Botanical Evaluation for the proposed ESKOM Power-line Route from Outeniqua Substation to Oudtshoorn, Western Cape Province

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Report prepared for SiVest Environmental

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 SiVest Environmental on behalf of SANRAL to provide specialist botanical consulting services for the for the proposed upgrade of the N7 National Highway between Trawal and Vanrhynsdorp, Matzikamma Municipality, Western Cape Province. The consulting services comprise an assessment of potential impacts on the flora and vegetation in the designated study area by the proposed project.

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).

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

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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.

David McDonald

Signature of the specialist:

Bergwind Botanical Surveys & Tours CC

Name of company:

27 October 2012

Date:

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/
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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

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1. Introduction

Oudtshoorn is the main town in the Eastern Little Karoo and is the economic hub of the area. Owing to proposed changes to the power supply to the town and the nearby Dysselsdorp, ESKOM requires additional 132 kV power-lines that would extend from the Outeniqua Substation near Herold to the Oudtshoorn Substation at the town.

SiVest Environmental was contracted to conduct the environmental assessment process for the proposed power-line development and in turn commissioned Bergwind Botanical Surveys & Tours CC to carry out a botanical study for the project. The main objective of the investigation reported here was to examine the proposed alternative power-line routes to see if they traverse any botanically sensitive areas. It deals with impacts that the proposed power-line and supporting activities may have on any natural vegetation along the proposed alternative routes. When doing the investigation the published guidelines for potential impacts on natural vegetation (Brownlie 2005, De Villiers *et al.* 2005) were carefully considered. In addition the requirements and recommendations of CapeNature and the Botanical Society of South Africa for proactive assessment of biodiversity in areas of proposed developments were also taken into account.

2. Terms of Reference

- Examine and record the vegetation along the proposed transmission line route alternatives between the Outeniqua Substation and the substation at Oudtshoorn, Oudsthoorn Local Municipality (Eden District Municipality), Western Cape Province (Figure 1).
- Identify vegetation along the proposed routes that may require avoidance or lesser mitigation to obviate or at least lessen impacts on such vegetation.
- Describe the vegetation along the proposed routes and comment on the conservation significance of these areas.
- Identify rare and endangered (threatened) plant species that should be avoided or that may require ‘search and rescue’ interventions should their habitat be unavoidably impacted by the proposed development. Co-ordinates of rare and endangered plant species must be provided.
- Identify practical mitigation measures to reduce negative and enhance positive impacts to vegetation and indicate how these could be implemented in the proposed project.

Figure 1. The general locality of the study area in the Eastern Little Karoo (Eden District Municipality) near Oudtshoorn is shown by the red dot.

3. Study Area

3.1 Locality

The study area is in the lower elevation hilly terrain of the Eastern Little Karoo between the Outeniqua Mountains in the south and the Swartberg in the north, and west of the Kamanassie. It is located in the Subtropical Thicket and Succulent Karoo biomes in the Little Karoo as classified by Vlok *et al.* (2005) (Figure 3). More specifically the proposed and alternative routes for the 132 kV power transmission lines are on the hills east of and roughly parallel to the N12 highway between Herold and Oudsthoorn (Figure 4). The beginning point in the south is at the Outeniqua Substation located along the district road between the N12 and Heimersrivier (Doringrivier) to the east. Both the proposed and alternative routes would traverse numerous farms north to north-westwards (see cadastral units in Appendix) to reach Oudtshoorn Substation which is located on the south side of the town near the railway line.

3.2 Topography

The elevation of the Outeniqua Substation is approximately 500 m above mean sea-level (a.m.s.l.) in the northern foothills of the Outeniqua Mountains near Herold (Figure 2). The proposed route (Alternative 1) would extend north to north-east from the substation through the valley of the Doringrivier to a high point alongside the P359 road to Dysselsdorp. From there it would turn northwest and traverse through valleys and over hills in the vicinity of Kleinvlakte before crossing first the Kamanassie River and then the Olifants River. Once across the rivers the route traverses low-lying with minimal relief westwards, following the railway line, to the Oudtshoorn Substation at approximately 300 m a.m.s.l.

The Alternative 2 route for the transmission line would be from the Outeniqua Substation northwestwards to Bend 11 (see Table 2 for co-ordinates) and then north over terrain highly dissected by valleys, to meet the proposed (Alternative 1) route at Bend 1 from which point the route would be the same as for Alternative 1 to the Oudtshoorn Substation.

Note: The botanical survey was conducted from south to north which is in the opposite direction to the number sequence for the 'bends' in the power-line routes.

Figure 2. Low elevation hills and valleys of the Eastern Little Karoo north of the Outeniqua Mountains seen in the background.

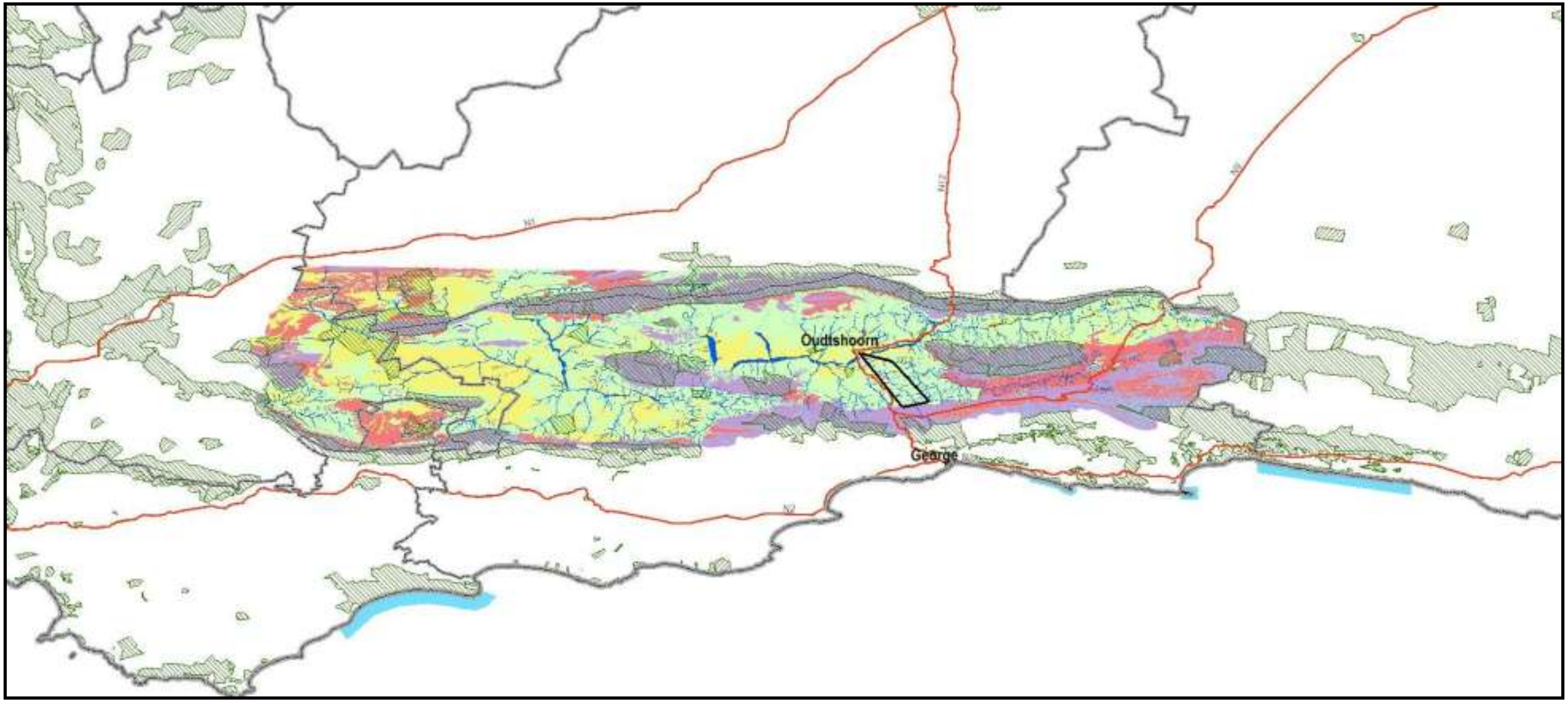

Figure 3. The Little Karoo as delimited by Vlok *et al.* (2005) – coloured area with the towns Oudtshoorn and George shown for reference. The shading represents the different biomes recognized by Vlok (see Vlok *et al.* (2005) for details). The study area is located in the Subtropical Thicket (light green) and Succulent Karoo biomes. (Source: bgis.sanbi.org)

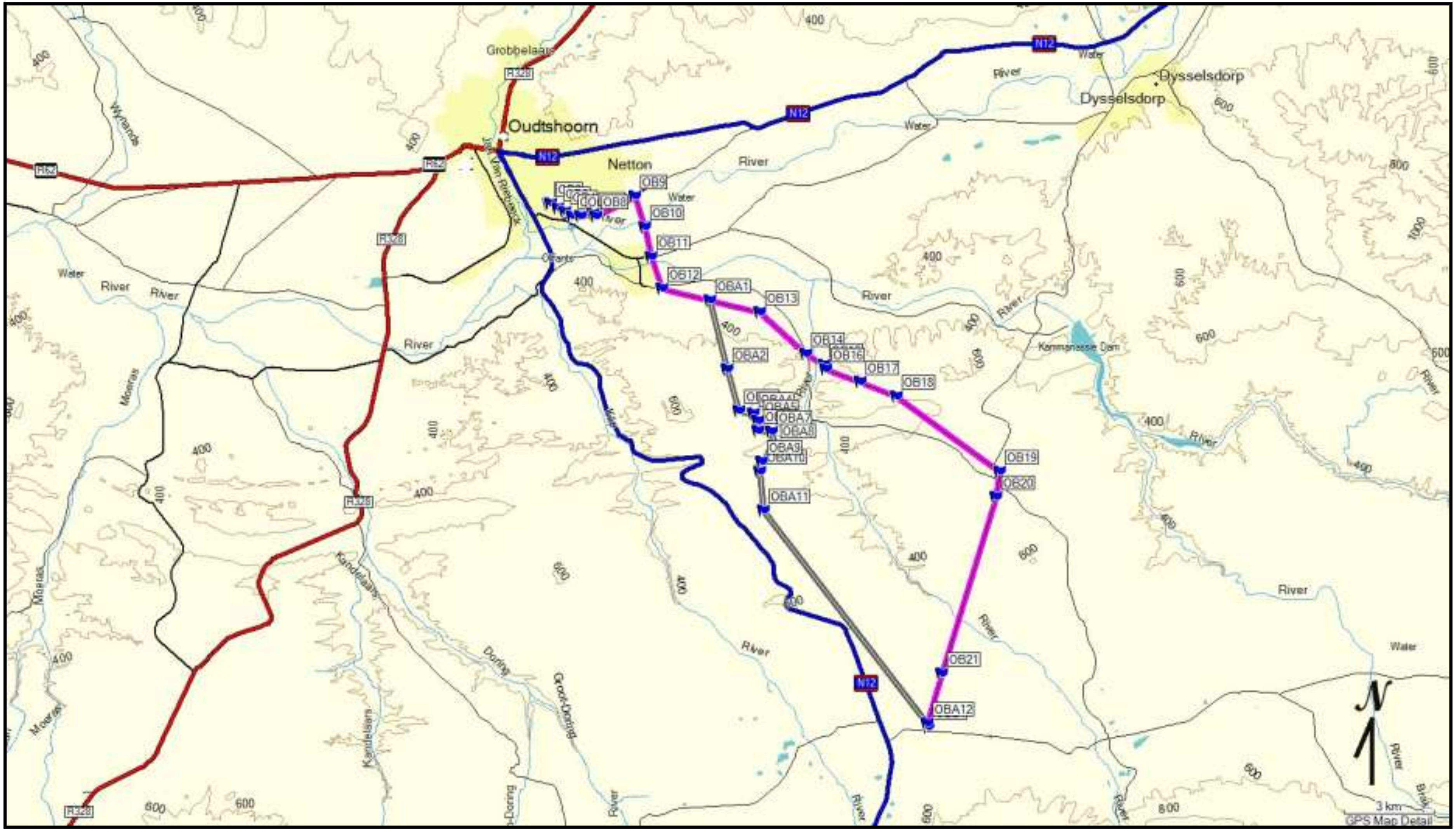

Figure 4. Topographic map of.the Eastern Little Karoo south of Oudtshoorn showing the two alternative transmission line routes: Alternative 1 – Pink; Alternative 2 – Grey. The proposed 'bends' in the respective lines are marked by blue flags.

