ANNEXURE C3

SPECIALIST ASSESSMENTS

- Botanical Impact Assessment

Botanical Assessment of the proposed solar energy installations at Hoekplaas RE/146, near Copperton, Northern Cape Province

Botanical Surveys & Tours

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Prepared for Aurecon SA (Pty) Ltd

June 2013

National Legislation and Regulations governing this report

This is a 'specialist report' and is compiled in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, and the Environmental Impact Assessment Regulations, 2010.

Appointment of Specialist

David J. McDonald of Bergwind Botanical Surveys & Tours CC was appointed by Aurecon South Africa (Pty) Ltd to provide specialist botanical consulting services for the Environmental Impact Assessment for the proposed extended Hoekplaas Solar Energy Plants in the Northern Cape Province. The consulting services comprise an assessment of potential impacts on the flora and vegetation in the designated study area by the proposed projects.

Details of Specialist

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Expertise

Dr David J. McDonald:

- Qualifications: BSc. Hons. (Botany), MSc (Botany) and PhD (Botany)
- Botanical ecologist with over 30 years' experience in the field of Vegetation Science.
- Founded Bergwind Botanical Surveys & Tours CC in 2006
- Has conducted over 300 specialist botanical / ecological studies
- Has published numerous scientific papers and attended numerous conferences both nationally and internationally (details available on request)

Curriculum Vitae: Appendix 2

Independence

The views expressed in the document are the objective, independent views of Dr McDonald and the survey was carried out under the aegis of, Bergwind Botanical Surveys and Tours CC. Neither Dr McDonald nor Bergwind Botanical Surveys and Tours CC have any business, personal, financial or other interest in the proposed development apart from fair remuneration for the work performed.

Conditions relating to this report

The content of this report is based on the author's best scientific and professional knowledge as well as available information. Bergwind Botanical Surveys & Tours CC, its staff and appointed associates, reserve the right to modify the report in any way deemed fit should new, relevant or previously unavailable or undisclosed information become known to the author from on-going research or further work in this field, or pertaining to this investigation

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of the report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEAT/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Proposed Hoekplaas Solar Energy Facility near Copperton, Northern Cape Province.

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THE INDEPENDENT PERSON WHO COMPILED A SPECIALIST REPORT OR UNDERTOOK A SPECIALIST PROCESS

I **David Jury McDonald**, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Note: The terms of reference must be attached.

Signature of the specialist:

Bergwind Botanical Surveys & Tours CC

Name of company:

4 June 2013

Date:

CONTENTS

1. Introduction

In 2011 an investigation was initiated to test the feasibility of solar energy installations on the farms Hoekplaas (Remainder of Farm 146), Klipgats Pan (Portion 4 of Farm 117) and Struisbult (Farm No. 104 Portion 1, also known as Vogelstruisbult) in the Copperton District, west of Prieska. Aurecon South Africa (Pty) Ltd (Aurecon) was appointed by Mulilo Renewable Energy (Pty) Ltd (the applicant) to conduct the environmental impact assessment process. At that time limited-scale photovoltaic (PV) solar energy facilities were proposed for each of the farms. Bergwind Botanical Surveys & Tours CC was appointed by Aurecon, on behalf of the applicant, to carry out botanical assessments of the designated properties to support the environmental impact assessment process (McDonald 2012 a, b & c). The purpose of the botanical impact assessment was to inform the environmental assessment on (a) the suitability of the site from a botanical viewpoint and (b) to determine any constraints that should be implemented to conserve the vegetation and flora (sensitivity analysis) while permitting the development to continue. The study was conducted in terms of the National Environmental Management Act (No.7 of 1998) as amended.

Environmental Authorizations (EAs) were granted for photovoltaic (PV) solar energy facilities on the farms Hoekplaas RE/146 and Klipgats Pan 4/117 as well as for Struisbult. Those on Hoekplaas and Klipgats Pan are referred to as Hoekplaas PV1 and Klipgats Pan PV1. Mulilo Renewable Energy (Pty) Ltd then proposed to pursue the development of further PV installations on Hoekplaas (discussed in this report) and Klipgats Pan. Aurecon was appointed to carry out the environmental impact assessments. Bergwind Botanical Surveys & Tours CC was once again appointed to carry out the specialist botanical studies required.

The principles, guidelines and recommendations of CapeNature [Western Cape] (although the study is in the Northern Cape) and the Botanical Society of South Africa for proactive assessment of the biodiversity of proposed development sites are followed (Brownlie 2005, De Villiers *et al*. 2005).

2. Terms of Reference

Undertake the requisite field work and compile a report which includes the following aspects:

- A broad description of the botanical characteristics of the site and surrounds;
- Identification and description of biodiversity patterns at community and ecosystem level (main vegetation type, plant communities in vicinity and threatened/ vulnerable

ecosystems species), at species level (Red Data Book species, presence of alien species) and in terms of significant landscape features;

- An assessment of the potential direct and indirect and cumulative impacts resulting from the proposed developments (including the associated infrastructure e.g. access roads and transmission lines), both on the footprints and the immediate surrounding area during construction and operation;
- Comment on whether or not biodiversity processes would be affected by the proposed projects, and if so, how these would be affected;
- A detailed description of appropriate mitigation measures that can be adopted to reduce negative impacts and improve positive impacts for each phase of the project, where required; and
- Cognisance must be taken of the Department of Environmental Affairs and Development Planning guideline: "Guideline for involving biodiversity specialists in EIA processes" (Brownlie, 2005) as well as the requirements of the Botanical Society of South Africa (BotSoc) and CapeNature in developing an approach to the botanical investigation.

Figure 1. Location of the proposed Mulilo PV installations (blue dot) near Copperton in the Northern Cape Province.

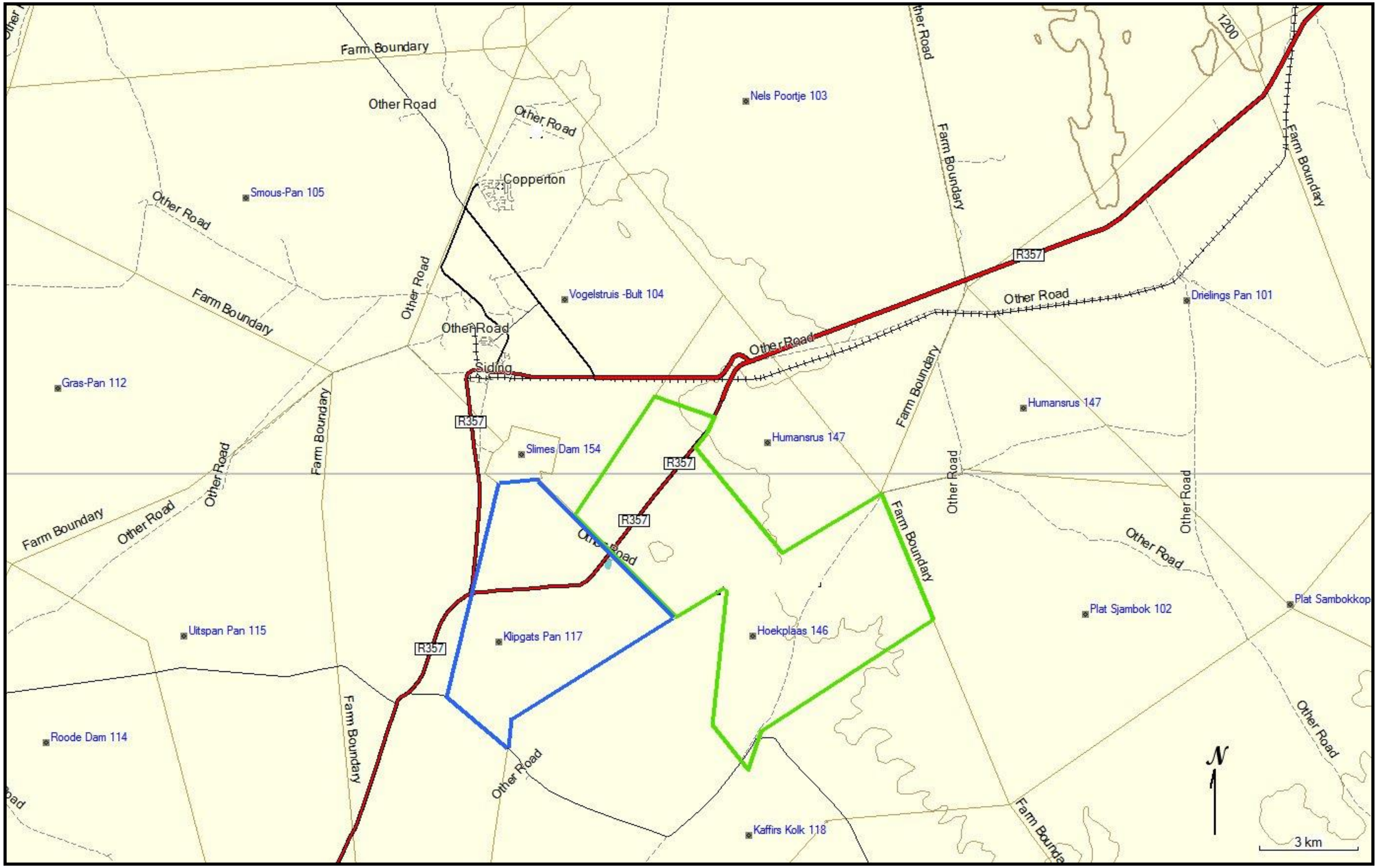

Figure 2. Topographic map of the study site at Hoekplaas Farm (green boundary) in relation to Copperton and the neighbouring Klipgats Pan (blue boundary).

