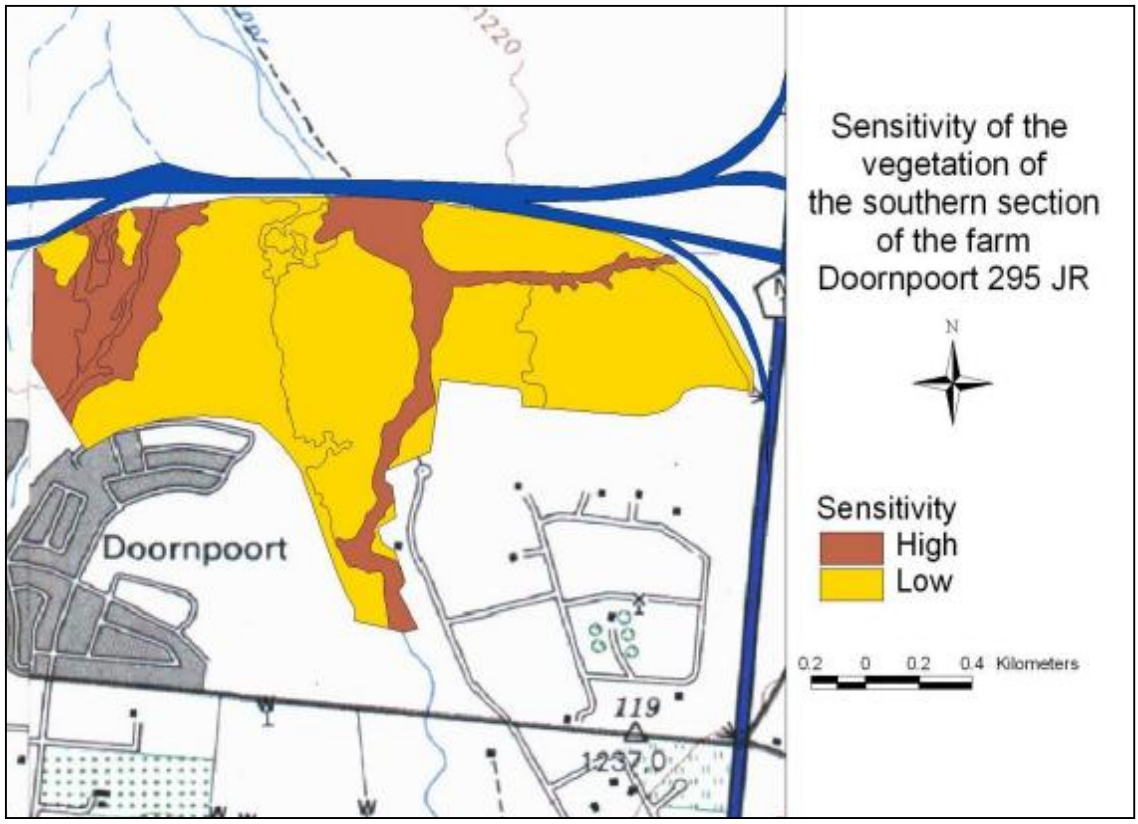
APPENDIX 1: Vegetation and sensitivity maps of the site.





APPENDIX 2: Preliminery checklist of plant species recorded.
Species marked with an asterisk are naturalized exotics. Species taxonomy is according to Germishuizen and Meyer (2001).

MONOCOTYLEDONS

TYPHACEAE
Typha capensis

CYPERACEAE
Cyperus sexangularis
Schoenoplectus corymbosus
Cyperus species

COMMELINACEAE
Commelina africana var. africana

JUNCACEAE
Juncus oxycarpus

ASPHODOLACEAE
Aloe zebrina

HYACINTHACEAE
Ledebouria revoluta

ASPARAGACEAE
Asparagus suaveolens

AMARYLLIDACEAE
Crinum macowanii

HYPOXIDACEAE
Hypoxis hemerocallidea **(Orange List "Declining" species)**
Hypoxis rigidula

POACEAE
Andropogon schirensis
Aristida bipartita
Bothriochloa insculpta
Cymbopogon plurinodis
Cynodon dactylon
Dichanthium annulatum
Eleusine coracana ssp. africana
Eragrostis chloromelas
Eragrostis curvula
Eragrostis gummiflua
Hemarthria altissima
Heteropogon contortus
Hyparrhenia dregeana
Hyparrhenia hirta

Imperata cylindrica
Leersia hexandra
Paspalum dilatatum*
Paspalum distichum*
Phragmites australis
Setaria pallide-fusca
Setaria sphacelata var. sphacelata
Sorghum versicolor
Sporobolus africanus
Themeda triandra

DICOTYLEDONS

MORACEAE
Morus alba* **(Declared invader category 3)**

POLYGONACEAE
Persicaria lapathifolia*

AMARANTHACEAE
Amaranthus hybridus*
Gomphrena celosioides*

RANUNCULACEAE
Ranunculus multifidus

FABACEAE
Acacia caffra
Acacia karroo
Acacia nilotica ssp. kraussiana
Dichrostachys cinerea
Indigofera daleoides
Vigna vexillata