Table 1. Proposed preferred transmission line route (Alternative 1).

Bend No.	Latitude (South)	Longitude (East)	Vegetation Type (Vlok)
1	33° 36' 30.5"	22° 13' 13.3"	Grootkop Apronveld
2	33° 36' 30.6"	22° 13' 16.0"	Grootkop Apronveld
3	33° 36' 35.0"	22° 13' 25.2"	Oudtshoorn Gannaveld
4	33° 36' 39.7"	22° 13' 34.1"	Oudtshoorn Gannaveld
5	33° 36' 44.2"	22° 13' 43.3"	Oudtshoorn Gannaveld
6	33° 36' 44.3"	22° 13' 53.7"	Oudtshoorn Gannaveld
7	33° 36' 41.0"	22° 14' 10.6"	Oudtshoorn Gannaveld
8	33° 36' 43.8"	22° 14' 13.7"	Oudtshoorn Gannaveld
9	33° 36' 22.7"	22° 15' 3.5"	Oudtshoorn Gannaveld
10	33° 36' 56.2"	22° 15' 16.8"	Oudtshoorn Gannaveld
11	33° 37' 27.3"	22° 15' 25.0"	Grootkop Apronveld
12	33° 38' 1.7"	22° 15' 39.4"	Grootkop Apronveld
13	33° 38' 26.9"	22° 17' 45.1"	De Rust Sandolien-Spekboomveld
14	33° 39' 11.6"	22° 18' 43.9"	De Rust Sandolien-Spekboomveld
15	33° 39' 22.8"	22° 19' 7.6"	De Rust Sandolien-Spekboomveld
16	33° 39' 28.5"	22° 19' 10.3"	Kandelaars Arid Spekboomveld
17	33° 39' 41.8"	22° 19' 54.9"	Kandelaars Arid Spekboomveld
18	33° 39' 57.1"	22° 20' 40.5"	Kandelaars Arid Spekboomveld
19	33° 41' 17.9"	22° 22' 54.0"	Blossoms Asbos-Gwarrieveld
20	33° 41' 45.0"	22° 22' 48.6"	Blossoms Asbos-Gwarrieveld
21	33° 44' 54.5"	22° 21' 39.7"	Blossoms Asbos-Gwarrieveld
22	33° 45' 47.8"	22° 21' 20.3"	Blossoms Asbos-Gwarrieveld
23	33° 45' 49.9"	22° 21' 21.6"	Blossoms Asbos-Gwarrieveld
24	33° 45' 51.1"	22° 21' 21.2"	Blossoms Asbos-Gwarrieveld

Table 2. Proposed Alternative 2 transmission line route.

Bend No.	Latitude (South)	Longitude (East)	Vegetation Type (Vlok)
1	-33° 38' 13.9"	22° 16' 40.3"	De Rust Sandolien-Spekboomveld
2	-33° 39' 27.6"	22° 17' 3.5"	De Rust Sandolien-Spekboomveld
3	-33° 40' 13.0"	22° 17' 17.8"	Kandelaars Gannaveld
4	-33° 40' 15.5"	22° 17' 37.3"	Kandelaars Arid Spekboomveld
5	-33° 40' 23.3"	22° 17' 42.1"	Kandelaars Arid Spekboomveld
6	-33° 40' 34.1"	22° 17' 42.4"	Kandelaars Arid Spekboomveld
7	-33° 40' 34.7"	22° 18'	Kandelaars Arid Spekboomveld
8	-33° 40' 49.5"	22° 18' 5.2"	Kandelaars Gannaveld
9	-33° 41' 6.7"	22° 17' 46.9"	Kandelaars Arid Spekboomveld
10	-33° 41' 17.4"	22° 17' 44.4"	Kandelaars Arid Spekboomveld
11	-33° 41' 59.8"	22° 17' 49.8"	Blossoms Asbos-Gwarrieveld
12	-33° 45' 47.8"	22° 21' 20.3"	Blossoms Asbos-Gwarrieveld

3.3 Geology and Soils

The Oudtshoorn Basin formed when the Falkland Plateau slid westwards along the southern Cape Coast during the Cretaceous Period, approximately 120 million years ago; the sliding caused fractures such as the Cango Fault which is a deep fracture running from East to West along the base of the Swartberg. The basin floor subsided mainly along its northern margin and the depression was filled with sediment from rejuvenated rivers on the new highlands of Gamkasberg and Rooiberg as well as from the uplifted area to the north (McCarthy & Rubidge, 2005). The geology of the area immediately around Oudtshoorn has been described and mapped as Tertiary to Quaternary calcrete and hardpan (Coertze 1979). These sediments developed subsequent to the Cretaceous deposits described above.

The greater part of the area considered in this study is underlain by sediments of the Bokkeveld Group (shale, siltstone and argillaceous sandstone) to a lesser extent by quartzitic and feldspathic sandstone of the Table Mountain Group. Occasional terrace gravel and silcrete occurs. These sediments all make up land-type Fc44. Towards the northern end of the study area sediments of the Enon Formation, Uitenhage Group consisting of conglomerate, sandstone, siltstone and mudstone are found. The conglomerate consists of large subrounded pebbles and cobbles cemented together by red limonite which also coats the pebbles, giving the conglomerate has a distinctive red appearance or yellowish colour (Shone, 2006). The land-type here is Ag19. The northern part of the study area, south of the railway line at Oudtshoorn is typified by alluvial sediments of the Oliphants and Kamanassie Rivers which is reflected in land-type Ia41 (Land Type Survey Staff, 1972 -- 2006) (Figure 5).

Heuweltjies or kraaltjies were noted in parts of the landscape and are an important topographic feature. They are understood to be the primarily the result of termite activity with possible secondary activity of animals such as mole rats contributing to their existence (Midgley & Musil 1990; Milton & Dean 1996; Fey, 2010). These mounds are clearly usually clearly visible in the veld as distinct circular patches and can be discerned on aerial photographs. A common phenomenon is that there is a different composition of plant species on the heuweltjies compared with off them and this is seen most obviously in the growing and flowering season when the heuweltjies stand out against the more drab surrounding vegetation.

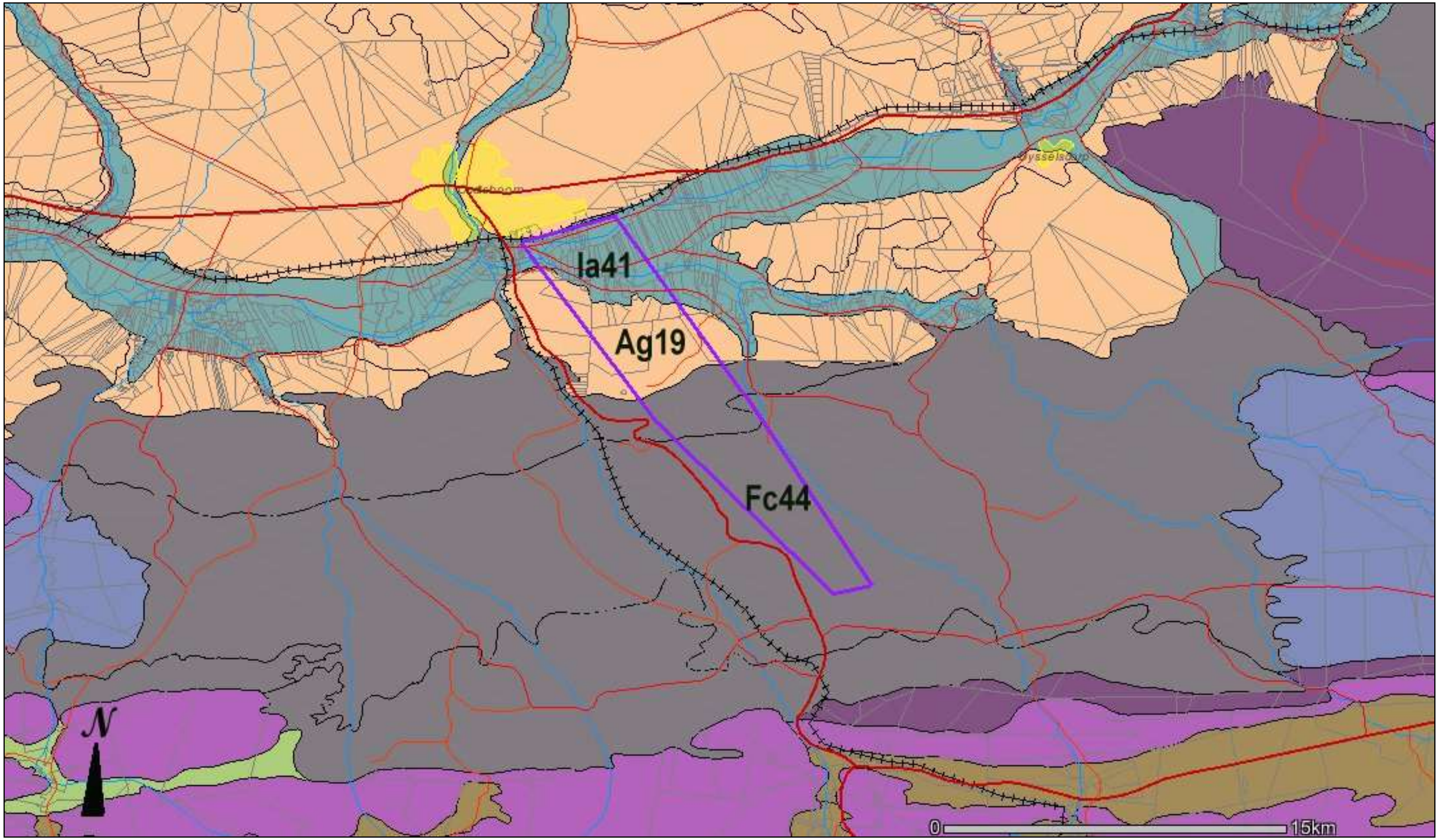

Figure 5. Land-type map of part of the Eastern Little Karoo, with the study area outlines as a purple polygon and including three land-types: Fc44, Ag19 and Ia41.