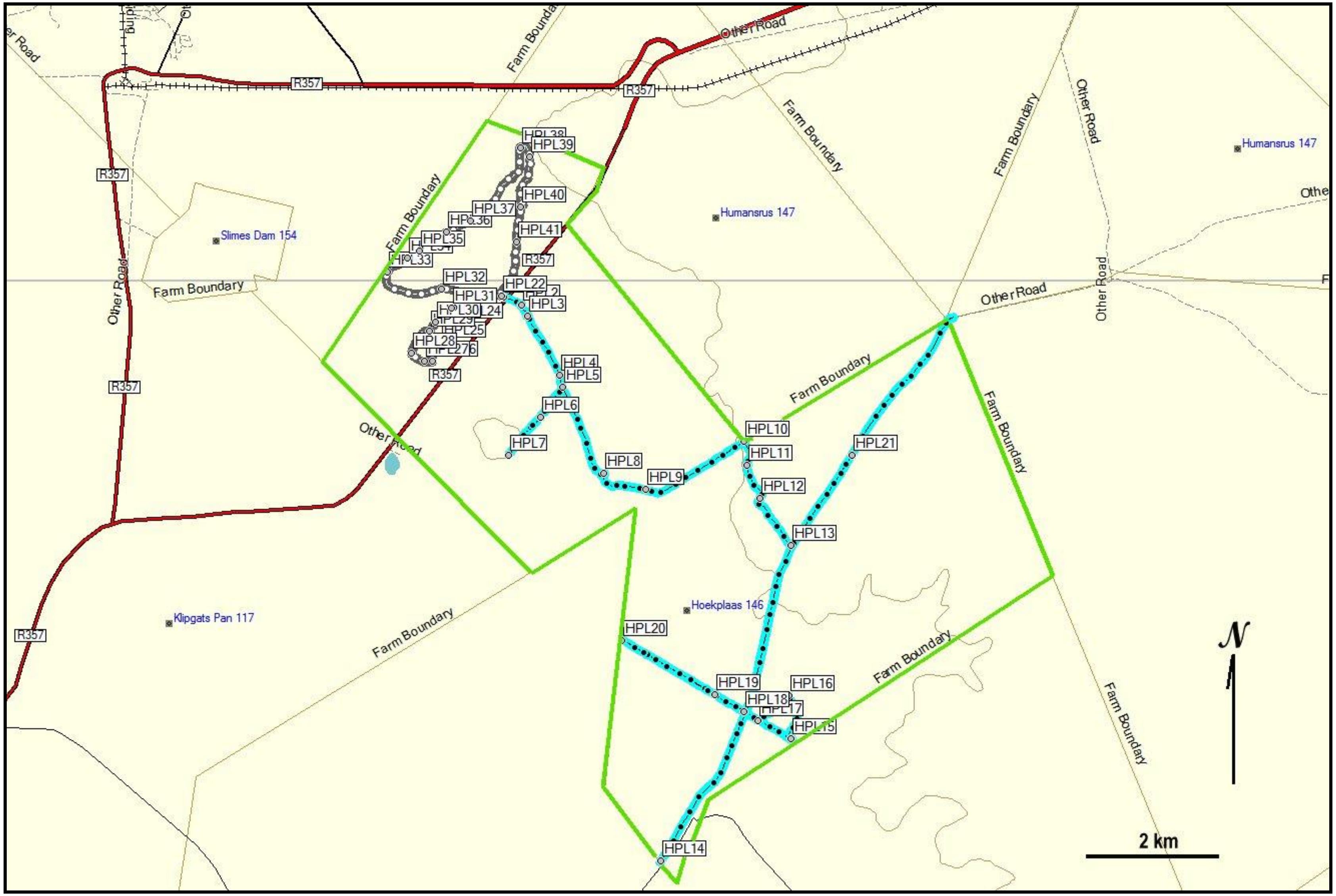

Figure 3. The Hoekplaas study area (green boundary) with the botanical sample track is shown as a light blue line and grey line with waypoints shown as HPL#.

3. Study Area

3.1 Locality

Hoekplaas is located 14 km southeast of Copperton and approximately 55 km southwest of Prieska in the in Northern Cape Province (Figure 1). The study area, Hoekplaas Farm, lies approximately 14 km southeast of Copperton. The farm has a multi-angled polygon shape and covers an area of 4 164 ha (Figures 2 & 3).

The study area falls within the Nama Karoo Biome which covers a large part of the Northern Cape Province. Hoekplaas Farm falls within the Bushmanland Bioregion which extends from the eastern part of Namaqualand in the west to near Prieska in the east and from Upington in the north to the Brandlvlei / Sak River area in the south (Rutherford, Mucina & Powrie, 2006).

3.2 Topography and geology

The landscape has characteristic low relief being underlain mainly by tillite, mudstone and shale sediments of the Mbizane Formation (Dwyka Group; Karoo Supergroup) laid down in the Late Carboniferous to Early Permian. Some parts are lower-lying and have Late Caenozoic (Quaternary to Recent) superficial deposits of the Gordonia Formation (Kalahari Group) [reddish aeolian sands] and Quaternary to Recent alluvium and pan sediments. Calcrete hardpan and lime nodules are found in the subsoil and often exposed at the surface ((Johnson *et al.* 2006; Partridge, Botha & Haddon, 2006; Mucina *et al.* 2006; Almond, 2012). It is the superficial sediments that influence the vegetation. The soils are classified as red and yellow, feely drained apedal soils with a high base status and usually <15 % clay (Land Type Survey Staff 1972—2006). They are generally grouped in the Calcic Soil Group (Fey, 2010). Over large areas the soil-surface is scattered with pebbles and small boulders.

The topographic map (Figure 2) shows the low relief of the study area. The land-type is classified as the Ah93-type (Figure 4) which consists of flats with a few rises (Land Type Survey Staff, 1972—2006; MacVicar *et al.* 1974), some shallow drainage lines and occasional endorheic pans.

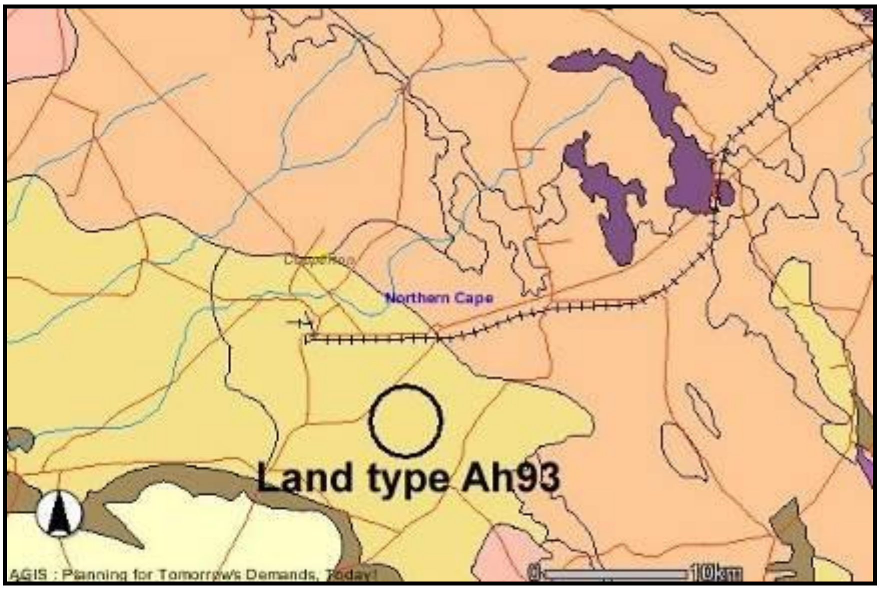

Figure 4. Land-type map for the Copperton area, N. Cape with the Ah93 land-type found in the study area (from http://www.agis.agric.za/agisweb/viewer.htm?pn=2015)

3.3 Climate

The climate of the study area is classified as 'arid' with mean annual precipitation of around 200 mm. Rain occurs mainly from late summer to autumn (January to April). The winter to spring months (May to October) are generally dry (Figure 5). Daytime temperatures regularly exceed 30°C in the summer whereas in the winter daytime temperatures are usually in the mid 20°C range (Figure 6). Winds can be strong with whirlwinds occurring in summer due to thermal convection. Frost occurs up to 35 days a year. A climate diagram for Bushmanland Basin Shrubland (Figure 7 from Mucina *et al.* 2006) represents the typical climate found in the study area but note that Figure 6 shows an average condition over the range of the vegetation type and not for a specific place such as Copperton (refer Figures 5 and 6).

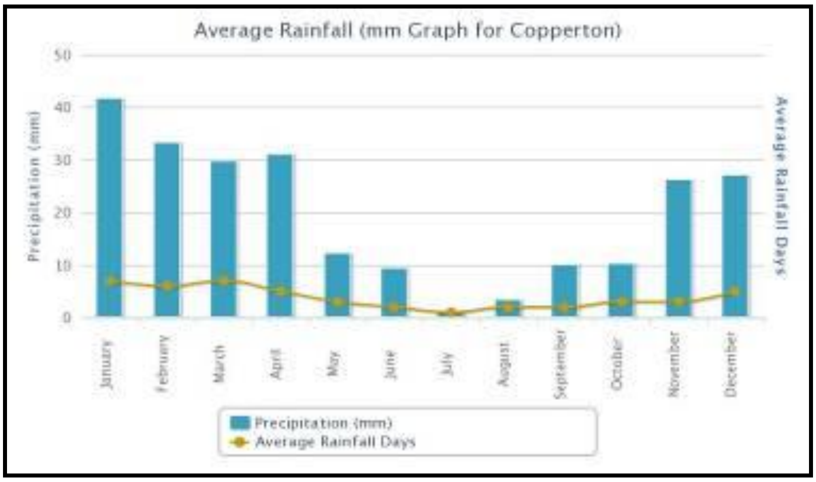

Figure 5. Rainfall for Copperton, the nearest main town to the study area.
(Source: http://www.worldweatheronline.com/Copperton-weather-averages/Northern-Cape/ZA.aspx)

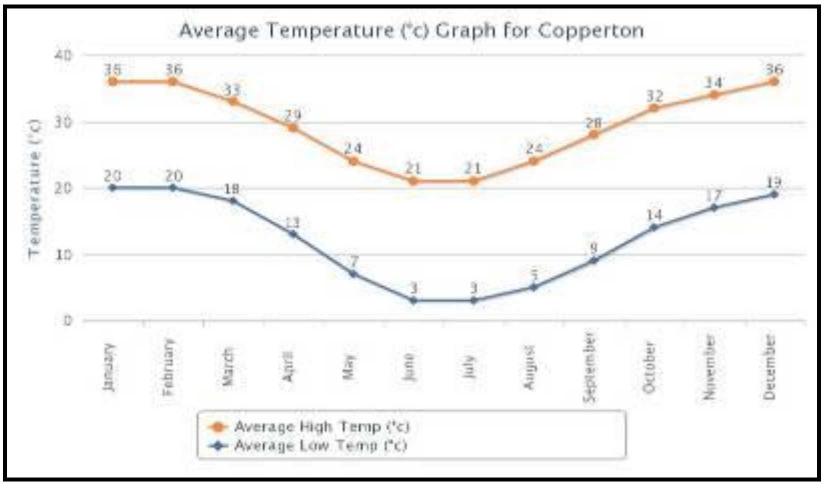

Figure 6. Temperatures for Copperton the nearest main town to the study area.
(Source: http://www.worldweatheronline.com/Copperton-weather-averages/Northern-Cape/ZA.aspx)

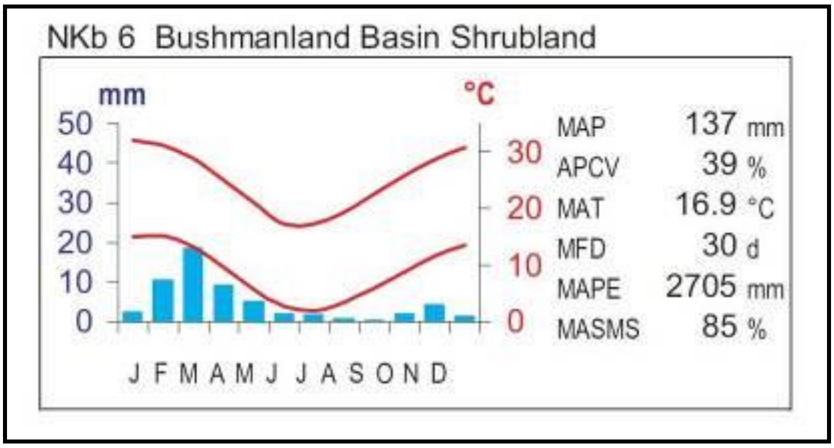

Figure 7. Climate diagram for Bushmanland Basin Shrubland (from Mucina *et al.,* 2006) showing MAP – Mean Annual Precipitation; ACPV = Annual Precipitation Coefficient of Variance; MAT = Mean Annual Temperature; MFD = Mean Frost Days; MAPE = Mean Annual Potential Evaporation; MASMA = Mean Annual Soil Moisture Stress

4. Methodology

The study area was originally visited on 24 November 2011. At that time only the PV1 site was surveyed (McDonald, 2012a). A second visit was conducted on 16 and 17 April 2013. Owing to the extensive area envisaged for the proposed solar PV installations Hoekplaas Farm was traversed using farm roads as much as possible to access the area. Occasionally it was necessary to travel off existing tracks. A hand-held Garmin ® GPSMap 62S and Apple iPad (using the GPA HD Tracks application) were used to track the route and record waypoints. Observations were made at 41 waypoints (Figure 3) and recorded by means of photographs, by describing the vegetation and by recording the plant species. As is standard practice, particular attention was given to the possibility of finding endemic and 'Red List' species.