GERANIACEAE
Monsonia angustifolia

ZYGOPHYLLACEAE
Tribulus terrestris

EUPHORBIACEAE
Euphorbia helioscopia*

MELIACEAE
Meila azeradach* **(Declared invader category 3)**

ANACARDIACEAE
Rhus pyroides

RHAMNACEAE
Ziziphus mucronata

MALVACEAE

Sida rhombifolia
Hibiscus trionum

STERCULIACEAE
Hermannia depressa
Hermannia species

ONAGRACEAE
Oenothera rosea*

ASCLEPIADACEAE
Pachycarpus vexillaris
Asclepias fruticosus

CONVOLVULACEAE
Convolvulus sagittatus
Ipomoea species

BORAGINACEAE
Cynoglossum hispidum
Ehretia rigida

VERBENACEAE
Verbena bonariensis L.*
Lippia javanica

LAMIACEAE
Salvia runcinata

SOLANACEAE
Solanum panduriforme
Datura ferox* **(Declared weed category 1)**

SELAGINACEAE
Walafrida densiflora

SCROPHULARIACEAE
Sutera aurantiaca

PEDALIACEAE
Ceratotheca triloba

ACANTHACEAE
Crabbea acaulis

RUBIACEAE
Kohautia virgata
Rubia horrida

CUCURBITACEAE
Cucumis zeyheri

ASTERACEAE

Berkheya radula
Bidens pilosa L.*
Conyza canadensis*
Conyza podocephala
Conyza species
Flaveria bidentis*
Nidorella hottentotta
Pseudognaphalium oligandrum
Schkuhria pinnata*
Senecio pentactinus
Sonchus dregeanus
Tagetes minuta*
Vernonia oligocephala
Xanthium strumarium* **(Declared weed category 1)**
Zinnia peruviana*

[1] Extracted from Henderson (2001). Legal Status is as stipulated in 'Conservation of Agricultural Resources Act' (Act 43 of the Republic of South Africa 1983), as amended in 2001. In terms of this Act 198 alien species were listed as declared weeds and invaders and ascribed to one of the following categories:

- **Category 1: Prohibited and must be controlled.**
- **Category 2 (commercially used plants): May be grown in demarcated areas provided that there is a permit and that steps are taken to prevent their spread.**
- **Category 3 (ornamentally used plants): May no longer be planted. Existing plants may be retained as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.**

APPENDIX 3: Red Data plant species recorded in the quarter degree grid 2628CB.

Taxon	Latest (IUCN version 3.1) Conservation Status**	Habitat	Flowering Time	Priority status in Gauteng	Probability of occurrence*
Bowiea volubilis subsp. volubilis	Vulnerable (VU)	Shady places, steep rocky slopes and in open woodland, under large boulders in bush or low forest.	September-April	B	LOW
Ceropegia decidua* subsp. *pretoriensis	Vulnerable (VU)	Direct sunshine or shaded situations, rocky outcrops of the quartzitic Magaliesberg mountain series, in pockets of soil among rocks, in shade of shrubs and low trees, can be seen twining around grass spikes	November-April	A1	LOW
Stenostelma umbelluliferum	Near Threatened (NT)	Deep black turf in open woodland mainly in the vicinity of drainage lines	September-February	A2	HIGH, previously recorded nearby
Delosperma gautengense	Vulnerable (VU)	Among rocks of Magaliesberg quartzite in grassland in transition to sour grassveld	November-April	A1	LOW
Eucomis autumnalis* subsp. *clavata	Declining	Open grassland, marshes.	November-April	N/A	MEDIUM
Eulophia leachii	Least Concern (LC)	Bushveld under trees on stony, black and heavy soils.	December - January	N/A	HIGH
Habenaria bicolor	Near Threatened (NT)	Terrestrial in drained grassland, recorded from about 1800m.	January-March	B	MEDIUM
Habenaria kraenzliniana	Near Threatened (NT)	Terrestrial in stony, grassy hillsides, recorded from 1000 to 1400m.	February-April	A3	LOW
Hypoxis hemerocallidea	Declining	Grassland and mixed woodland.	January-March	N/A	HIGH
Trachyandra erythrorrhiza	Near Threatened (NT)	Marshy areas, grassland, usually in black turf marshes.	September-October	A3	HIGH

**** Status according to GDACE list of Red and Orange list plants and from personal communication with Ms. J.E. Victor of the Threatened Species Programme of the South African National Biodiversity Institute in Pretoria. Conservation Status Category assessment according to IUCN Ver. 3.1 (IUCN, 2001). Status updated on 7 August 2008.**

***Probability of occurrence, as follows: LOW – no suitable habitats occur on site / habitats on site do not match habitat description for species, MEDIUM – habitats on site match general habitat description for species (e.g. grassland), but microhabitat requirements are absent (e.g. rocky grassland on shallow soils overlying dolomite), HIGH – habitats on site match very strongly the general and microhabitat description for the species, DEFINITE – species found on site.**