3.5 Climate

The Eastern Little Karoo experiences erratic rainfall with distinct peaks in autumn (March – May) and early summer (October) (Figure 6). Average annual rainfall is 288 mm. The winters are cool to cold and snow often lies on the nearby Swartberg after the passage of a cold front. The summers are long and hot with daytime temperatures often exceeding 40°C although mean monthly temperature seldom exceeds 30°C or less than 4°C (Figure 7). Mean annual potential evaporation is high and mean annual soil moisture stress (% of days when evaporative demand is double the soil moisture supply is 84% (Mucina & Rutherford, 2006) (Figure 8). These climatic conditions contribute to a very arid climate that has a profound effect on the plant life in the Eastern Little Karoo.

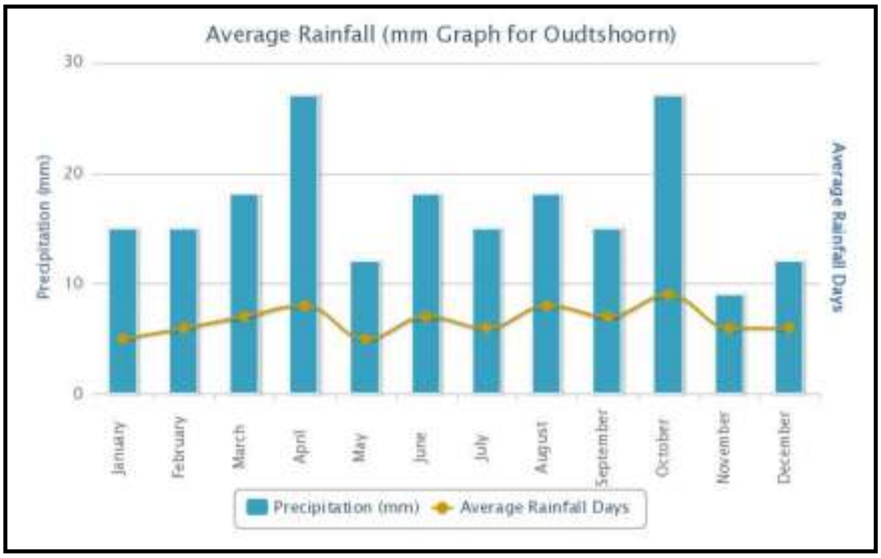

Figure 6. Average rainfall for Oudtshoorn in the Eastern Little Karoo. Note the bi-modal pattern with peaks in April and October.

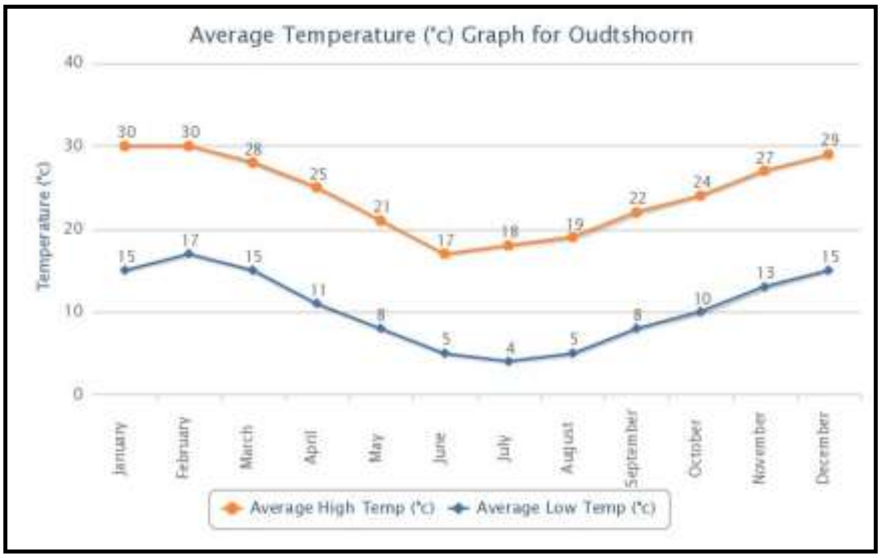

Figure 7. Average temperature for Oudtshoorn in the Eastern Little Karoo reflecting hot summers and cold winters.

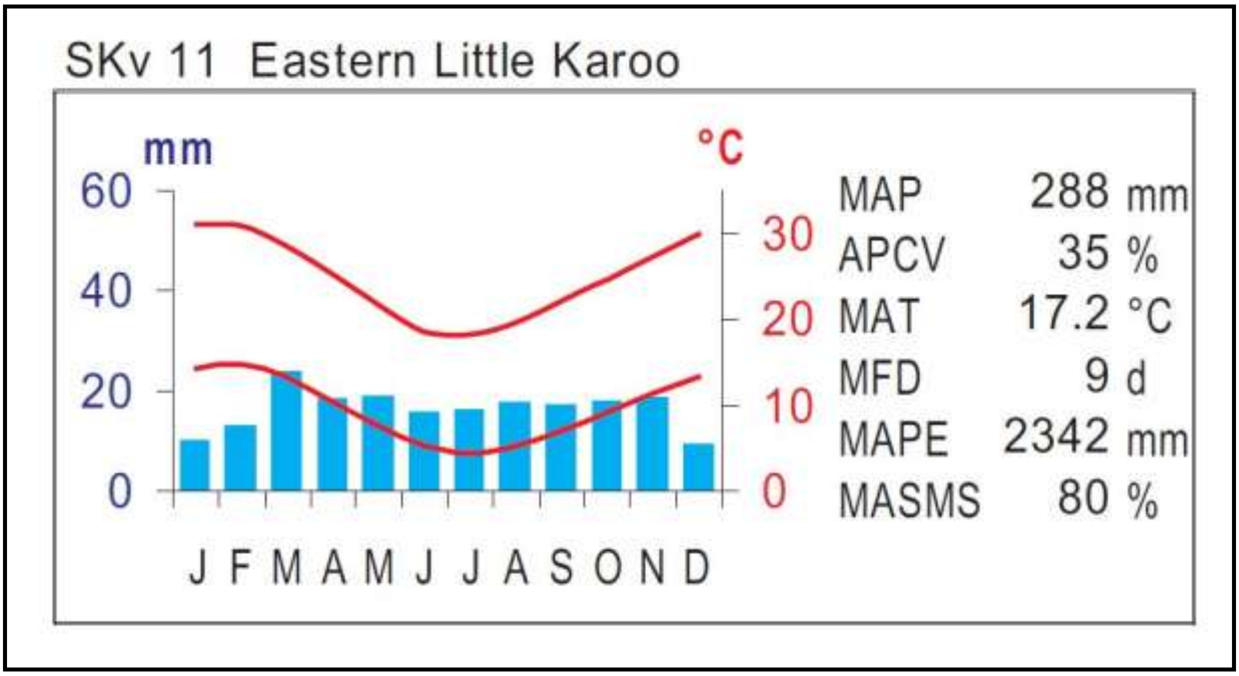

Figure 8. Climate diagram for Eastern Little Karoo (from Rutherford & Mucina, 2006) showing MAP – Mean Annual Precipitation; ACPV = Annual Precipitation Coefficient of Variance; MAT = Mean Annual Temperature; MFD = Mean Frost Days; MAPE = Mean Annual Potential Evaporation; MASMA = Mean Annual Soil Moisture Stress

4. Study Approach and Methods

A rapid-scan approach as opposed to a plot-based evaluation method was used. The method was to follow, where possible, the pre-determined and proposed alternative power-line routes from the Outeniqua Substation northwards to the Oudtshoorn Substation. The study area was visited over a three-day period from 28 – 30 August 2012. Sections of the proposed routes were walked whereas other areas were accessed by motor vehicle. The vegetation encountered along the routes was recorded and where possible the routes were tracked using a hand-held Garmin ® GPS. Co-ordinates of 'check-sites' (waypoints) were taken along the routes and at these sites more specific details of the surrounding vegetation were recorded and photographs taken to support the observations. Additional notes were also made about any features of the habitat that were of particular interest or importance.

It was not possible to gain access to all of the sections of the alternative routes for various reasons. However, an adequate sample of the vegetation types was made to be able to extrapolate, with the help of aerial photograph interpretation, to those sections of the routes not accessed.

5. Disturbance regime

The study area is largely uncultivated and used as rangeland for livestock. The exceptions are areas in the south around the Outeniqua Substation, an area in the central part on the farm Kleynspoort, the lower reaches of the Doringrivier before its confluence with the Kamanassierivier and the alluvial plains of the Kamanassie and Olifants Rivers where there is cultivation.

6. Vegetation

6.1 General description

In the classification of the vegetation of southern Africa (Mucina, Rutherford & Powrie, 2005; Mucina *et al.* 2006 in Mucina & Rutherford, 2006), the vegetation of the study area was classified as two types: Eastern Little Karoo (SKv11) and Muscadel Riviere (AZi8) (Figure 9). Subsequently in a fine-scale classification of the vegetation of the Little Karoo (Vlok *et al.* 2005) numerous vegetation types were described. The result is that within the study area six distinct vegetation types or units are now recognized. They are grouped under '*Major Habitat Types'* as follows:

Subtropical Thicket:

(1) Kandelaars Arid Spekboomveld

(2) De Rust Sandolien-Spekboomveld

Arid Thicket Mosaics:

(1) Blossoms Asbos Gwarrieveld

Gannaveld

(1) Kandelaars Gannaveld

(2) Oudtshoorn Gannaveld

Gravel Apronveld

(1) Grootkop Gravel Apronveld

The vegetation types or units were comprehensively mapped by Vlok et al. (2005) and by superimposing the proposed Alternative 1 and 2 transmission line routes it was possible to determine which vegetation types would be affected (Figure 10). Specific sites visited are described in the following section.