Aerial photography, mainly from Google Earth ™ and also GPS HD Tracks, was used to assist with interpretation of the landscape and the distribution of plant communities and vegetation types.

The impact assessment methodology applied is given in Appendix 1.

5. Limitations and Assumptions

At the time of the second site visit (April 2013) the study area was not as dry as at the time of the previous field visit. The area had received approximately 80 mm rain a few weeks before the second visit which resulted in the vegetation being in somewhat better condition that when first sampled in November 2011. However, management of Hoekplaas as a sheep-farm is good and apart from the lack of flowers on the shrubs, most plants could be identified with a fair level of accuracy in the field, adequate enough for the purposes of this survey. Some species were undoubtedly missed due to the nature of the survey which had a broad focus and relies on widely-spaced sample points. Occurrence of grasses was patchy and many species were not identifiable despite the recent rains.

6. Disturbance regime

As mentioned above, the main activity on Hoekplaas is sheep-farming. Good husbandry of the veld with appropriate stocking levels has resulted in the fair to good condition of the veld. As is expected only certain areas, such as around watering points and at kraals, were more heavily trampled than in areas away from sites of livestock concentration. This, however, has little bearing on the proposed solar energy project since the installations would be away from these watering points.

Very few trees were found on Hoekplaas and the invasive alien mesquite (*Prosopis glandulosus*) is well controlled.

6. Proposed photovoltaic (PV) facilities

A number of alternatives are proposed for the PV facilities. These alternatives are (6.1) location alternatives (6.2) layout alternatives (6.3) technology alternatives and (6.4) the ‘No Go’ alternative (F. Gresse pers. comm., Aurecon).

6.1 Location alternatives

Following studies and environmental impact assessments in 2012 on two farms near Copperton in the Northern Cape Province, Klipgats Pan (4/117) and Hoekplaas (RE/146), it has been proposed that six (6) PV facilities be constructed on Klipgats Pan (4/117) and 10 PV facilities on Hoekplaas (RE/146). These farms lie adjacent to one-another.

6.2 Layout alternatives

6.2.1 Layout Alternative 1

On the farm Hoekplaas (RE/146) layout Alternative 1 would consist of ten (10) 75MW facilities (PV2–PV11) and associated infrastructure (the capacity of each is limited by the Department of Energy's 75MW cap per project) (Figure 8).

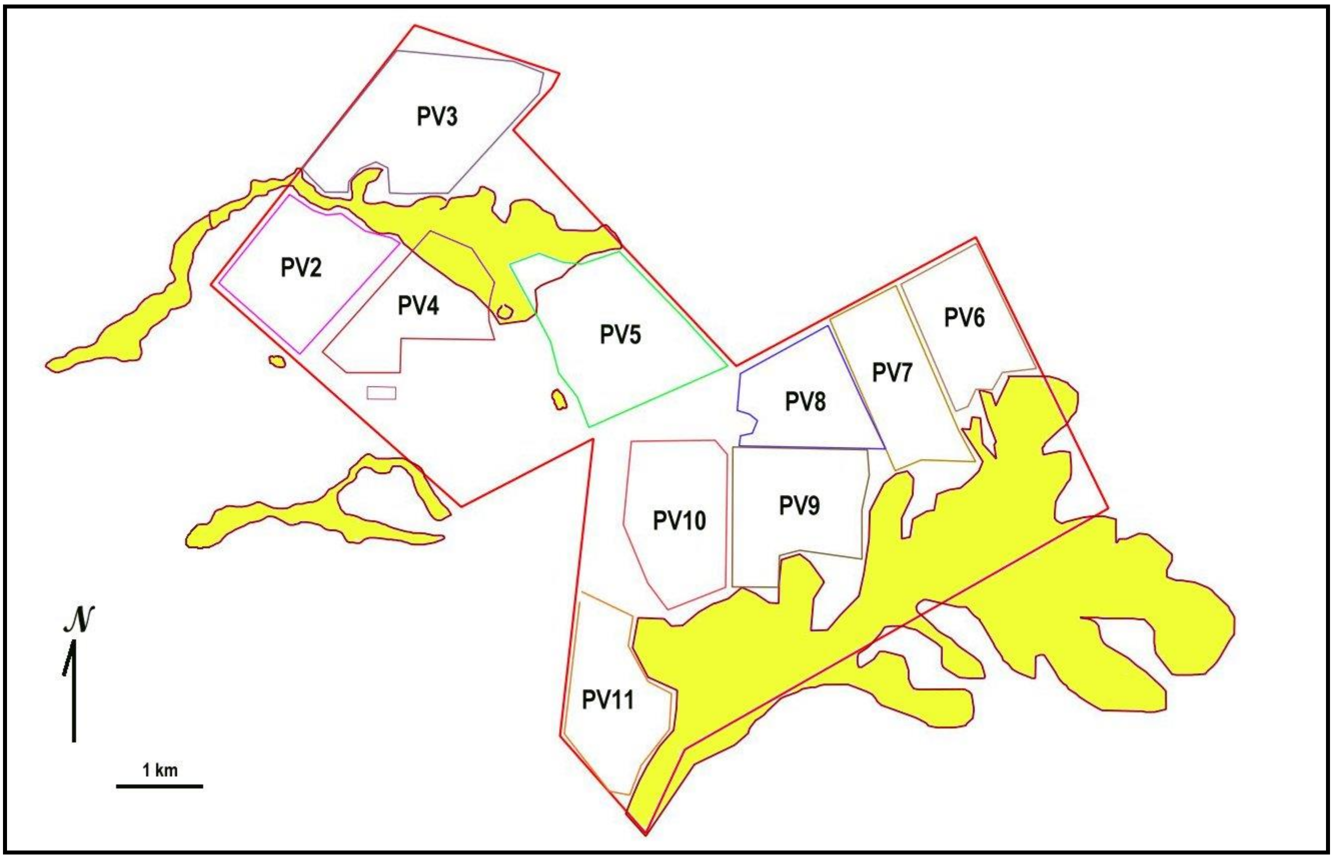

Figure 8. The Alternative 1 layout at Hoekplaas (RE/146) indicating eleven separate 75 MW PV facilities (PV1 – PV11). The areas shade yellow or ecologically sensitive areas.

6.2.2 Transmission Line Alternatives

On-site transmission lines would link the various PV installations to the on-site Hoekplaas substation. This in turn would either be linked to the Eskom Chronos Substation or to the Eskom Cuprum Substation near Copperton, depending on available capacity. The alternative transmission line corridors are shown in the diagrammatic map in Figure 9.

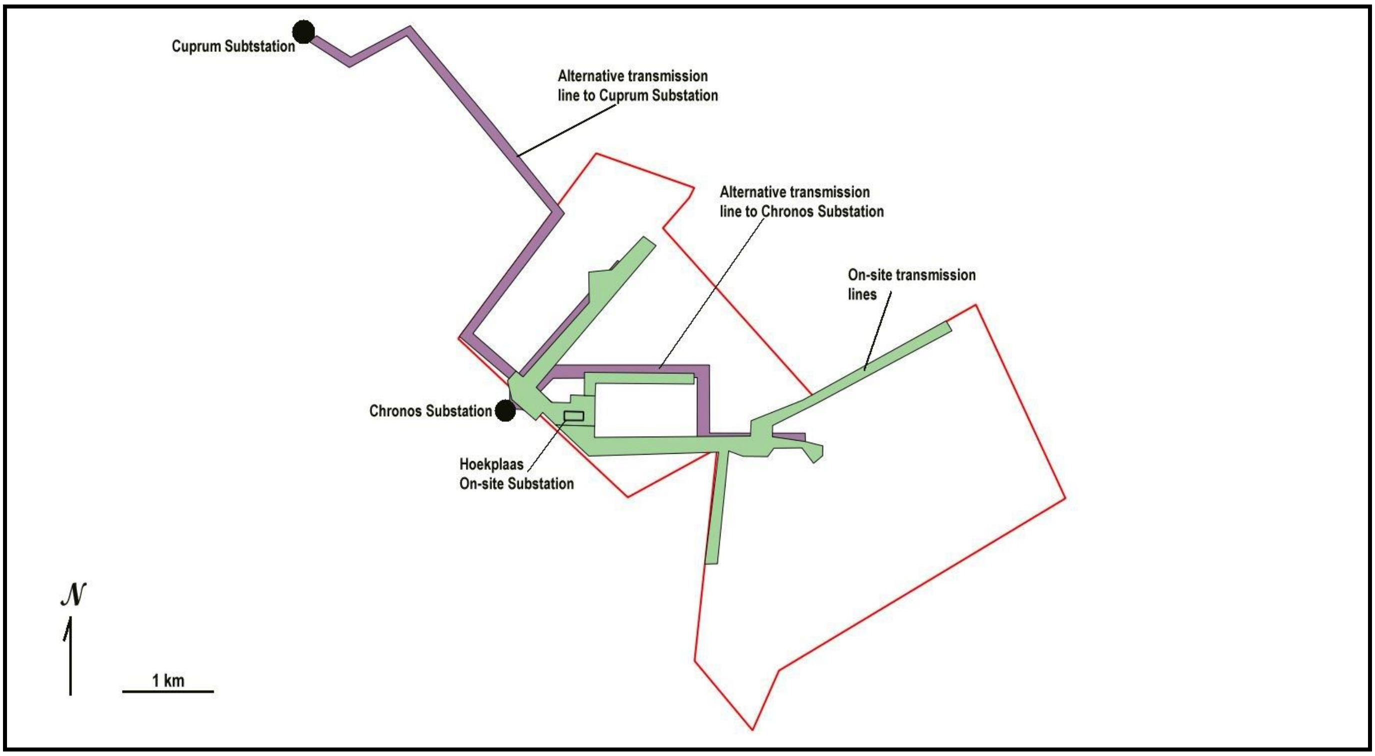

Figure 9. Hoekplaas is indicated by the red boundary with the on-site transmission corridors shown as green and the transmission line corridors to link to the Eskom grid shown as dark mauve.

6.2.3 Layout Alternative 2

Layout alternative 2 would incorporate the above ten facilities into three large facilities by combining then into PV2A (PV2—PV3 = 225MW), PV3A (PV4—PV6 = 290MW) and PV4A (PV7—PV11 = 500MW) (Figure 10).