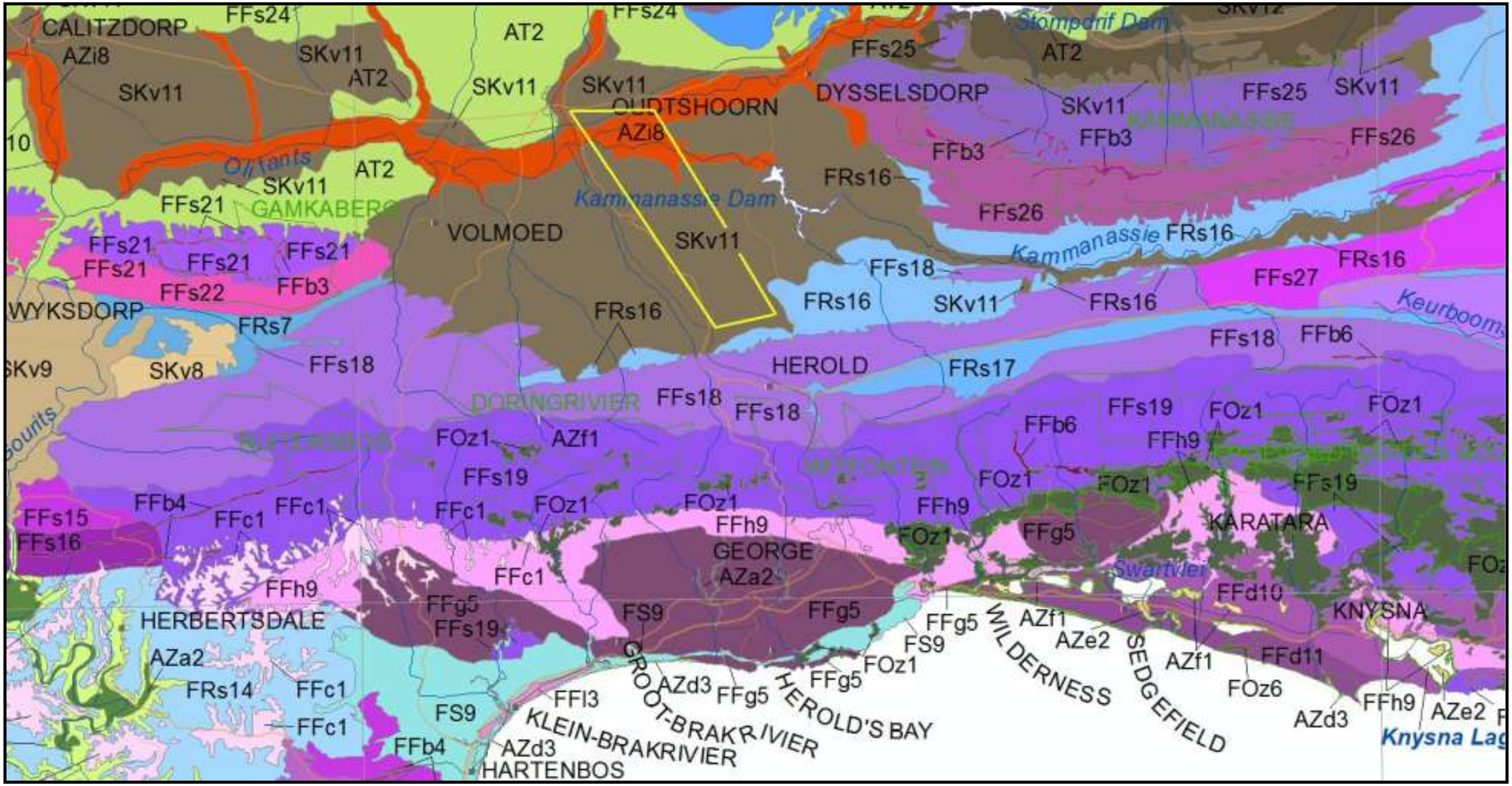

Figure 9. Portion of the vegetation map of southern Africa (Mucina, Rutherford & Powrie, 2005) showing the vegetation types found in the study area (yellow polygon) as Eastern Little Karoo (SKv11) and Muscadel Riviere (AZi8).

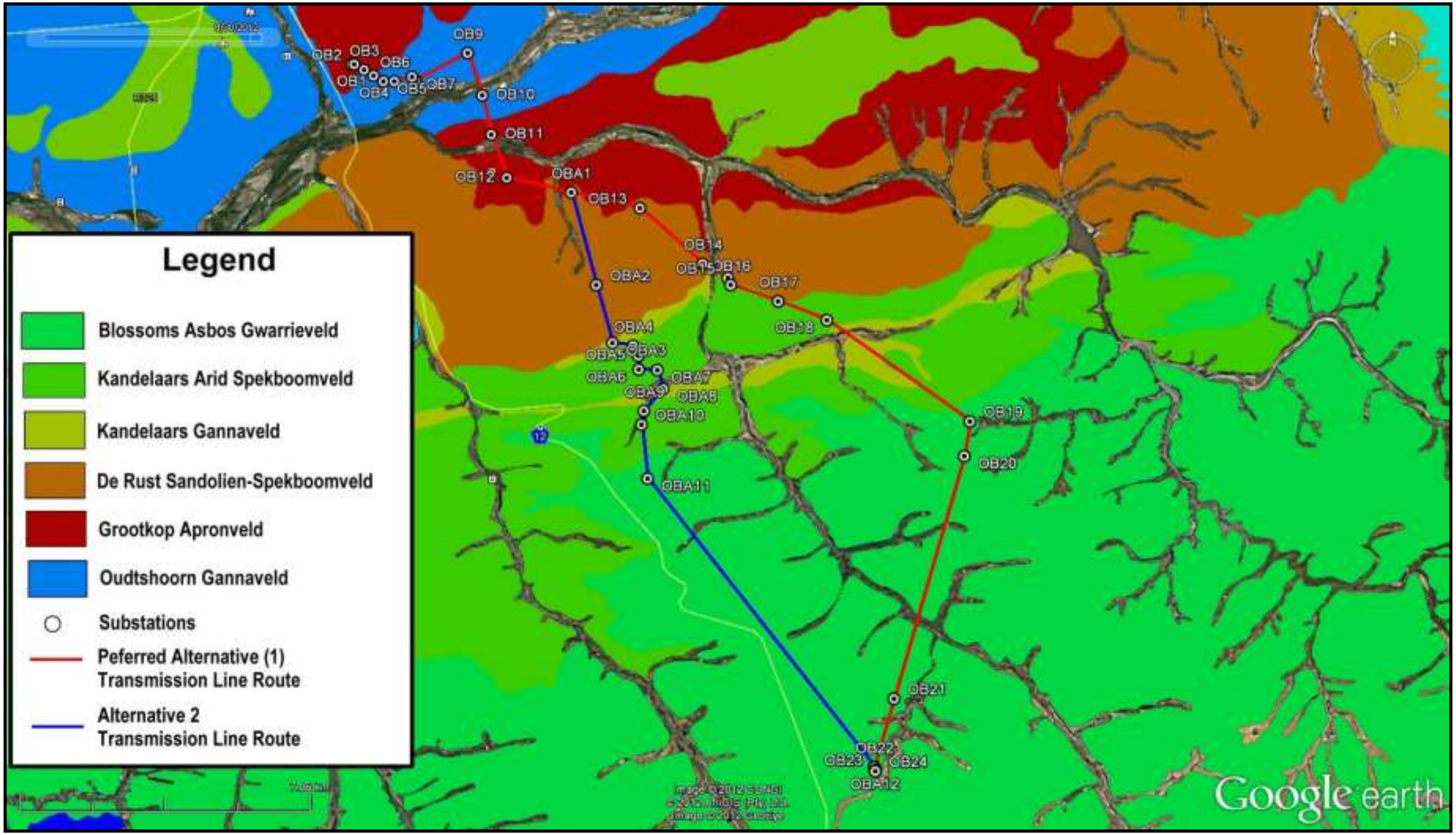

Figure 10. Portion of the vegetation map of the Little Karoo (Vlok *et al.* 2005) with the respective vegetation type that would be affected by the proposed transmission line routes. The circular icons represent the 'bend' locations.

6.3 Vegetation of the power-line routes

No attempt is made here to re-classify the vegetation or re-invent the classification of Vlok *et al.* (2005) but rather to apply it to determine the potential impacts on the vegetation type encountered along the proposed transmission line routes. The vegetation types found at the predetermined 'bends' on the Alternative 1 and 2 routes are given in Table 1 & 2. The vegetation types found and sampled at the 30 sample waypoints in this survey are given in Table 3 and depicted in Figure 11.

Table 3. The waypoints sampled in the vegetation survey with the vegetation units as assigned by Vlok et al. (2005).

Waypoint	Latitude	Longitude	Vegetation Type (Vlok *et al.* 2005)
OE1	S33° 44' 29.6"	E22° 21' 51.6"	Blossoms Asbos-Gwarrieveld
OE2	S33° 44' 33.2"	E22° 21' 50.6"	Blossoms Asbos-Gwarrieveld
OE3	S33° 44' 42.8"	E22° 21' 46.4"	Blossoms Asbos-Gwarrieveld
OE4	S33° 44' 51.1"	E22° 21' 44.3"	Blossoms Asbos-Gwarrieveld
OE5	S33° 45' 08.7"	E22° 21' 42.9"	Blossoms Asbos-Gwarrieveld
OE6	S33° 45' 25.2"	E22° 21' 30.8"	Blossoms Asbos-Gwarrieveld
OE7	S33° 45' 36.3"	E22° 21' 26.5"	Blossoms Asbos-Gwarrieveld
OE8	S33° 41' 46.6"	E22° 22' 49.6"	Blossoms Asbos-Gwarrieveld
OE9	S33° 41' 05.0"	E22° 22' 50.3"	Blossoms Asbos-Gwarrieveld
OE10	S33° 40' 44.5"	E22° 21' 39.8"	Kandelaars Gannaveld
OE11	S33° 37' 26.3"	E22° 15' 24.5"	Grootkop Gravel Apronveld
OE12	S33° 36' 29.1"	E22° 13' 19.8"	Grootkop Gravel Apronveld
OE13	S33° 36' 44.5"	E22° 13' 51.1"	Oudtshoorn Gannaveld
OE14	S33° 36' 42.5"	E22° 14' 12.0"	Oudtshoorn Gannaveld
OE15	S33° 36' 21.0"	E22° 15' 04.1"	Oudtshoorn Gannaveld
OE16	S33° 37' 58.4"	E22° 15' 35.0"	Grootkop Gravel Apronveld
OE17	S33° 38' 17.4"	E22° 16' 56.7"	Grootkop Gravel Apronveld
OE18	S33° 38' 32.9"	E22° 17' 52.1"	De Rust Sandolien-Spekboomveld
OE19	S33° 39' 11.5"	E22° 18' 46.8"	De Rust Sandolien-Spekboomveld
OE20	S33° 40' 33.8"	E22° 20' 58.9"	Kandelaars Gannaveld
OE21	S33° 39' 35.8"	E22° 20' 40.6"	De Rust Sandolien-Spekboomveld
OE22	S33° 39' 56.4"	E22° 20' 38.2"	Kandelaars Arid Spekboomveld
OE23	S33° 42' 20.7"	E22° 18' 08.5"	Blossoms Asbos-Gwarrieveld
OE24	S33° 39' 45.4"	E22° 17' 08.3"	De Rust Sandolien-Spekboomveld
OE25	S33° 39' 42.5"	E22° 17' 05.5"	De Rust Sandolien-Spekboomveld
OE26	S33° 41' 00.2"	E22° 17' 53.0"	Kandelaars Gannaveld
OE27	S33° 40' 36.7"	E22° 18' 00.9"	Kandelaars Arid Spekboomveld
OE28	S33° 40' 34.7"	E22° 17' 42.2"	Kandelaars Arid Spekboomveld
OE29	S33° 40' 22.9"	E22° 17' 41.6"	Kandelaars Arid Spekboomveld
OE30	S33° 40' 13.8"	E22° 17' 35.7"	Kandelaars Arid Spekboomveld