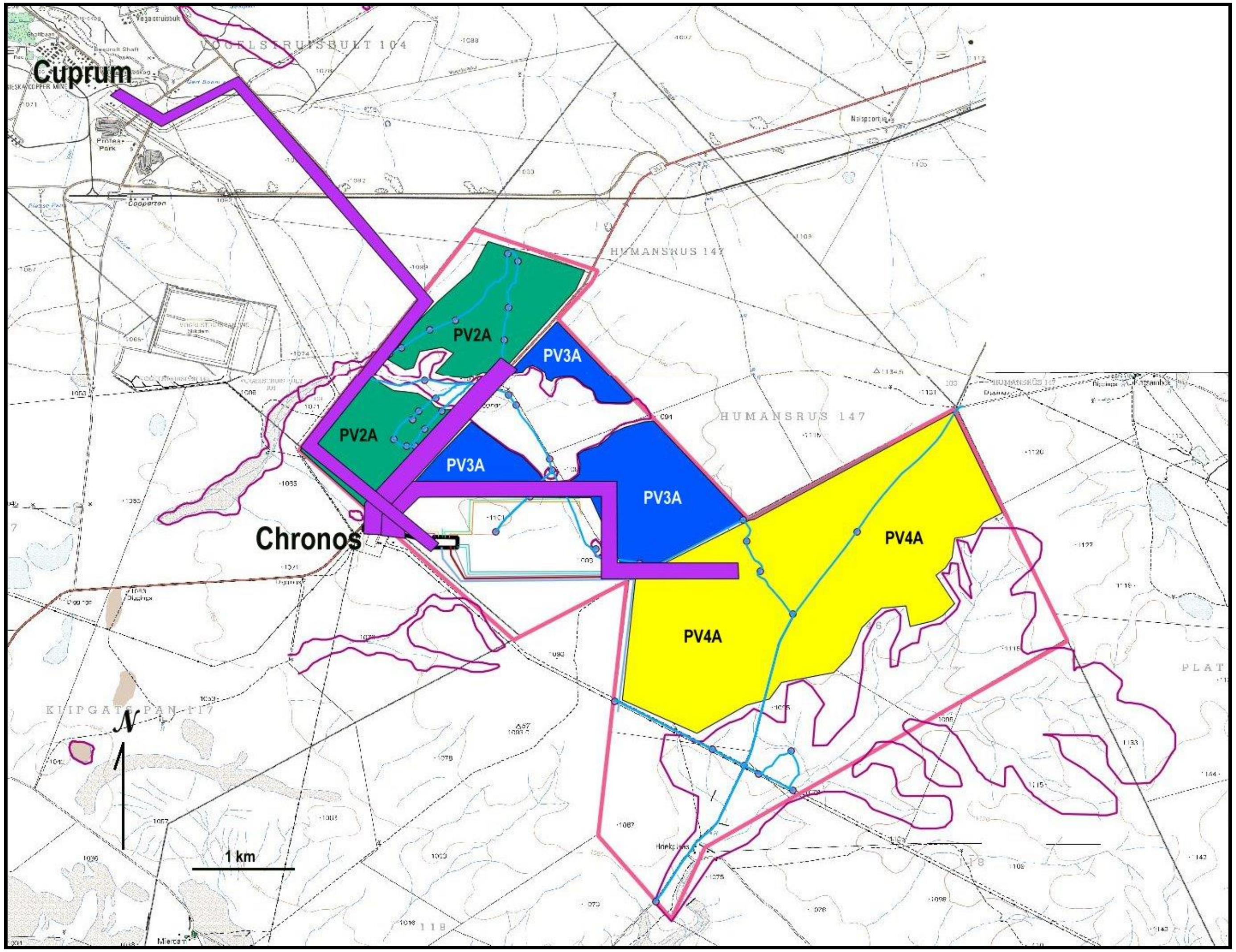

Figure 10. The Hoekplaas (RE/146) study area (red boundary) with the major PV layout areas (PV2A = green; PV3A = blue; PV4A = yellow). The broad purple lines indicate the transmission line corridors. The light pink dots are sample waypoints and the blue lines, sample tracks. The ecologically sensitive areas are outlined in maroon red. The positions of the Cuprum and Chronos Eskom Substations are labeled.

6.3 Technology alternatives

In terms of impacts on vegetation and flora the technology alternatives are not of great importance and are not emphasized in this report. It is accepted that concentrated photovoltaic (CPV) and conventional photovoltaic (PV) solar cells would be installed on a single-axis tracking system. Of more importance to the vegetation is the overall footprint of the PV facilities i.e. the location and layout alternatives.

6.4 No Go alternative

The question of the suitability or not (No Go) of the proposed PV facilities at Hoekplaas is assessed to determine the capacity of the landscape and vegetation type to ‘absorb’ the proposed infrastructure and the desirability of the infrastructure in terms of impact on the vegetation and flora.

7. The Vegetation

7.1 The vegetation in context

The national classification of the vegetation of South Africa (Mucina *et al.* 2006 in Mucina & Rutherford, 2006) as mapped by Mucina *et al.* (2005) shows that the vegetation found in the study area is all Bushmanland Basin Shrubland (NKb6) (Figure 8). The vegetation found at the study site is described in detail below.

7.2 Conservation status

The Bushmanland Basin Shrubland found at Hoekplaas occurs over extensive areas in the Bushmanland Bioregion. Although there are few statutory conservation areas in this vegetation type, it forms agricultural rangelands and is conserved for its grazing potential. According to the National Biodiversity Assessment (Driver *et al.* 2012) this vegetation type is classified as **LEAST THREATENED**. It is not listed in the recently gazetted National List of Threatened Terrestrial Ecosystems (Government Gazette No. 34809, 2011).

Even though a vegetation type may be rated as **LEAST THREATENED** it is still important to observe caution when developing an area where undisturbed vegetation occurs. No rare plant species or plant species of special concern were found during the survey.

7.3 The vegetation of Hoekplaas: Bushmanland Basin Shrubland

In the survey conducted for the PV1 site on Hoekplaas it was found that specifically for that site there was little variation in the vegetation with only two communities identified which are sub-communities of the broader Bushmanland Basin Shrubland vegetation type (McDonald, 2012a). They were described as (1) *Rhigozum trichotomum* Shrubland and (2) Asteraceous Shrubland. From the broader survey conducted in April 2013, although not all areas proposed for PV facilities were visited or sampled, four additional plant communities were recognized. They are (3) the *Salsola* spp. – *Pentzia incana* Shrubland, (4) the ‘Leegte’ Shrubland, (5) *Psilocaulon junceum* – *Lycium* spp. Shrubland and (6) Endorheic Pans. The waypoints and respective plant communities which occur are presented in Table 1 which should be cross-referenced with Figure 7.

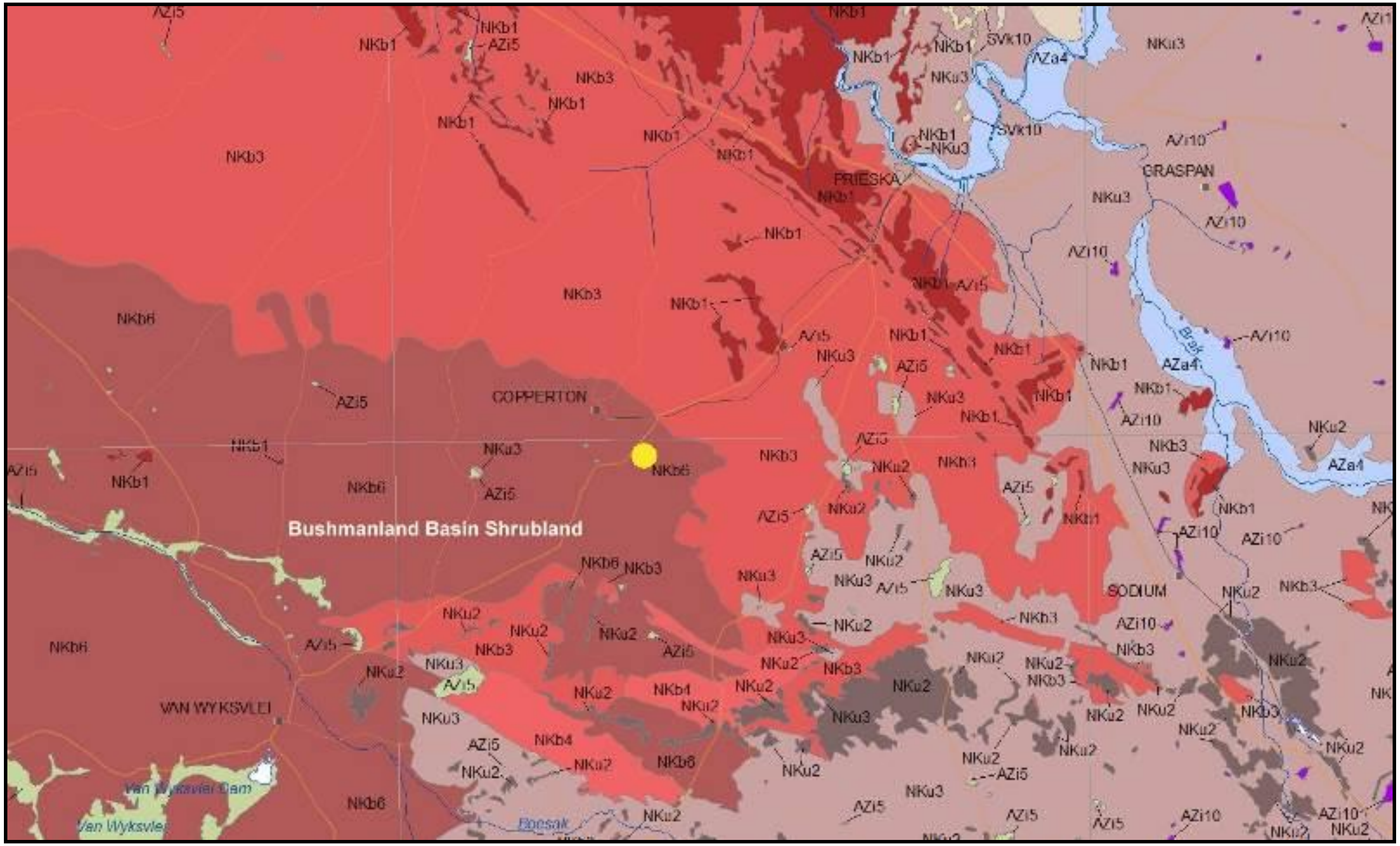

Figure 8. Portion of the vegetation map of southern Africa (Mucina *et al*. 2005) showing the vegetation of the study area (yellow dot) at Hoekplaas RE146 classified as Bushmanland Basin Shrubland.

Table 1. Sample waypoints at Hoekplaas with the vegetation communities found.