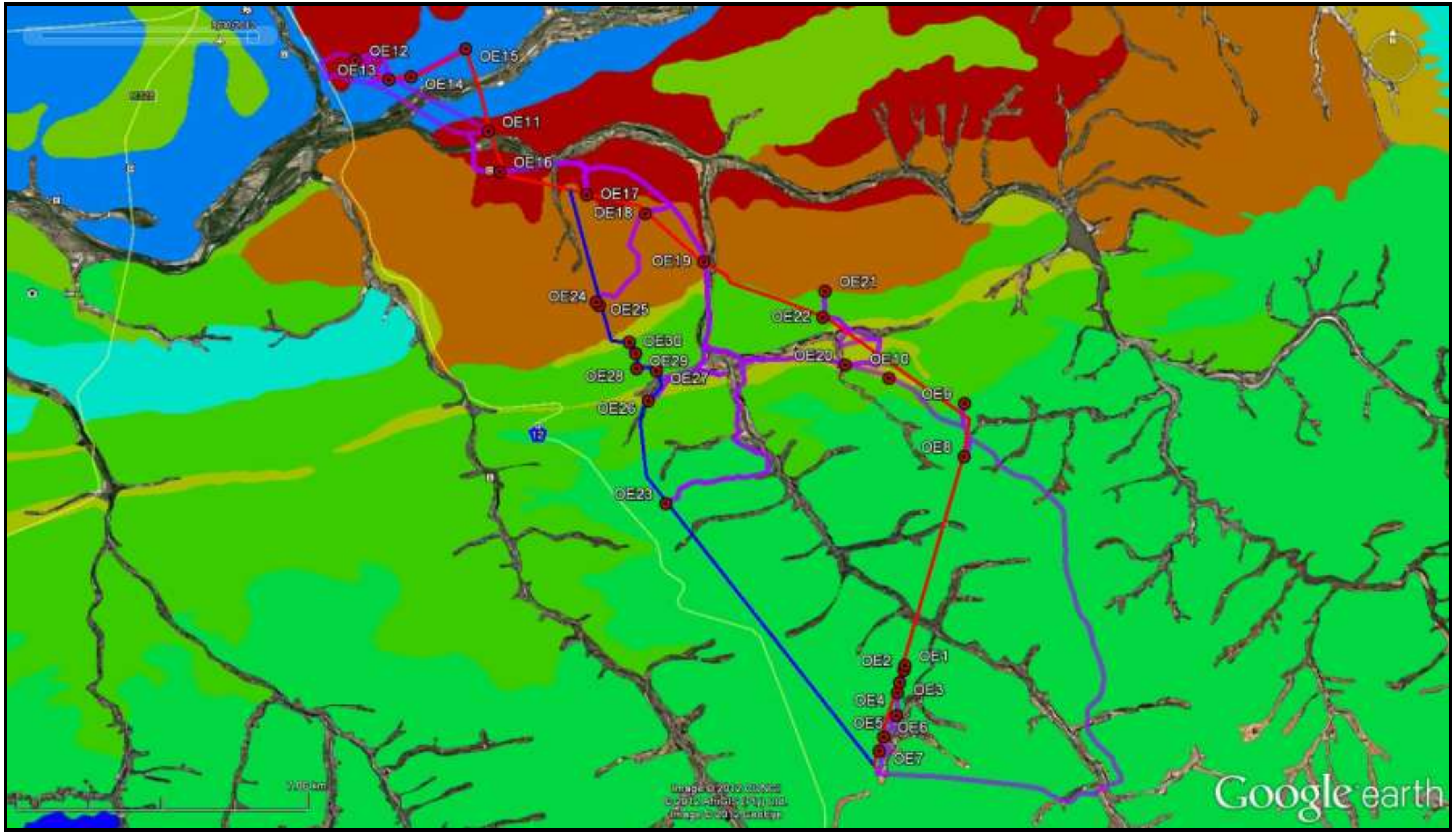

Figure 11. Portion of the vegetation map of the Little Karoo (Vlok *et al.* 2005) with the respective vegetation type that would be affected by the proposed transmission line routes. The circular icons represent the vegetation sample waypoints (see Table 3) (Legend for vegetation types in Figure 10)

6.2.1 Vegetation of Alternative 1 – the preferred route

The preferred route from the Outeniqua Substation north-eastwards follows an existing Eskom servitude which presently has a 400 kV and a 132 kV line running parallel to Dysselsdorp. Apart from crossing the Doringrivier and some of its smaller tributaries the preferred route crosses a large area of Blossoms Asbos Gwarrieveld i.e. from Bend OB24 to Bend OB19, a distance of 8.6 km.

Around the Outeniqua Substation the natural vegetation has been cleared over a large area and converted to pasture for ostriches and other livestock. The soil is shale–derived and arable and no-longer supports Blossoms Asbos Gwarrieveld and is not botanically sensitive (Figures 12 & 13). From waypoint OE7 to OE1 the Blossoms Asbos Gwarrieveld is in **moderate** condition with signs of grazing by sheep (Figures 14 & 15).

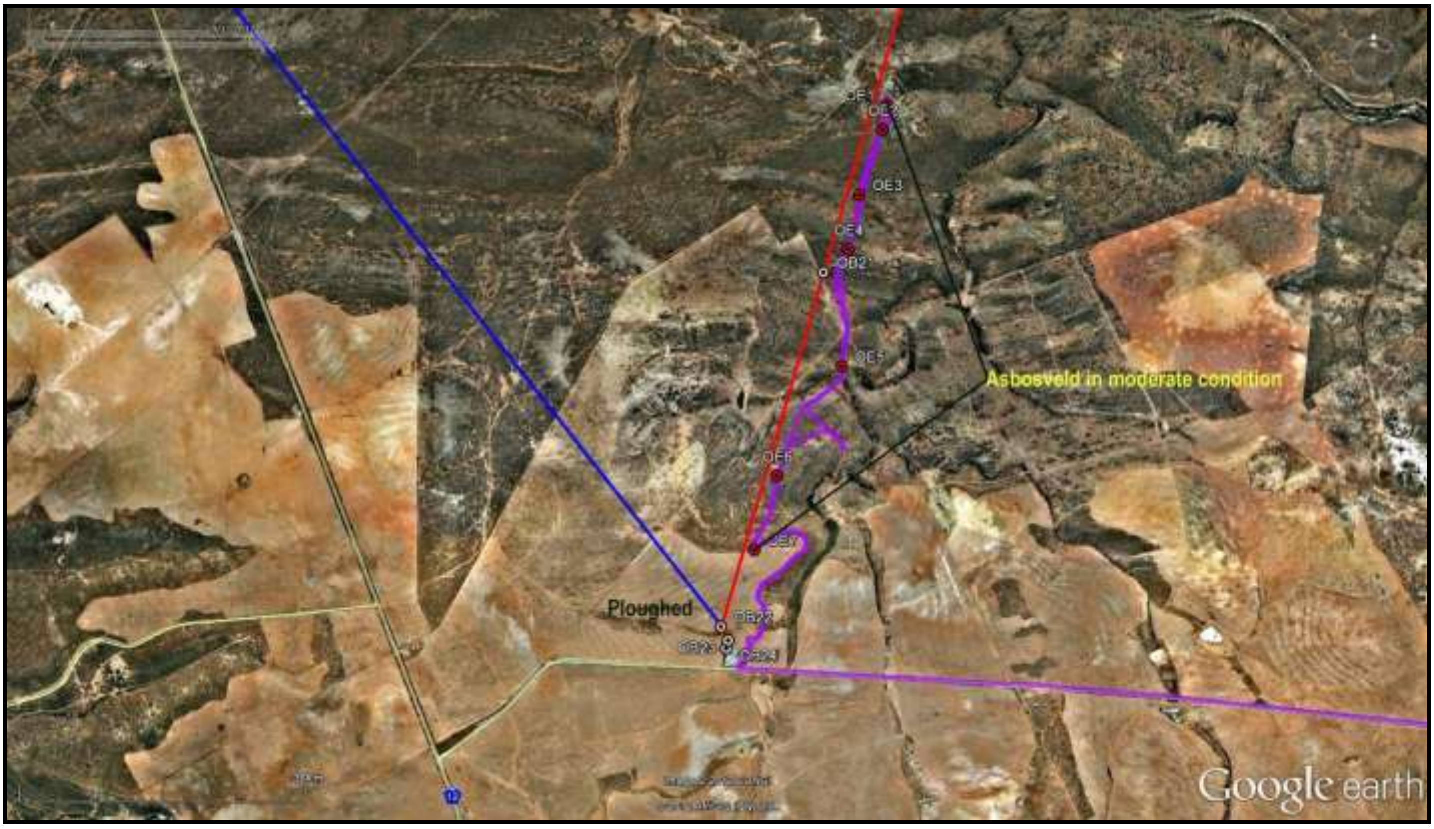

Figure 12. Aerial image (Google Earth™) of the southern part of the study area showing extensive clearing and cultivation of shale-derived soils.

Figure 13. Blossoms Asbos Gwarrieveld in foreground with cleared lands in the mid-ground. View looking southwards along the Eskom servitude, towards the Outeniqua Substation.

The natural Blossoms Asbos Gwarrieveld vegetation is low to mid-high shrubland with emergent tall shrubs forming thickets (Mosaic) (Figure 14). The species composition of the area is represented by those recorded at sample waypoints OE1 and OE2 which include *Asparagus capensis, Asparagus mucronatus* and *Babiana sambucina. Bulbine abyssinica, Carissa haematocarpa, Cotyledon orbiculata, Crassula* sp., *Diascia bicolor, Dimorphotheca* sp., *Euclea undulata, Eriocephalus africanus, Felicia* sp., *Gloveria integrifolia, Helichrysum* sp., *Heliophila cornuta, Hemimeris gracilis, Hermannia* sp., *Lycium* sp., *Massonia depressa, Moraea cf. falcifolia, Oxalis pes-caprae, Oxalis* sp., *Oxalis* sp. – orange flowers, *Pelargonium* sp., *Pentzia incana, Polygala scabra, Pteronia pallens, Euphorbia arceuthobioides, Ruschia cradockensis, Trachyandra* sp., *Trichodiadema* sp., Vygie – mat-forming and *Zygophyllum lichtensteinianum.*

At waypoint OE1 *Pentzia incana* (ankerkaroo) was strikingly dominant whereas elsewhere *Pteronia incana* (asbos) was typically the dominant species with *Eriocephalus africanus* co-dominant. At waypoint OE4 *Elytropappus rhinocerotis* was dominant on shale-derived soils; this could be attributed to overgrazing by ostriches.

No usual or threatened species were encountered at the sample waypoints OE1 – OE7 although endemic species are likely to occur. It was notable that despite the presence of the power-lines, there was no evidence of degradation of the habitat that could be attributed to the power-lines in the form of disturbance around the base of the pylons or as tracks for maintenance of the infrastructure. Disturbance can be mostly attributed to grazing.

Figure 14. Blossoms Asbos Gwarrieveld along the existing Eskom servitude. The area has been grazed by sheep.

The transmission line servitude was accessed from the road between Heimersrivier and Dysselsdorp and sampled at waypoint OE8 along a farm road which is near bend OB20 (Figure 15). The soil is shale-derived and the vegetation at this location is also Blossoms Asbos Gwarrieveld (mosaic). The vegetation is denser at this location than in the area between waypoints OE1 and OE7. In particular the gwarrie (*Euclea undulata*) thickets are much more pronounced and denser. Between the thickets is low to mid-high shrubland (Figure 16). Species recorded here include *Aloe microstigma, Asparagus burchellii, Asparagus capensis, Bulbine abyssinica, Cineraria sp., Cotula cf. laxa, Cotyledon orbiculata, Crassula tetragona, Drosanthemum sp., Elytropappus rhinocerotis, Eriocephalus africanus, Euclea undulata, Euphorbia mauritanica, Gloveria integrifolia, Hemimeris gracilis, Hermannia althaeifolia, Lycium sp., Malephora lutea, Mesembryanthemum junceum, Nymania capensis, Opuntia ficus-indica, Pteronia incana* (dominant), *Ruschia archeri, Ruschia caroli, Salsola aphylla, Searsia pallens, Searsia undulata, Senecio cf. acaulis, Senecio cotyledonis, Tetragonia sarcophylla, Tylecodon cacalioides, Tylecodon paniculatum* and *Zygophyllum morgsana.*

Numerous farm roads and livestock (cattle & sheep) paths criss-cross this area (Figure 18) and there is localized disturbance around kraals.

Figure 15. Typical Blossoms Asbos Gwarrieveld at sample waypoint OE20.

Figure 16. Mid-high shrubland in mosaic with gwarrie thickets at sample waypoint OE20.

Waypoint OE9 is at the 17 km road marker on the P359 road to Dysselsdorp. This is the near to Bend OB19 and near to where the transmission lines of the preferred route (Alternative 1) would cross the road. The vegetation is Blossoms Asbos Gwarrieveld as described above (Figure 17).