Waypoint	Latitude (S)	Longitude (E)	PV Facility Layout 1	PV Facility Layout 2	Vegetation Community	Sensitivity
HPL1	30° 00’ 08.1”	22° 21’ 23.2”	__	__	Asteraceous Shrubland	Low
HPL2	30° 00’ 11.5”	22° 21’ 33.0”	—	—	*Psilocaulon junceum – Lycium sp Shrubland*	Low
HPL3	30° 00’ 17.0”	22° 21’ 36.7”	__	__	Asteraceous Shrubland	Low
HPL4	30° 00’ 45.5”	22° 21’ 54.5”	—	—	*Rhigozum trichotomum* Shrubland	Low
HPL5	30° 00’ 51.7”	22° 21’ 56.0”	__	__	Endorheic Pan	High
HPL6	30° 01’ 05.9”	22° 21’ 44.0”	PV4	PV3A	Asteraceous Shrubland	Low
HPL7	30° 01’ 24.5”	22° 21’ 26.0”	PV1	__	Asteraceous Shrubland	Low
HPL8	30° 01’ 33.3”	22° 22’ 19.2”	__	__	Endorheic Pan	High
HPL9	30° 01’ 41.2”	22° 22’ 42.5”	PV6	PV3A	*Salsola* spp.–*Pentzia incana* Shrubland	Low
HPL10	30° 01’ 17.9”	22° 23’ 37.7”	PV6	PV3A	Asteraceous Shrubland	Low
HPL11	30° 01’ 29.5”	22° 23’ 39.5”	—	—	*Salsola* spp.–*Pentzia incana* Shrubland	Low
HPL12	30° 01’ 45.5”	22° 23’ 46.5”	—	—	*Psilocaulon junceum – Lycium sp Shrubland*	Low
HPL13	30° 02’ 08.3”	22° 24’ 04.1”	PV9	PV4A	*Psilocaulon junceum – Lycium sp Shrubland*	Low
HPL14	30° 04’ 41.1”	22° 22’ 50.9”	__	__	Asteraceous Shrubland	Low

HPL15	30° 03’ 41.9”	22° 24’ 03.9”	—	—	Leegte Shrubland	High
HPL16	30° 03’ 20.9”	22° 24’ 02.8”	—	—	Leegte Shrubland	High
HPL17	30° 03’ 33.0”	22° 23’ 45.7”	—	—	Asteraceous Shrubland	Low
HPL18	30° 03’ 28.7”	22° 23’ 37.8”	—	—	Asteraceous Shrubland	Low
HPL19	30° 03’ 20.2”	22° 23’ 21.3”	—	—	*Rhigozum trichotomum* Shrubland	Low
HPL20	30° 02’ 54.3”	22° 22’ 29.3”	—	—	Asteraceous Shrubland	Low
HPL21	30° 01’ 24.4”	22° 24’ 38.1”	PV8	PV4A	Asteraceous Shrubland	Low
HPL22	30° 00’ 07.5”	22° 21’ 21.9”	—	—	*Salsola* spp.–*Pentzia incana* Shrubland	Low
HPL23	30° 00’ 10.3”	22° 21’ 08.7”	—	—	*Salsola* spp.–*Pentzia incana* Shrubland	Low
HPL24	30° 00’ 20.3”	22° 20’ 57.1”	PV2	PV2A	Asteraceous Shrubland	Low
HPL25	30° 00’ 29.8”	22° 20’ 48.0”	PV2	PV2A	*Rhigozum trichotomum* Shrubland	Low
HPL26	30° 00’ 39.0”	22° 20’ 43.1”	PV2	PV2A	*Salsola* spp.–*Pentzia incana* Shrubland	Low
HPL27	30° 00’ 39.0”	22° 20’ 38.7”	PV2	PV2A	Asteraceous Shrubland	Low
HPL28	30° 00’ 35.2”	22° 20’ 31.7”	PV2	PV2A	*Salsola* spp.–*Pentzia incana* Shrubland	Low
HPL29	30° 00’ 24.6”	22° 20’ 41.6”	PV2	PV2A	*Salsola* spp.–*Pentzia incana* Shrubland	Low
HPL30	30° 00’ 20.2”	22° 20’ 45.1”	PV2	PV2A	*Rhigozum trichotomum* Shrubland	Low

HPL31	30° 00’ 13.3”	22° 20’ 54.2”	—	—	*Salsola* spp.–*Pentzia incana* Shrubland	Low
HPL32	30° 00’ 03.9”	22° 20’ 48.3”	—	—	*Salsola* spp.–*Pentzia incana* Shrubland	Low
HPL33	29° 59’ 55.9”	22° 20’ 18.3”	—	—	*Psilocaulon junceum*	Low
HPL34	29° 59’ 48.8”	22° 20’ 29.6”	PV3	PV2A	*Rhigozum trichotomum* Shrubland	Low
HPL35	29° 59’ 45.7”	22° 20’ 36.0”	PV3	PV2A	Asteraceous Shrubland	Low
HPL36	29° 59’ 36.2”	22° 20’ 51.0”	PV3	PV2A	*Rhigozum trichotomum* Shrubland	Low
HPL37	29° 59’ 30.8”	22° 21’ 04.7”	PV3	PV2A	Asteraceous Shrubland	Low
HPL38	29° 58’ 55.6”	22° 21’ 32.4”	PV3	PV2A	Asteraceous Shrubland	Low
HPL39	29° 58’ 59.8”	22° 21’ 37.7”	PV3	PV2A	Asteraceous Shrubland	Low
HPL40	29° 59’ 24.4”	22° 21’ 32.8”	PV3	PV2A	Asteraceous Shrubland	Low
HPL41	29° 59’ 41.3”	22° 21’ 30.3”	PV3	PV2A	Asteraceous Shrubland	Low

1. *Rhigozum trichotomum* Shrubland

Rhigozum trichotomum (driedoring[1]) is a tough, woody shrub ranging in height from 0.5 – 2 m. It is easily identifiable with stems typically branching in three and terminating in spine-like tips. The leaves are small and borne in clusters on short shoots. Flowers are white or salmon pink (Van Rooyen, 2001). This species is the dominant shrub in the plant community (Figure 9) to which it gives its name. The plant community is scattered throughout the study area but tends to be concentrated in areas where there is an accumulation of red sand, usually at least 150 mm deep. Other low shrubs are found only in low numbers whereas *Stipagrostis* spp. and other grasses are often co-dominant with *R. trichotomum*. This vegetation has low botanical / ecological sensitivity.

Figure 9. A mid-dense to dense stand of *Rhigozum trichotomum* shrubland on red sandy soil.

2. Asteraceous Shrubland

The Asteraceous Shrubland (Figure 10) is the most extensive vegetation type at Hoekplaas. It also has the greatest diversity of species, mainly low shrubs but grasses occur patchily and other herbaceous species are present. The vegetation is typically low < 0.4 m and coarse, being dominated by low shrubs in the family Asteraceae. It may be described as "bossieveld" to distinguish it from areas of grassland. This vegetation occurs on shallow sandy-loam soils often with bedrock, mostly as hardpan calcrete. It is not ecologically sensitive.

[1] Note: McDonald (2012a) used the incorrect common name for *Rhigozum trichotomum*, referring to it as 'granaatbos' which is more correctly applied to the closely related *Rhigozum obovatum*.

Figure 10. The low Asteraceous Shrubland at Hoekplaas, interspersed with taller *R. trichotomum* shrubs (right-hand-side).

3. *Salsola spp. – Pentzia incana* Shrubland

The *Salsola* spp. – *Pentzia incana* Shrubland (Figure 11) is a low shrubland <40 cm that is found on red sandy soil and is ecotonal between Asteraceous Shrubland and *Rhigozum trichotomum* Shrubland. It has few species and is dominated by one and in some places two *Salsola* spp. (gannabos) and *Pentzia incana* (ankerkaroo). This plant community is not ecologically or botanically sensitive.

Figure 11. Low *Salsola* spp.–*Pentzia incana* Shrubland.

4. 'Leegte' Shrubland

The 'Leegte' Shrubland is found in the shallow seasonal drainage lines on Hoekplaas (RE/146). It was not found in the PV1 area but does occur in the PV2 area and was highlighted as sensitive by McDonald (2012a). This vegetation is variable in stature depending on the depth of soil in the drainage lines. This vegetation has a low stratum dominated by grasses but also with low shrubs. The upper mid-high stratum (1 - 2 m) is most often dominated by *Lycium* spp. in particular *Lycium bosciifolium*. The *Rhigozum trichotomum* Shrubland is also found in drainage lines and grades into the 'Leegte' Shrubland in places.

Figure 12. 'Leegte' Shrubland found in seasonal drainage lines. The low stratum is dominated by grasses and taller shrubs, mainly *Lycium* spp. are emergent to 2 m.

5. *Psilocaulon junceum – Lycium spp.* Shrubland

Psilocaulon junceum (Figure 13) is a succulent shrub most often found in disturbed areas. In the open veld it is typically found on 'heuweltjies' where fossorial mammals disturb the soil. (Recorded in the PV1 area by McDonald, 2012a). *P. junceum* is also usually found around stock watering points together with taller *Lycium* spp. where the vegetation is disturbed by trampling (Figure 14). The *Psilocaulon junceum* – *Lycium* spp. Shrubland is therefore characteristic of disturbed places and is not botanically or ecologically sensitive.

Figure 13. *Psilocaulon junceum*

Figure 13. Stock watering point with *Psilocaulon junceum – Lycium* spp. Shrubland which has developed in response to disturbance from trampling.

6. Endorheic Pans

A few endorheic pans (see Allan, Seaman & Kaletja, 1995 for definition) are found at Hoekplaas (McDonald, 2012a). These are shallow basins that fill with water during rainy periods but then later dry out. At Hoekplaas the pans become vegetated with grasses, forbs and in some places clusters of shrubs. They are an important landscape feature with assemblages of plant species peculiar to them (Allan *et al.* 1995; Cilliers & Bredenkamp, 2003). The pan plant communities were not studied in detail in this survey but rather recognized as a specific and important and therefore sensitive habitat that should be avoided and not disturbed.

Figure 14. An endorheic pan at Hoekplaas with the central part demarcated by a red boundary.

8. Qualitative sensitivity analysis

The plant communities on Hoekplaas do not form discreet units in the landscape, often being interlaced with each other in a mosaic depending on local micro-topography and variation in soil conditions and drainage. It is therefore equally not possible to assign discreet vegetation units to each PV layout area. The result is that a qualitative assessment must be made that 'averages' the sensitivity over each of the PV layout areas based on the vegetation types found in each.

McDonald (2012a) described the vegetation of Hoekplaas as 'moderately grazed and mostly intact with low ecological and botanical sensitivity' apart from low-lying depressions (endorheic pans) and seasonal watercourses which were judged as having moderate to high ecological sensitivity. It was recommended by McDonald (2012a) that the pans located at S 30° 00' 54.4" E 22° 21' 56.9" and S 30° 01' 33.5" E 22° 22' 19.5" as well as all seasonal watercourses should be avoided. This was taken into consideration when determining the layouts for the various PV facilities proposed for Hoekplaas (Aurecon, 2013).

The summary of the analysis of botanical / ecological sensitivity for each of the PV areas is presented as a hierarchy in Table 2. The overall assessment of sensitivity is 'Low' for all the areas proposed for the PV installations.

Table 2. Summary of analysis of botanical and ecological sensitivity in the proposed PV construction areas at Hoekplaas RE/146.