Figure 17.

Figure 18. Aerial view (Google Earth ™) of the central part of the Alternative 1 (preferred) transmission line route (red line) with a sharp bend at OB19. The intersection of the P359 road with the P1668 road is seen with the purple line representing the sample track with OE8 and OE9 being two sample waypoints.

From Bend OB19 the Alternative 1 route would traverse an area of Kandelaars Arid Spekboomveld and an area of Kandelaars Gannaveld *en route* to Bend OB18.The latter vegetation unit was noted at waypoints OE10 and OE20 and it is recommended that as far as possible the route should be aligned **in the valley** through Kandelaars Gannaveld as opposed to being aligned along the low ridge which supports Kandelaars Arid Spekboomveld with well-developed stands of old gwarrie shrubs (Figure 19).

Figure 19. An area of Kandelaars Gannaveld is seen in the foreground with Kandelaars Arid Spekboomveld on the hills. The

The area at Bend OB18 (sample waypoint OE22) is on a mid-elevation plateau and is a stock watering-point. This area was previously grazed by ostriches which severely impacted the veld. Now that the ostriches have been removed the area is recovering but the immediate vicinity of the watering point is still highly disturbed (Figures 20 & 21).

Figure 20. Highly disturbed area at a stock watering point at the proposed location of Bend OB18.

Figure 21. Kandelaars Arid Spekboomveld around the disturbed stock watering point at sample waypoint OE22 (proposed Bend OB18)

Along the proposed Alternative 1 route between Bend OB18 and Bend OB17 is a large concentration of *Aloe ferox* (Figure 22). These aloes although not uncommon, should be avoided as far as possible and, if necessary, transplanted away from the transmission line route. Heuweltjies are also a prominent feature in this area and the pylons should preferably avoid impacting these as well.

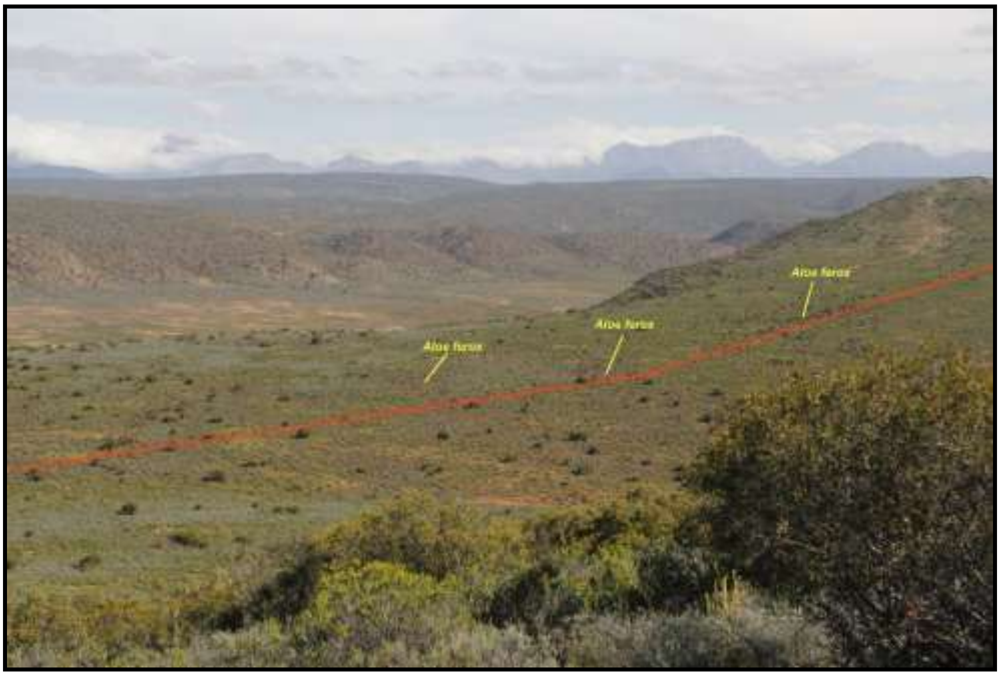

Figure 22. Kandelaars Arid Spekboomveld with clusters of *Aloe ferox*, between Bend OB18 and bend OB17.

The proposed Alternative1 route between Bend OB17 and OB16 is on the north-facing slopes of a low ridge where the vegetation is Kandelaars Arid Spekboomveld (Figure 23) found on red soils derived from Enon Conglomerate. The route will probably be at the mapped boundary between Kandelaars Arid Spekboomveld and De Rust Sandolien-Spekboomveld which are similar in character.

Figure 23. Kandelaars Arid Spekboomveld on red soils derived from Enon Conglomerate at Kleynspoort.

De Rust Sandolien-Spekboomveld was sampled at waypoint OE19 on the west side of the P1668 road at the 9 km marker at Franshof. Bend OB14 would be on the west side of the road. The vegetation is grazed by goats but is in moderate to good condition. *Aloe ferox* is abundant in this area but interestingly there was no evidence of sandolien (*Dodonaea viscosa*) suggesting that the vegetation has greater affinity to Kandelaars Arid Spekboomveld than to De Rust Sandolien-Spekboomveld (Figure 24). A feeding area for goats is located near the sample waypoint. This area is highly disturbed and would be ideal for the erection of a pylon (Figure 25). It should also be noted that the property is also earmarked by the farmer as a game-camp where he plans to stock eland.

Figure 24. An area mapped by Vlok et al. (2005) as De Rust Sandolien-Spekboomveld at sample waypoint OE19.

Figure 25. Feeding area for goats with trampled, disturbed vegetation near waypoint OE19.

The vegetation at sample waypoint OE18 is also mapped by Vlok *et al. (*2005) as De Rust Sandolien-Spekboomveld but once again, there was no evidence of *Dodonaea viscosa* (sandolien) and from the description for Kandelaars Arid Spekboomveld, the vegetation would be more satisfactorily classified as this type (Figure 26). The vegetation has three distinct strata: An upper stratum (2 – 4 m) of open, tall *Euclea undulata* thicket; a mid-stratum (0.4 – 1.5 m) dominated by *Ruschia fourcadei* and *Senecio cotyledonis* and a low stratum dominated by mat-forming vygies e.g. *Ruschia esterhuyseniae. Portulacaria afra* (spekboom) is present but not abundant and *Aloe ferox* is represented by scattered large old specimens.

Figure 26. The vegetation at waypoint OE18 which according to Vlok et al. (2005) is De Rust Sandolien-Spekboomveld but appears to be more classified as Kandelaars Arid Spekboomveld.

The vegetation at sample waypoint OE17 is on the farm 'De Denne' (Figure 28) where it is highly disturbed by (1) removal of gravel and (2) grazing by cattle. The Grootkop Gravel Apronveld is in extremely poor condition as reflected in the abundance of the weedy vygie *Malephora lutea* (Figure 27).

Figure 27. Disturbed area of Grootkop Gravel Apronveld on the farm 'De Denne'. The dominant low succulent shrub is *Malephora lutea*, indicating intense disturbance.

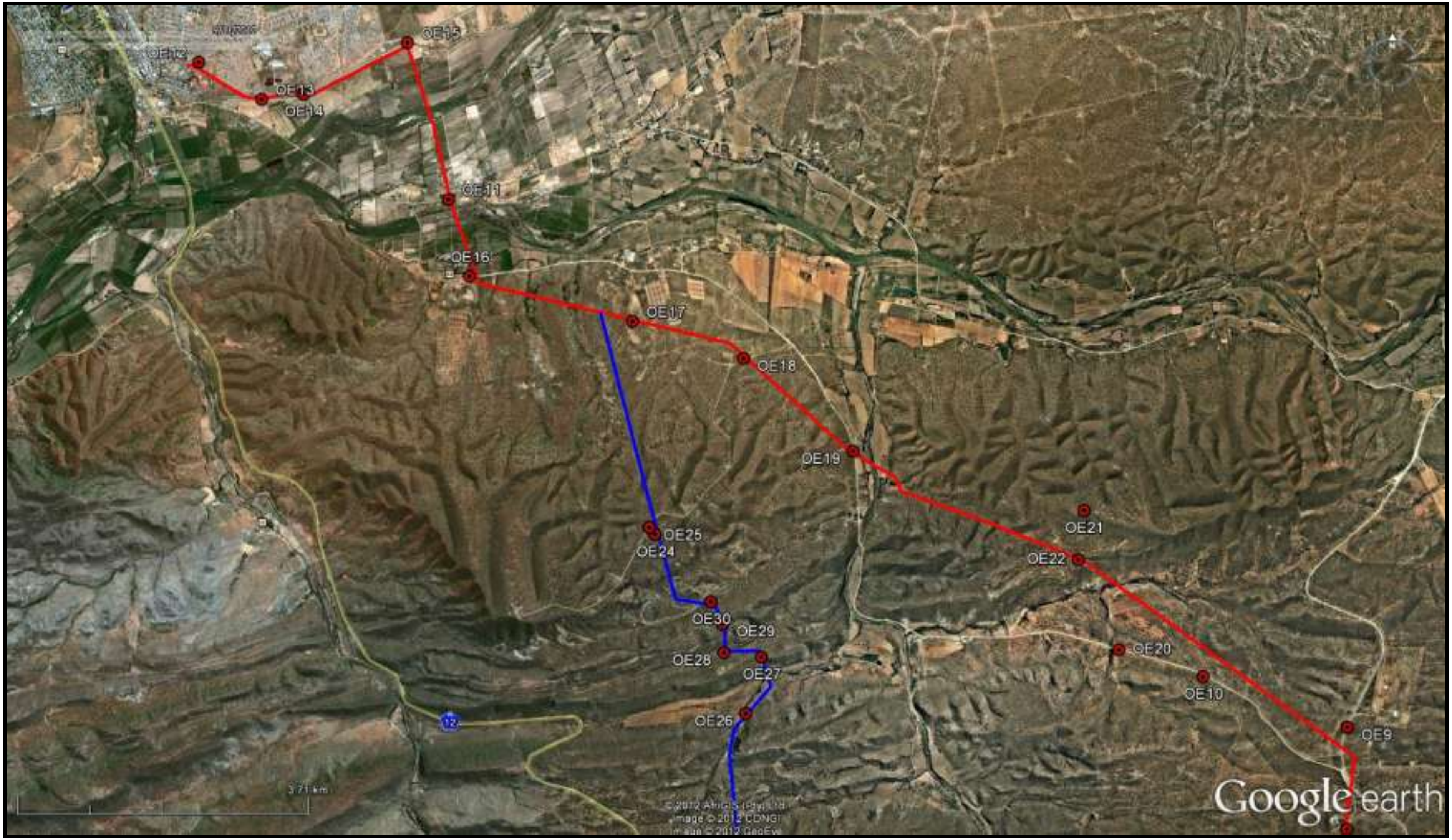

Figure 28. Aerial image (Google Earth ™) of the northern part of the study area showing the convergence of the two proposed alternative transmission line routes Alternative 1 – red; Alternative 2- blue), with sample waypoints shown as OE#.

Waypoints OE11, OE12 and OE16 are mapped as occurring in Grootkop Gravel Apronveld (Figures 10 & 11). However, at these locations the vegetation has been dramatically transformed by either by agriculture or by urbanization (near Oudtshoorn Substation) and very little if any natural, undisturbed vegetation persists. These sites have very low botanical sensitivity and are not restorable to the natural condition (Figures 29, 30 & 31).

Figure 29. Sample waypoint OE16 with landscape highly transformed by agriculture.

Figure 30. An area that would have originally been Grootkop Apronveld around the Oudtshoorn Substation, now completely disturbed and transformed.

Figure 31. Location of waypoint OE11 on the north side of the Kamanassierivier where Grootkop Apronveld would have originally occurred. It is now completely lost to agriculture.

Waypoints OE13, OE14 and OE15 are located on the north side of the Olifantsrivier along the railway track and parallel gravel road. The original vegetation that would have occurred here would have been Oudtshoorn Gannaveld on alluvial sediments. This is a highly desirable zone for agriculture and is also close to the town of Oudtshoorn. The environment is now highly disturbed and has very low botanical and conservation value. Apart from where agriculture is practiced and crops or pastures are cultivated the vegetation is transformed to weedy, ruderal groups of plant species with remnant species such as *Salsola aphylla* (gannabos) and *Lycium* sp. (Figure 32).

Figure 32. Shrubs of *Salsola aphylla* and *Lycium* sp. – remnants of Oudtshoorn Gannaveld along the railway.

6.2.2 Vegetation of Alternative 2 – the secondary route

The Alternative 2 route also traverses Blossoms Asbos Gwarrieveld but further west than the Alternative 1 route, and closer to the N12 highway. Access to the southern part of the Alternative 2 route is not simple but a few farm tracks requiring a 4x4 vehicle were passable. Such a track allowed access to waypoint OE23 which is on a high plateau (Figure 35). The vegetation in the vicinity of the waypoint has been extremely heavily grazed in the past resulting in marked degradation of the veld to form a low mid-dense to open shrubland dominated by grazing resistant composite plants (Asteraceae). It is now recovering slowly in the absence of livestock (Figure 33). The tall shrub element with aloes is absent. *Pentzia incana* (ankerkaroo) is the dominant species and *Mesembryanthemum junceum* co-dominant. Other species recorded include *Crassula* sp., *Selago glomerata, Drosanthemum hispidum*, *Euryops oligoglossus*, *Felicia ovata*, *Galenia africana*, *Galenia* cf. *secunda*, *Malephora lutea*, *Mesembryanthemum guerichianum* and *Senecio cotyledonis*.

Figure 33. An extremely heavily grazed area of Blossoms Asbos Gwarrieveld at waypoint OE23

Not far from waypoint OE23 typical gwarrie-thicket is found in a well-developed state and is not overgrazed. Two strata are found with *Pteronia incana* (asbos) dominant in the lower stratum and *Euclea undulata* dominant in the upper stratum. *Aloe ferox* is also prominent in this vegetation (Figure 34). Other prominent species are *Nymania capensis* (klapperbos) and *Rhigozum obovatum* (granaatbos).

Figure 34. Gwarrie thicket with prominent Aloe ferox near waypoint OE23.

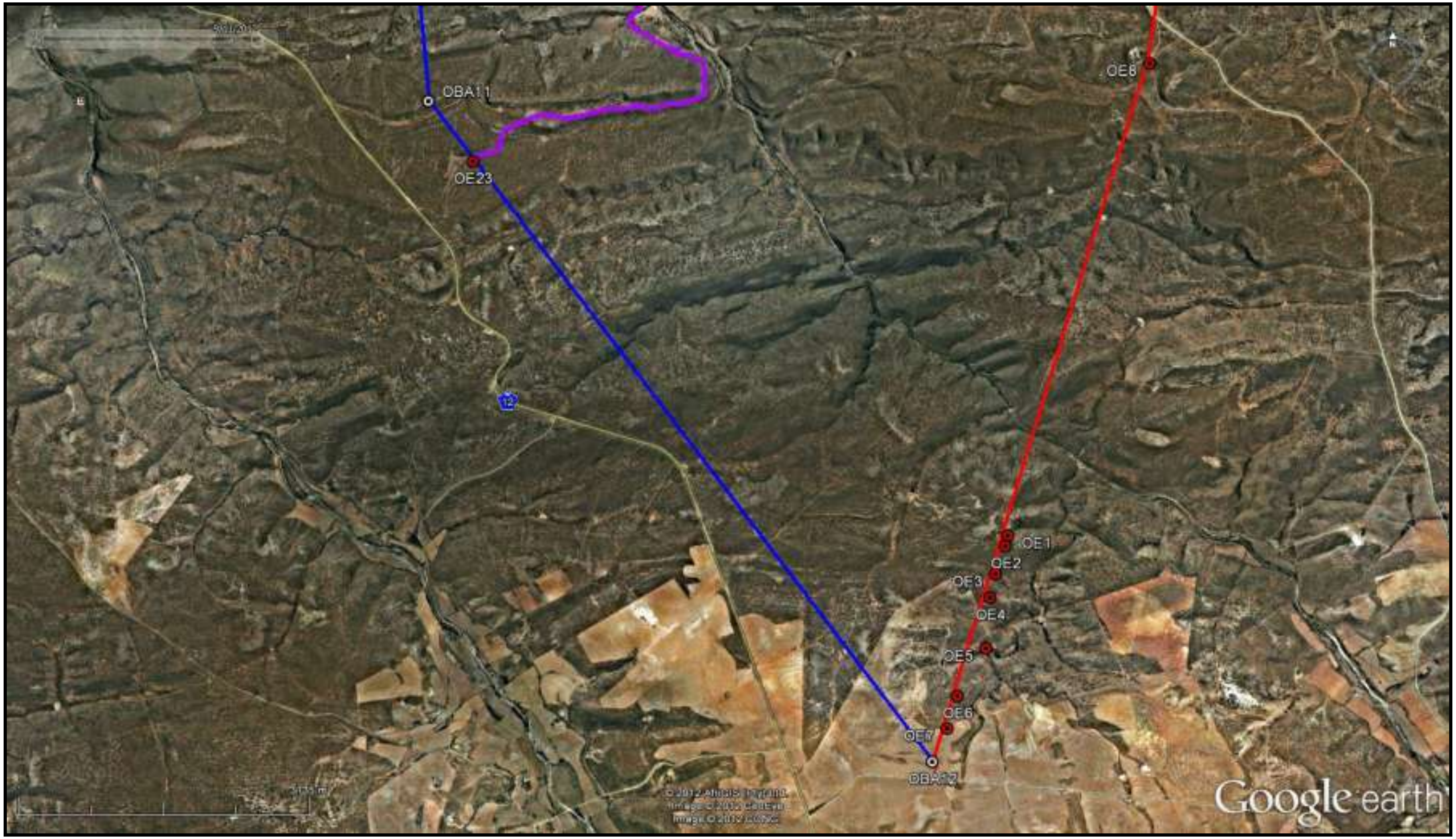

Figure 35. Aerial view of the southern part of the study area showing the two alternative transmission line routes (Alternative 1 – red; Alternative 2 – blue). The purple line represents the access track to waypoint OE23.

North of waypoint OE23 the terrain becomes strongly dissected with hills and valleys. The Blossoms Asbos Gwarrieveld gives way to Kandelaars Arid Spekboomveld on the hills (Figure 36) and Kandelaars Gannaveld in the valleys. Waypoint OE26 is in a valley on Farm 166. This valley has been ploughed and the vegetation severely disturbed (Figure 37); the site now has low botanical sensitivity.

Figure 36. Kandelaars Arid Spekboomveld on the north-facing slopes of the hills at Farm 166.

Figure 37. Kandelaars Gannaveld would have occurred in the area in the foreground but it has been ploughed. The area is now invaded by the dominant *Galenia africana* (kraalbos).

Waypoints OE27, OE28, OE29 and OE30 are all located in Kandelaars Arid Spekboomveld (Figures 38 & 39). The vegetation is a mosaic of thickets and 'open' areas of low to mid-high shrubland. Species recorded in the area represented by the above four waypoints are, *Aloe ferox, Aptosimum indivisum, Babiana* sp., *Blepharis capensis, Carissa haematocarpa, Carissa haematocarpa, Chrysocoma ciliata, Cineraria* sp., *Cotyledon orbiculata, Crassula muscosa, Crassula tetragona, Drosanthemum* cf. *hispidum, Ehrharta* sp., *Elytropappus rhinocerotis,* *Euclea undulata, Euphorbia mauritanica, Galenia africana, Gazania krebsiana, Gymnosporia buxifolia, Hemimeris gracilis, Hermannia* sp., *Jamesbrittenia tortuosa, Leipoldtia schultzei, Lessertia microphylla, Lotononis pumila, Lycium pumilum, Nemesia ligulata, Nymania capensis, Oxalis pes-caprae, Oxalis* sp. – orange flowers, *Pentzia incana, Polygala pinifolia, Pteronia incana, Rhigozum obovatum, Ruschia caroli, Ruschia* cf. *archeri, Searsia pallens, Selago eckloniana, Selago fourcadei, Senecio* cf. *juniperinus, Thesium strictum, Tylecodon cacalioides* and *Zygophyllum lichtensteinianum.*

Figure 38. The area around sample waypoint OE27 with Kandelaars Arid Spekboomveld according to Vlok et al. (2005).

Figure 39. Prominent occurrence of *Euclea undulata* (gwarrie) on the proposed Alternative 2 route near waypoint OE28.

Waypoints OE24 and OE25 are located south and north respectively of the road to the Rooiberg Sentech Mast, where the Alternative 2 route would pass. The area around waypoint OE24 has sandy clay loam soil strewn with boulders and pebbles on the surface. The vegetation is grazed by cattle and goats. The vegetation is mapped as De Rust Sandolien-Spekboomveld but *Dodonaea viscosa* (sandolien) was recorded and in the opinion of the author would probably be more accurately placed in Kandelaars Arid Spekboomveld with thickets interspersed with low to mid-high shrubland and *Aloe ferox* prominent (Figure 40). The vegetation is species-rich and species recorded include *Aloe ferox, Anthospermum spathulatum, Asparagus burchelii, Babiana* sp., *Chaenostoma subnudum, Chrysocoma ciliata, Crassula columnaris, Crassula cotyledonis, Crassula rupestris, Crassula* sp., *Crassula tetragona, Dorotheanthus* cf. *hispidus, Drosanthemum crissum, Ehrharta* sp., *Elytropappus rhinocerotis, Eriocephalus africanus, Eriocephalus capitellatus, Euclea undulata, Euphorbia arceuthobioides, Grewia occidentalis, Hermannia filifolia, Lycium ferocissimum,* Mesemb. – mat-forming, *Pelargonium abrotanifolium, Pelargonium radens, Portulacaria afra, Pteronia flexicaulis. Pteronia incana, Pteronia pallens, Sceletium tortuosum, Selago eckloniana, Senecio cotyledonis, Senecio cotyledonis, Senecio radicans, Senecio* sp. – succulent leaves, *Tetragonia sarcophylla, Trichodiadema* sp. and *Zygophyllum morgsana.*

Figure 40. An area of De Rust Sandolien-Spekboomveld according to Vlok *et al.* (2005) (sample waypoint OE24).

In complete contrast to the area around OE24, that at OE25 has been trampled by livestock (goats) with the result that much of the low to mid-high shrub vegetation has been lost and the vygie *Malephora lutea* and invasive grasses have proliferated (Figures 41 & 42). The area between waypoint OE25 and the point where the Alternative 2 route would meet the Alternative 1 route at OBA1 (Figure 43) is mapped as De Rust Sandolien-Spekboomveld. Although this area was not sampled, using samples OE18 and OE24 as surrogates it is believed that the vegetation from OE25 to the Alternative 1 route strongly resembles that of sample OE24 and is characteristic of Kandelaars Arid Spekboomveld rather than De Rust Sandolien-Spekboomveld.