PV Amalgamated Layout 2	PV Sub-area (Layout 1)	Vegetation Type	Area of PV facility	Sensitivity
PV2A	Hoekplaas PV2	Asteraceous Shrubland & *Salsola* ssp. *Pentzia incana* Shrubland	258 ha	Low
	Hoekplaas PV3	Asteraceous Shrubland	373 ha	Low
PV3A	Hoekplaas PV4	Asteraceous Shrubland	161 ha	Low
	Hoekplaas PV5	Asteraceous Shrubland	220 ha	Low
	Hoekplaas PV6	Asteraceous Shrubland & *Salsola* ssp. *Pentzia incana* Shrubland	207 ha	Low
PV4A	Hoekplaas PV7	Asteraceous Shrubland	208 ha	Low
	Hoekplaas PV8	Asteraceous Shrubland	234 ha	Low

	Hoekplaas PV9	Asteraceous Shrubland	202 ha	Low
	Hoekplaas PV10	Asteraceous Shrubland	319 ha	Low
	Hoekplaas PV11	Asteraceous Shrubland	320 ha	Low

9. Development layouts

9.1 PV panel layouts

The overall proposed PV facility development layouts are depicted in Figure 10. The PV2A area (green) is an amalgamation of the smaller areas PV2 and PV3 which, importantly, avoids impacting the seasonal drainage line which approximately divides the PV2A area in half (the sensitive area outlined in red) (Figure 15). The PV3A area (blue – Figure 16) is an amalgamation of the three smaller areas PV4, PV5 and PV6. The sensitive seasonal drainage in the north of the PV3A area (outlined in red) is avoided by the Alternative 1 PV sites. The PV4A area (yellow – Figure 17) comprises the smaller areas of PV7 to PV11. The sensitive catchment and seasonal watercourses in the southeast of the PV4A area are avoided by the Alternative 1 PV sites.

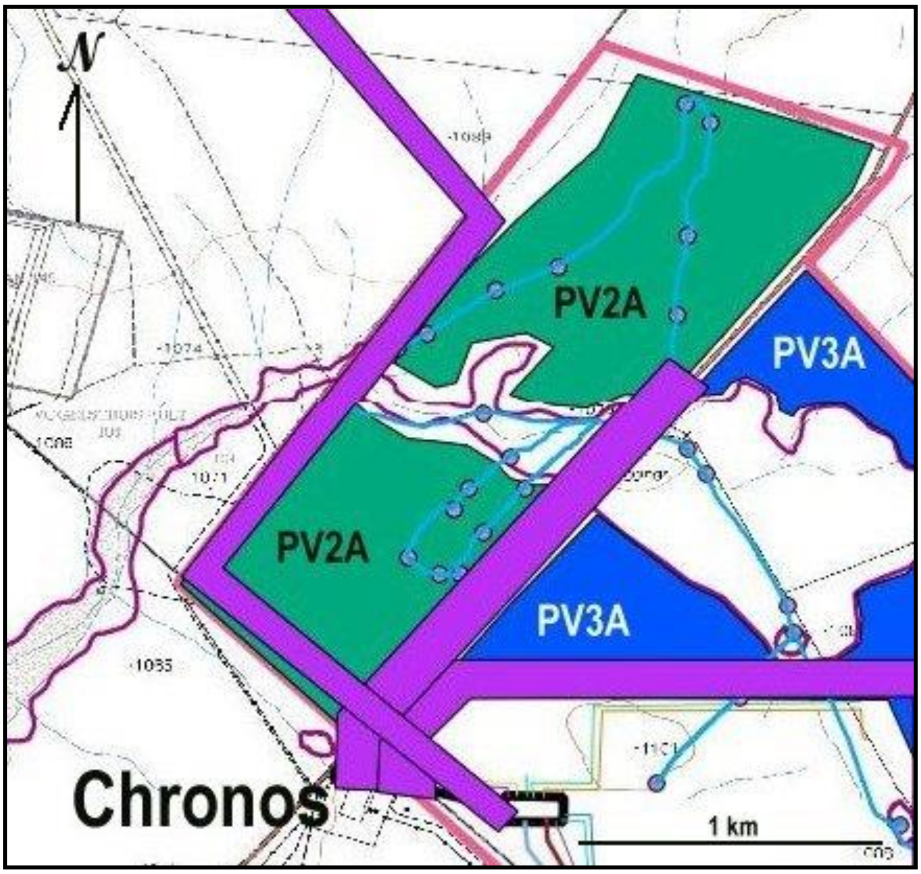

Figure 15. The PV2A area (green) is an amalgamation of PV2 and PV3 'minor' (i.e. Alternative 1) areas.

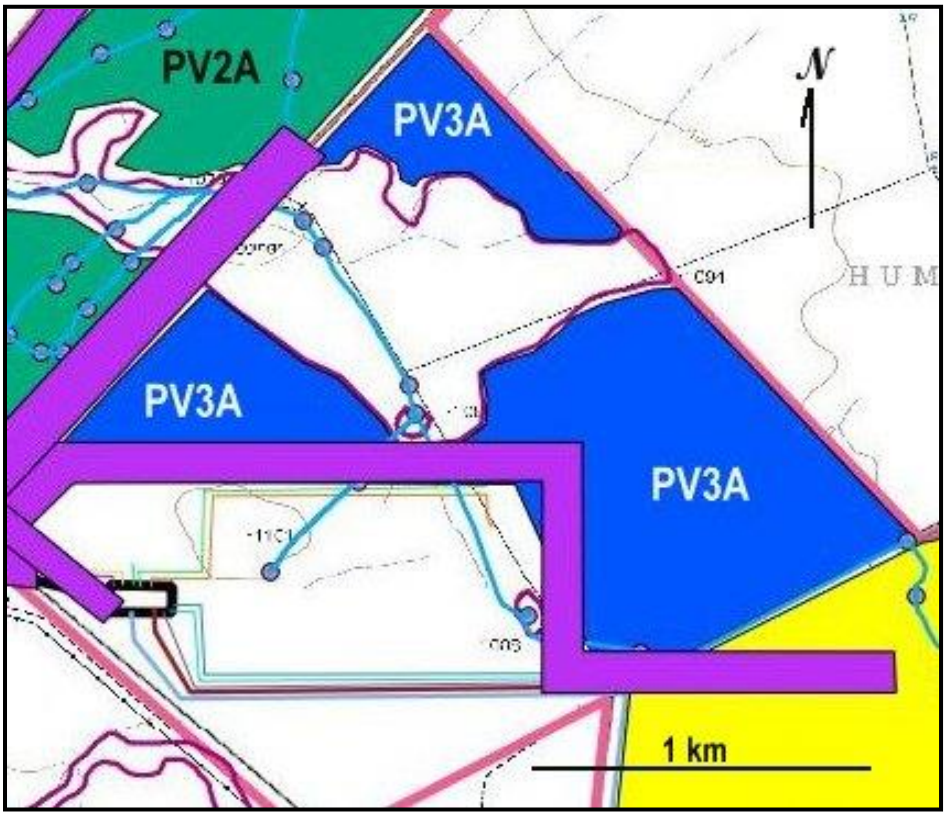

Figure 16. The PV3A area (blue) boundary) is an amalgamation of PV4 - PV6 'minor' (i.e. Alternative 1) areas.

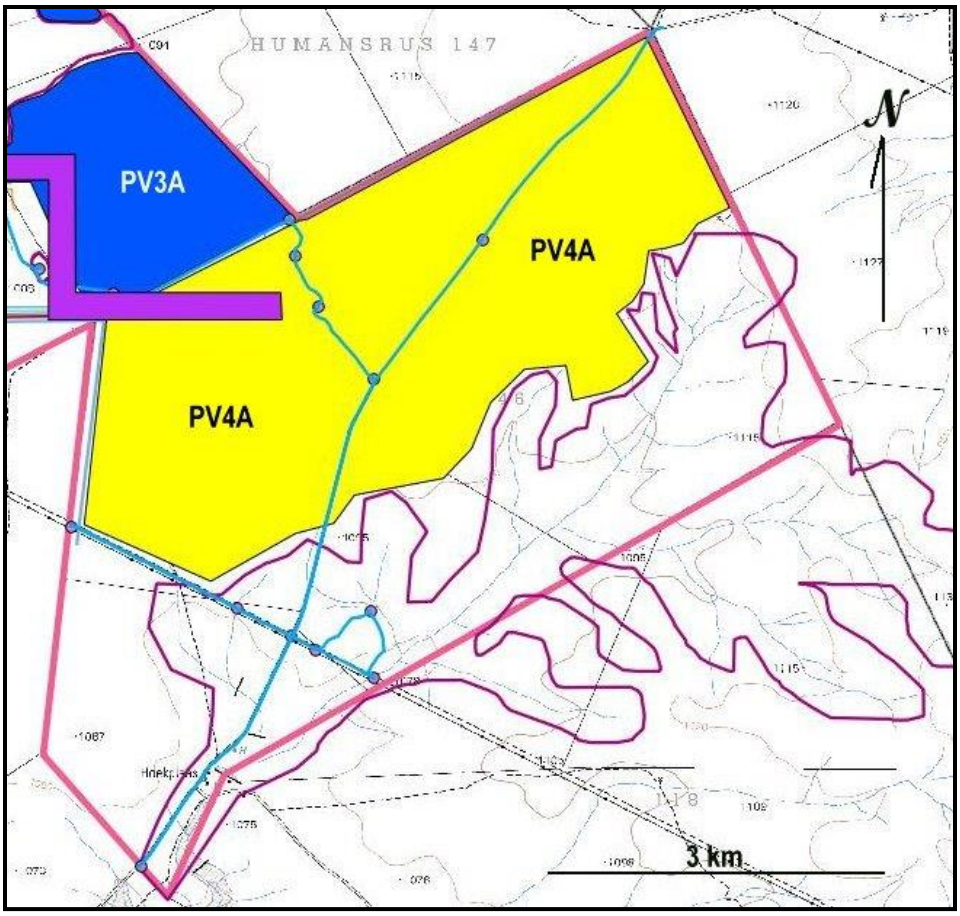

Figure 17. The PV4A area (yellow) is an amalgamation of the PV7 –PV11 'minor' (i.e. Alternative 1) areas.

9.2 Internal roads

No layout of internal roads is available for assessment but it can be said that the roads would mostly be in areas with vegetation of **LOW** sensitivity. The roads would therefore add to the local negative impact but would not have a significant additive cumulative effect on the loss of natural vegetation on Hoekplaas. New roads required for the construction and servicing of the facility would be constructed in the least sensitive areas i.e. the identified sensitive areas would be avoided wherever possible.

9.3 Transmission lines and on-site substations

The PV facilities would each require an on-site sub-station which would then feed into a central multi-bay substation by means of overhead 132 kV transmission lines. The central substation would be connected to either the Kronos or Cuprum Eskom sub-stations depending on available capacity. The transmission line corridors have been identified as shown in Figure 7.

10. Impact Assessment

Impacts on the vegetation are assessed for two development alternatives: either 10 ‘minor’ separate 75MW solar energy facilities (PV facilities) for which separate applications have been submitted [Alternative 1] or three ‘major’ amalgamated PV facilities (Alternative 2): PV2A 225MW comprising ‘minor’ areas PV2 (258 ha) and PV3 (373 ha); PV3A 290MW comprising ‘minor’ areas PV4 (161 ha), PV5 (220 ha) and PV6 (207 ha); PV4A 500MW comprising ‘minor’ areas PV7 (208 ha), PV8 (234 ha), PV9 (202 ha), PV10 (319 ha) and PV11 (320 ha). The ‘No Go’ alternative is also assessed.

10.1 Direct Impacts

Direct impacts are those that would occur directly on the vegetation of the respective alternative sites as a direct result of the proposed development. The rating system used is given in Appendix 1. Mitigation is also brought into the assessment.

The impacts of the proposed solar PV developments on the vegetation and habitat at Hoekplaas are considered with respect to:

- Loss of vegetation type and habitat including plant species due to construction and operational activities.

- Loss of ecological processes due to construction and operational activities.

10.1.1 Loss of vegetation type and habitat including plant species due to construction and operation of PV facilities at Hoekplaas RE/146

The **'No Go' alternative** would be if no development takes place at Hoekplaas. The *status quo* would persist and the farming operation would continue in much the same way as at present. The 'no development' alternative or 'No Go' alternative would thus have a **LOW NEGATIVE** impact on the natural vegetation with no significant loss in the long-term.

If the Alternative 1 development option is followed, one or more 75MW solar plants could be approved and constructed and the areas of vegetation affected by each would be as given in Table 2. Also indicated in Table 2 is the botanical sensitivity for each of the areas which is **LOW** in all cases. The proposed PV facilities would therefore all have similar impacts on the vegetation and flora; the local effect would be a **HIGH NEGATIVE** impact because a considerable amount but not all of vegetation would be disturbed locally. However, taking the vegetation type as a whole which covers a wide area in the Bushmanland Bioregion the local impact becomes **LOW NEGATIVE** in the context of overall loss of the vegetation type (Table 3). Scale is therefore an important element when making the assessment and Table 2 reflects the 'bioregional scale' as opposed to the 'local scale'.

If only a limited number of the proposed 'minor' PV facilities are constructed the local impact would also be less. However, if they were all built, the cumulative effect on the vegetation would be the same as if the Alternative 2 layout (preferred alternative) (Table 3) was to be implemented. The overall effect on the vegetation type would be **LOW NEGATIVE** on the vegetation type but **HIGH NEGATIVE** at a local scale due to loss vegetation on Hoekplaas itself.

In the case of the Hoekplaas PV3 'minor' facility and part of PV2A 'major' facility there is one 'Red Flag'. A tree of *Boscia albitrunca* is found at waypoint HPL39. This is a protected tree species and must be avoided. Fortunately it is located at the north end of the site, almost on the boundary (Figure 7) so construction can be designed to accommodate this tree. It was the only individual encountered in the survey on Hoekplaas. However, a more intensive search could reveal more of these trees. If so, and if any are likely to be impacted, they should preferably be avoided but if that is not possible, a permit would be required to remove such trees.

Aloe claviflora, a protected species in the Northern Cape Province, may occur on Hoekplaas RE/146 but was not encountered in the survey. If it is encountered during the construction phase the plants could be removed and relocated elsewhere in similar habitat which would not be affected by construction. This would require relevant permits from provincial authorities.

Table 3. Impact and Significance – Loss of natural vegetation and habitat at Hoekplaas RE/146 during construction and operational phases. The assessment reflects impacts at a bioregional scale and not at the local scale.

Actions	Alternative	Impact	Extent	Duration	Intensity	Significance	Status	Probability of occurrence	Confidence
	"No Go"	Loss of natural vegetation	Local (within bioregional context)	Long-term	Low	Low	- ve	Probable	High
Without mitigation	Alt 1 (for all 75MW PV facilities)	Loss of natural vegetation	Local (within bioregional context)	Long- term	Low	Low	- ve	Probable	High
With mitigation	Alt 1 (for all 75MW PV facilities)	Loss of natural vegetation	Local (within bioregional context)	Long-term	Low	Low	- ve	Probable	High
Without mitigation	Alt 2 for three 'major' PV facilities (preferred alternative)	Loss of natural vegetation	Local (within bioregional context)	Long- term	Low	Low	- ve	Probable	High
With mitigation	Alt 2 for three 'major' PV facilities (preferred alternative)	Loss of natural vegetation	Local (within bioregional context)	Long-term	Low	Low	- ve	Probable	High

10.1.2 Mitigation

For both alternatives the development would have a high physical impact over the area of the respective PV plants. However, over a broad scale the vegetation has been described as generally being not sensitive and it has a **LEAST THREATENED** conservation status as determined in the National Biodiversity Assessment (Driver *et al.* 2012). Therefore construction of the PV installations would not cause concern botanically and the impact (broadly speaking) would be **LOW NEGATIVE.** The principal condition, however, would be that sensitive locations such as endorheic pans and depressions as well as seasonal watercourses should be avoided. Where it may be necessary to cross such areas with roads or transmission lines appropriate care must be exercise to limit the physical impacts as far as possible. It would be best to align roads so that they do not cross seasonal drainage lines and all 'Leegte Shrubland' should be buffered by at least 30 m. All construction activities should be contained within the PV facility footprints to minimize disturbance outside these areas.

It is anticipated that there would be minimal loss of vegetation due to the installation of the distribution power-line to the Kronos Sub-station or Cuprum sub-station. In the latter case existing approved Eskom servitudes could be used.

Protected trees must be avoided or if that is not possible, permission must be obtained for their removal. Any *Aloe* species, particularly *Aloe claviflora* should be relocated if affected by the PV facilities.

10.2.1 Loss of ecological processes

As a general rule ecological processes are closely linked to vegetation and habitat and therefore can only function where the habitat is in reasonable condition. Ecological processes operate over a wide area and there will no-doubt be some local effects such as loss of small mammal activity associated with 'heuweltjies'[2]. Heuweltjies, considered to be a 'living landform', would probably cease to function in any area where they may occur that may be affected by construction of a PV plant. Other ecological effects may occur such as the promotion of particular species of mammal e.g. rodents that would be able to escape predation due to more cover being available from PV panels. There could be trampling and concentration of animals around panels Such scenarios are speculative and only long-term observation would provide data to test these theoretical effects. Apart from the identified sensitive areas, due to the scale of the project in relation to the extent of Bushmanland Basin Shrubland and the low botanical sensitivity, the loss of ecological processes is predicted to be small, resulting in a **LOW NEGATIVE** effect overall.

In general, if no construction takes place i.e. the **'No Go'** alternative is followed, it would allow the *status quo* to continue and the ecological processes in the areas of natural vegetation to continue unhindered. The impact of the 'No-Go' option would therefore be **LOW NEGATIVE,** but there would still be grazing which could have limited long-term negative effects.

[2] 'Heuweltjies' are are mounds of soil as much as 20 m in diameter and 1 m high often with a calcrete / limestone base 0.5 – 1 m below the surface. They are found in many parts of Africa but in southern Africa are particularly prevalent on clay-rich soils. They give the landscape a characteristic 'pock-marked' appearance and are easily discernible in the field

Table 3. Loss of ecological processes at Hoekplaas RE/146 during construction and operational phases. The assessment reflects impacts at a bioregional scale and not at the local scale.

Actions	Alternative	Impact	Extent	Duration	Intensity	Significance	Status	Probability of occurrence	Confidence
	"No Go"	Loss of ecological processes	Local (within bioregional context)	Long term	Low	Low	-ve	Probable	High
Without mitigation	Alt 1 (for all 75MW PV facilities)	Loss of ecological processes	Local (within bioregional context)	Long term	Low	Low	-ve	Probable	High
With Mitigation	Alt 1 (for all 75MW PV facilities)	Loss of ecological processes	Local (within bioregional context)	Long term	Low	Low	-ve	Probable	High
Without mitigation	Alt 2 for three 'major' PV facilities (preferred alternative)	Loss of ecological processes	Local (within bioregional context)	Long term	Low	Low	-ve	Probable	High
With mitigation	Alt 2 for three 'major' PV facilities (preferred alternative)	Loss of ecological processes	Local (within bioregional context)	Long term	Low	Low	-ve	Probable	High

10.2.2 Mitigation

It is anticipated that ecological processes would be more heavily impacted in the drainage system and pans than elsewhere. These areas must be completely avoided and well buffered from any infrastructure and construction activity. Ecological processes within the proposed construction area are difficult to describe or define without intensive research. Prescription of mitigation measures are equally difficult to advocate. Therefore best practice principles must be applied following the *'light on land'* philosophy espoused by the proponent.

10.3 Indirect impacts

By definition indirect impacts occur away from the 'action source' i.e. away from the development site. The impact assessed here is specifically how the proposed development would have an indirect impact on <u>vegetation and flora</u> away from the development site.

Owing to the extensive range of Bushmanland Basin Shrubland no indirect impacts were identified.

10.4 Cumulative impacts

Two levels of cumulative impacts are identified. They are scale-dependent. The first is on-site cumulative impacts i.e. cumulative impacts on the farm Hoekplaas RE/146 itself. If only one 75MW PV facility is constructed, then the impact may be locally small and contained. However, if successively more 75MW PV facilities are constructed there would be incremental cumulative impacts. Ultimately the cumulative impact would be large locally and of the same order as for each of the PV2, PV3 and PV4 (major) installations. So at a local scale the cumulative impact would be large and **High negative** on the vegetation. However, Bushmanland Basin Shrubland is found extensively in the Bushmanland Bioregion so the proposed PV facilities would have a small impact on this vegetation type as a whole. Therefore the cumulative impact would be **Low negative** even though another solar energy project is planned for the neighbouring farm Klipgats Pan (4/117) and other renewable energy projects are planned for the Copperton area.

11. General Assessment and Recommendations

- A single main vegetation type, Bushmanland Basin Shrubland, is found at Hoekplaas RE/146 southeast of Copperton. It is a Least Threatened vegetation type according to the National Biodiversity Assessment (Driver *et al.* 2012).
- This study identified 6 vegetation subunits (sub-types) and the sensitivity of each of these was determined and applied in the impact assessment.
- Two of the vegetation sub-types, Leegte Shrubland and Endorheic Pans, are considered botanically and ecologically sensitive and should be avoided by any solar PV installations and the proposed road network. They could, however, be straddled by transmission lines if necessary.
- The overall result of the impact assessment is that the 'No Go' option would allow the *status quo* to continue which would have a **LOW NEGATIVE** impact on the site.
- Construction of the Alternative 1 solar energy facilities at Hoekplaas would result in a **LOW NEGATIVE** impact. Similarly the Alternative 2 would also result in a **LOW NEGATIVE** impact based on the scale of the project in relation to the wide extent of the vegetation type as a whole.
- Construction of access roads should be designed for minimal impact. All construction should take place within the footprint of the proposed PV array.
- The construction phase should be closely monitored by an Environmental Control Officer who should identify any areas that would require rehabilitation in the post-construction

phase. The restoration of those areas must follow the construction phase. A rehabilitation plan for the site should be compiled with the aid of a rehabilitation specialist and adhered to.

12. Conclusions

The vegetation at Hoekplaas RE/146 was in reasonable condition when assessed in April 2013 following recent good rain. It was therefore possible to obtain a fair to good impression of the vegetation and habitat on which to base the assessment of impacts of the proposed PV facilities.

The construction of the solar energy facilities as proposed for both development alternatives is botanically acceptable as long as the areas identified as sensitive are avoided. In addition, although McDonald (2012a) indicated that the area proposed for Alternative 1: PV2 and PV3 or Alternative 2: PV2A should be viewed as a 'No Go' area, that conclusion was made on the basis that the sensitive low-lying 'leegtes' or drainage lines would have been negatively impacted. In this study, with an altered layout which avoids the botanically sensitive areas, the PV2 and PV3 'minor' areas (which make up the PV2 'major' area) are acceptable for construction.

Only one specimen of the protected tree *Boscia albitrunca* was found. This tree can and should be avoided. If any other specimens of this species are found and are likely to be impacted appropriate action should be followed to obtain permission if the trees are likely to be affected in any way. In addition, should any *Aloe claviflora* possibly be negatively influenced, these plants must be relocated to 'safe sites'.

13. References

Allan, D.G, Seaman, M.T. & Kaletja, B. 1995. The endorheic pans of South Africa. In: Cowan, G., *Wetlands of South Africa*. Department of Environment Affairs & Tourism.

Brownlie, S. 2005. *Guideline for involving biodiversity specialists in EIA processes: Edition 1. CSIR Report No. ENV-S-C 2005-053 C. Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning.*

Cilliers, S.S. & Bredenkamp, G.J. 2003. Vegetation of inland endorheic pans in the North-West Province, South Africa. *Phytocoenologia* 32: 289 – 308.

De Villiers, C.C. Driver, A. Clark, B. Euston-Brown, D.I.W. Day, E.G. Job, N. Helme, N.A. Holmes, P. M. Brownlie, S. and Rebelo, A. G. 2005. *Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape*. Fynbos Forum, Cape Town 94pp.

Driver A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. & Maze, K. 2012. National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria.

Fey, M. 2010. *Soils of South Africa – Their distribution, properties, classification, genesis, use and environmental significance.* Cambridge University Press, Cape Town.

Government Gazette No. 34809. 2011. Threatened Terrestrial Ecosystems in South Africa.

Johnson, M.R., Van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H. de V., Christie, A.D.M., Roberts, D.L. and Brandl, G. Sedimentary Rocks of the Karoo Supergroup. In: Johnson, M.R., Annhaeusser, C.R., and Thomas, R.J. (eds), The Geology of South Africa. Geological Society of South Africa and Council for Geoscience. pp. 461 – 500.

Land Type Survey Staff 1972—2006. Land Types of South Africa: Digital Map (1 250 000 scale) and soil inventory databases. ARC – Institute for Soil, Climate & Water, Pretoria.

MacVicar, C. N., Scotney, D. M. Skinner, T. E. Niehaus, H. S. & Loubser, J. H., 1974. A classification of land (climate, terrain form, soil) primarily for rainfed agriculture. *S. Afr. J. Agric. Extension*, 3(3): 1-4.

McDonald, D.J. 2012a. Botanical Assessment for a proposed solar energy plant at Hoekplaas, near Copperton, Northern Cape. Unpublished report prepared for Aurecon SA (Pty) Ltd.

McDonald, D.J. 2012b. Botanical Assessment for a proposed solar energy plant at Klipgats Pan, near Copperton, Northern Cape. Unpublished report prepared for Aurecon SA (Pty) Ltd

McDonald, D.J. 2012c. Botanical Assessment for a proposed solar energy plant at Struisbult 104 Portion 1 at Copperton, Northern Cape Province Unpublished report prepared for Aurecon SA (Pty) Ltd

Mucina, L., Rutherford, M.C., & Powrie, L.W. (Eds.). 2005. Vegetation map of South Africa, Lesotho, and Swaziland 1:1 000 000 scale sheet maps. South African National Biodiversity Institute, Pretoria. ISBN 1-919976-22-1.

Mucina, L. & Rutherford, M.C. 2006. (eds.)The Vegetation of South Africa. Lesotho & Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

Mucina, L., Rutherford, M.C., Palmer, A.R., Milton, S.J., Scott, L., Lloyd, J.W., Van der Merwe, B., Hoare, D.B. Bezuidenhout, H., Vlok, J.H.J., Euston-Brown, D.I.W., Powrie, L.W. and Dold, A.P. 2006. Nama-Karoo Biome. In: Mucina, L., & Rutherford, M.C. (Eds.). 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Partridge, T.C., Botha, G.A. and Haddon, I.G. 2006. Chapter 29.Cenozoic deposits of the interior. In: Johnson, M.R., Annhaeusser, C.R., and Thomas, R.J. (eds), The Geology of South Africa. Geological Society of South Africa and Council for Geoscience. pp. 585—604.

Rutherford, M.C., Mucina, L. & Powrie, L.W. 2006. Biomes and Bioregions of Southern Africa. In: Mucina, L. & Rutherford, M.C. 2006. (eds.) The Vegetation of South Africa. Lesotho & Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria. pp. 31—51.

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Appendix 1: Impact Assessment Methodology

The assessment of impacts needs to include the determination of the following:

- The nature of the impact – see Table 1.1
- The magnitude (or severity) of the impact – see Table 1.2
- The likelihood of the impact occurring - see Table 1.2

The degree of confidence in the assessment must also be reflected.

Table 1.1 Impact assessment terminology

Term	Definition
Impact nature	
Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct impact	Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (e.g. between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality).
Indirect impact	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (e.g. in-migration for employment placing a demand on resources).
Cumulative impact	Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.

Assessing significance

There is no statutory definition of '*significance*' and its determination is, therefore, somewhat subjective. However, it is generally accepted that significance is a function of the magnitude of the impact and the likelihood of the impact occurring. The criteria used to determine significance are summarized in *Table 1.2*

Table 1.2 Significance criteria

Impact magnitude	
Extent	*On-site* – impacts that are limited to the boundaries of the rail reserve, yard or substation site. *Local* – impacts that affect an area in a radius of 20km around the development site. *Regional* – impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem. *National* – impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences.
Duration	*Temporary* – impacts are predicted to be of short duration and intermittent/occasional.

	Short-term – impacts that are predicted to last only for the duration of the construction period. *Long-term* – impacts that will continue for the life of the Project, but ceases when the Project stops operating. *Permanent* – impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.
Intensity	BIOPHYSICAL ENVIRONMENT: *Intensity can be considered in terms of the sensitivity of the biodiversity receptor (ie. habitats, species or communities).* **Negligible** – the impact on the environment is not detectable. **Low** – the impact affects the environment in such a way that natural functions and processes are not affected. **Medium** – where the affected environment is altered but natural functions and processes continue, albeit in a modified way. **High** – where natural functions or processes are altered to the extent that it will temporarily or permanently cease. ***Where appropriate, national and/or international standards are to be used as a measure of the impact.*** *Specialist studies should attempt to quantify the magnitude of impacts and outline the rationale used.* SOCIO-ECONOMIC ENVIRONMENT: *Intensity can be considered in terms of the ability of project affected people/communities to adapt to changes brought about by the Project.* **Negligible** – there is no perceptible change to people's livelihood **Low** - People/communities are able to adapt with relative ease and maintain pre-impact livelihoods. **Medium** - Able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support. **High** - Those affected will not be able to adapt to changes and continue to maintain-pre impact livelihoods.
Impact likelihood (Probability)	
Negligible	The impact does not occur.
Low	The impact may possibly occur.
Medium	Impact is likely to occur under most conditions.
High	Impact will definitely occur.

Once a rating is determined for magnitude and likelihood, the following matrix can be used to determine the impact significance.

Table 7.5 Example of significance rating matrix

SIGNIFICANCE RATING					
	LIKELIHOOD	**Negligible**	**Low**	**Medium**	**High**
MAGNITUDE	**Negligible**	**Negligible**	**Negligible**	**Low**	**Low**
	Low	**Negligible**	**Negligible**	**Low**	**Low**
	Medium	**Negligible**	**Low**	**Medium**	**Medium**
	High	**Low**	**Medium**	**High**	**High**

In *Table 7.6*, the various definitions for significance of an impact is given.

Table7.6 Significance definitions

Significance definitions	
Negligible significance	An impact of negligible significance (or an insignificant impact) is where a resource or receptor (including people) will not be affected in any way by a particular activity, or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.
Minor significance	An impact of minor significance is one where an effect will be experienced, but the impact magnitude is sufficiently small (with and without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.
Moderate significance	An impact of moderate significance is one within accepted limits and standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that 'moderate' impacts have to be reduced to 'minor' impacts, but that moderate impacts are being managed effectively and efficiently.
Major significance	An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. A goal of the EIA process is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a development. It is then the function of regulators and stakeholders to weigh such negative factors against the positive factors such as employment, in coming to a decision on the Project.

Once the significance of the impact has been determined, it is important to qualify the **degree of confidence** in the assessment. Confidence in the prediction is associated with any uncertainties, for example, where information is insufficient to assess the impact. Degree of confidence can be expressed as low, medium or high.

Appendix 2: Curriculum Vitae

Dr David Jury McDonald Pr.Sci.Nat.

Name of Firm: Bergwind Botanical Surveys & Tours CC. (Independent consultant)

Work and Home Address: 14 A Thomson Road, Claremont, 7708

Tel: (021) 671-4056 **Mobile:** 082-8764051 **Fax:** 086-517-3806

E-mail: dave@bergwind.co.za

Website: www.bergwind.co.za

Profession: Botanist / Vegetation Ecologist / Consultant / Tour Guide

Date of Birth: 7 August 1956

Employment history:

- 19 years with National Botanical Institute (now SA National Biodiversity Institute) as researcher in vegetation ecology.
- Five years as Deputy Director / Director Botanical & Communication Programmes of the Botanical Society of South Africa
- Six years as private independent Botanical Specialist consultant (Bergwind Botanical Surveys & Tours CC)

Nationality: South African (ID No. 560807 5018 080)
Languages: English (home language) – speak, read and write
Afrikaans – speak, read and write

Membership in Professional Societies:

- South Africa Association of Botanists
- International Association for Impact Assessment (SA)
- South African Council for Natural Scientific Professions (**Ecological Science, Registration No. 400094/06**)
- Field Guides Association of Southern Africa

Key Qualifications :

- Qualified with a M. Sc. (1983) in Botany and a PhD in Botany (Vegetation Ecology) (1995) at the University of Cape Town.
- Research in Cape fynbos ecosystems and more specifically mountain ecosystems.
- From 1995 to 2000 managed the Vegetation Map of South Africa Project (National Botanical Institute)
- Conducted botanical survey work for AfriDev Consultants for the Mohale and Katse Dam projects in Lesotho from 1995 to 2002. A large component of this work was the analysis of data collected by teams of botanists.

- **Director: Botanical & Communication Programmes** of the Botanical Society of South Africa (2000—2005), responsible for communications and publications; involved with conservation advocacy particularly with respect to impacts of development on centres of plant endemism.

- Further tasks involved the day-to-day management of a large non-profit environmental organisation.

- **Independent botanical consultant** (2005 – to present) over 300 projects have been completed related to environmental impact assessments in the Western, Southern and Northern Cape, Karoo and Lesotho. A list of reports (or selected reports for scrutiny) is available on request.

Higher Education

Degrees obtained
and major subjects passed: B.Sc. (1977), University of Natal, Pietermaritzburg
Botany III
Entomology II (Third year course)

B.Sc. Hons. (1978) University of Natal, Pietermaritzburg
Botany (Ecology /Physiology)

M.Sc - (Botany), University of Cape Town, 1983.
Thesis title: 'The vegetation of Swartboschkloof, Jonkershoek, Cape Province'.

PhD (Botany), University of Cape Town, 1995.
Thesis title: 'Phytogeography endemism and diversity of the fynbos of the southern Langeberg'.

Certificate of Tourism: Guiding (Culture: Local)
Level : 4 Code: TGC7 (Registered Tour Guide: WC 2969).

Employment Record :

January 2006 – present: Independent specialist botanical consultant and tour guide in own company: **Bergwind Botanical Surveys & Tours CC**
August 2000 - 2005 : Deputy Director, later Director Botanical & Communication Programmes, Botanical Society of South Africa
January 1981 – July 2000 : Research Scientist (Vegetation Ecology) at National Botanical Institute
January 1979—Dec 1980 : National Military Service

Further information is available on my company website: www.bergwind.co.za