Figure 41. Area at waypoint OE25, trampled by livestock with the vygie *Malephora lutea* dominant.

Figure 42. Stock feeding area near waypoint OE25 with *M. lutea* and invasive grasses prominent. Away from the trampled area, *Euclea undulata* shrubs are a prominent feature.

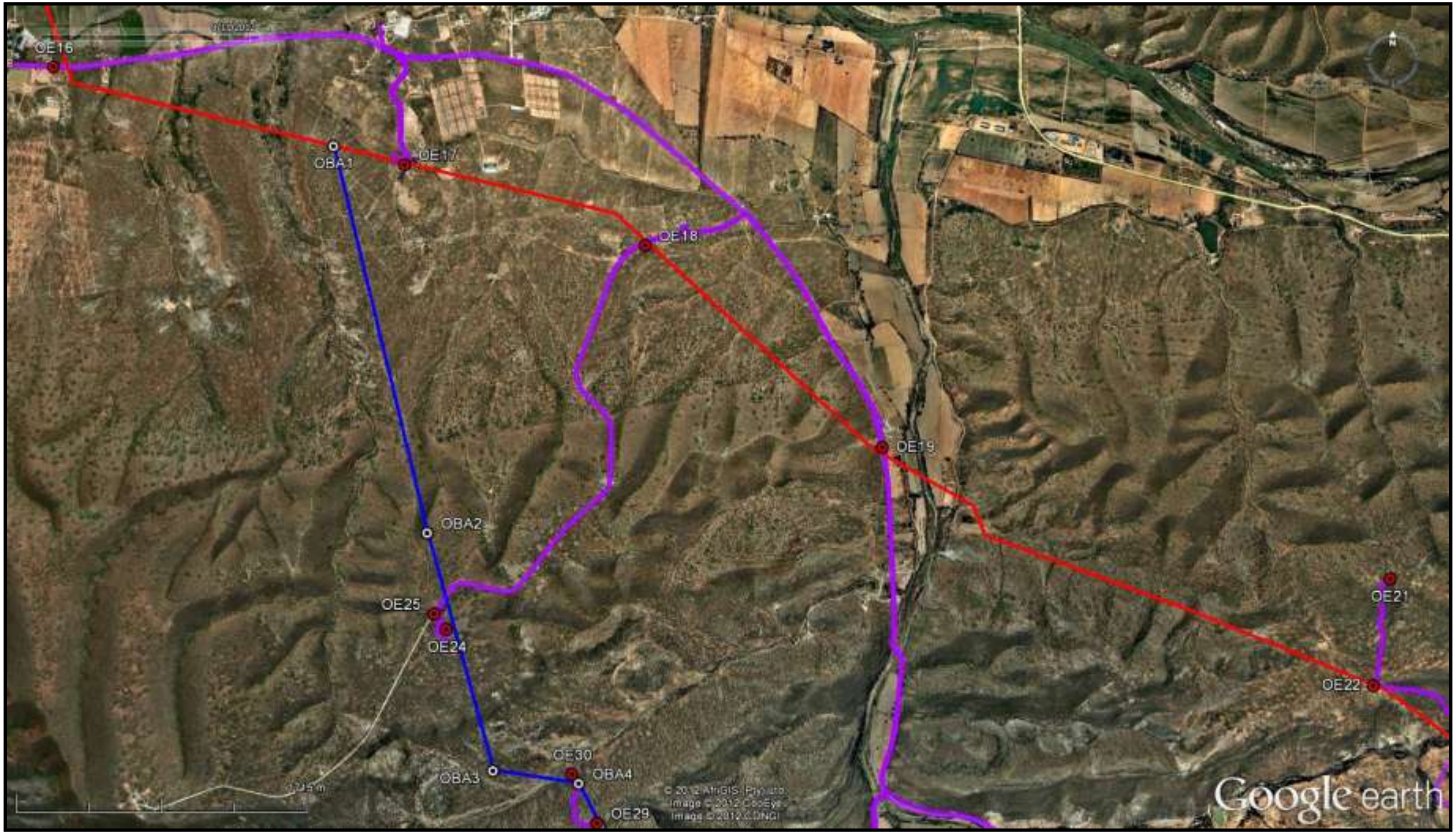

Figure 43. Aerial view (Google Earth ™) of the northern part of the study area indicating the sample tracks (purple), sample waypoints (OE#) and proposed alternative transmission line routes (Alternative 1 – red; Alternative 2 – blue).

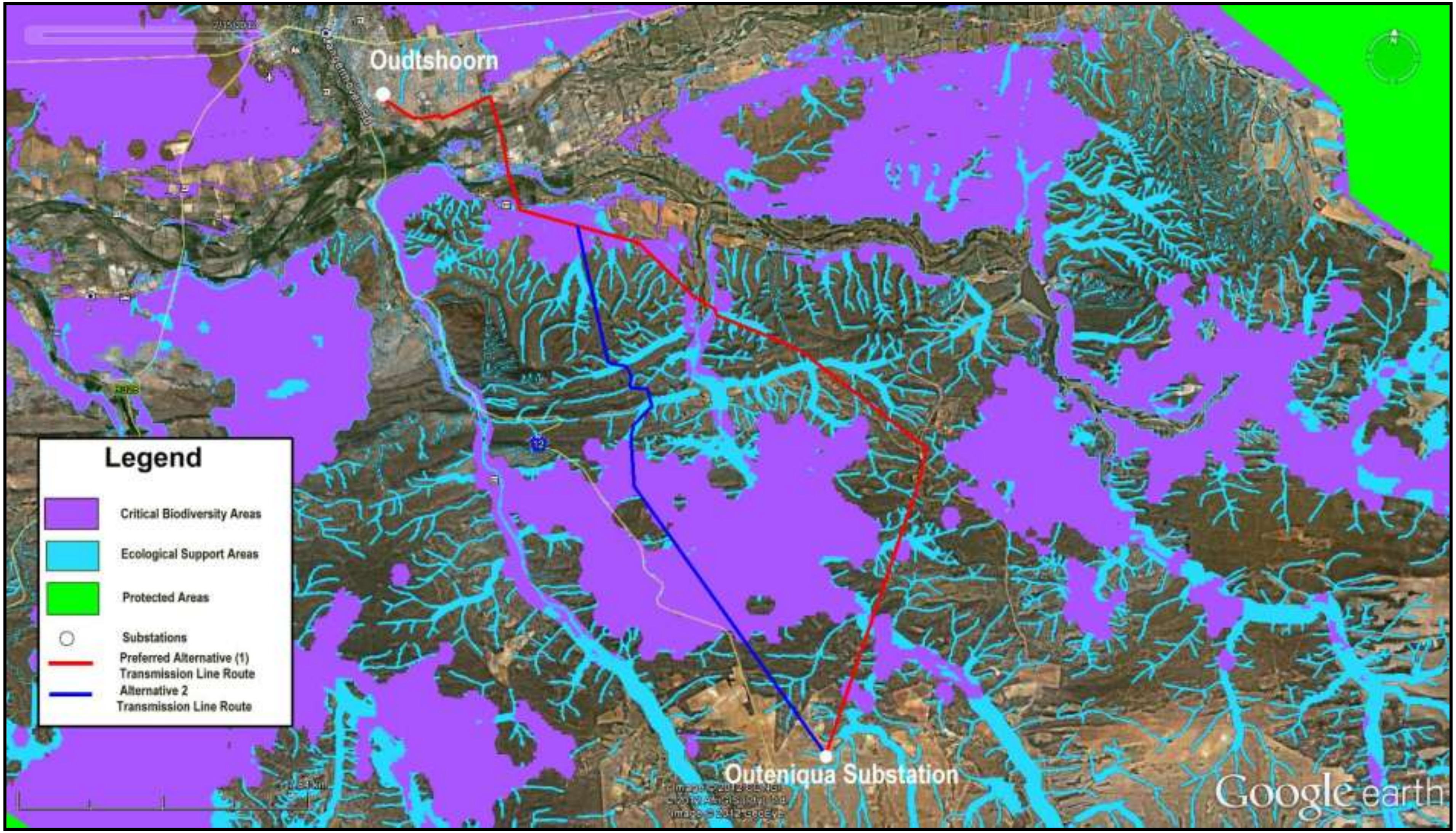

Figure 44. Portion of the CBA map of the Little Karoo (Skowno *et al.* 2010) with superimposed proposed transmission line routes. The Alternative 2 route (blue) would impact more CBA areas (purple) than the Alternative 1 (preferred) route.

6.2 Conservation status

A biodiversity assessment was carried out for the Kannaland and Oudtshoorn Local Municipalities and the District Management Area 4 (Uniondale) (Skowno, Holness & Desmet, 2010) based on the vegetation units of Vlok *et al.* (2005) (see also Vlok & Schutte-Vlok, 2010). The conservation status of the vegetation units found in the study area, extracted from the report by Skowno *et al.* (2010) are given in Table 4.

Table 4. Conservation status of the vegetation units occurring in the study area

Vegetation Unit	Conservation or Eco-Status	Protection Level	Protection Urgency
Blossoms Asbos Gwarrieveld	EN	Very poorly protected	Medium urgency
De Rust Sandolien-Spekboomveld	LT	Very poorly protected	Low urgency
Grootkop Apronveld	CR	Completely unprotected	Critically urgent
Kandelaars Arid Spekboomveld	LT	Completely unprotected	Low urgency
Kandelaars Gannaveld	LT	Completely unprotected	Low urgency
Oudtshoorn Gannaveld	CR	Completely unprotected	Critically urgent

The Kandelaars Arid Spekboomveld and De Rust Sandolien-Spekboomveld fall within the more general category of Gwarrie Spekboomveld. It occurs in the northern half of the study area and is used for principally grazing. It has generally not been converted to ploughed lands but there are areas where, due to trampling and overgrazing, the mid-high shrub component has been lost leaving gwarrie thickets with disturbed veld in between. The spekboomveld vegetation is moderate to good condition within the study area. It is considered to be non-flammable (fire return interval > 100 years) and least threatened (LT) with low urgency for conservation.

Grootkop Gravel Apronveld is found within the study area towards the north. In some places the Gravel Apronveld is severely disturbed by removal of gravel for roads and other purposes. This vegetation type is considered to be highly threatened and in urgent need of conservation.

Blossoms Asbos Gwarrieveld is the principal vegetation type in the southern part of the study area and apart from some cultivation in the vicinity of the Outeniqua Substation where the natural vegetation has been lost and secondly where there has been severe overgrazing, most of the natural thicket mosaic is intact. This vegetation has a fire return interval of > 75 years and is flammable due mainly to presence of *Pteronia incana* and other resinous shrubs. This vegetation is considered to be endangered (EN) because it is poorly protected and is being converted to agriculture.

Gannaveld is mostly found in low-lying situations. Oudtshoorn Gannaveld which would have occurred on alluvial soils along the Olifantsrivier and Kamanassierivier has been lost to cultivation in the study area where there is little chance of its recovery. It is now considered to be critically endangered (CR) as a vegetation type.

Kandelaars Gannaveld persists within the study area but in some places has been unwisely and indiscriminately ploughed e.g. around waypoint OE26. It may become more threatened is more areas of this type are converted to agriculture but for now it is rated as least threatened (LT).

The northern part of the study area in the vicinity of Bend OBA1 (Figure 43) has numerous farm tracks which criss-cross the area (in Grootkop Gravel Apronveld). This means that no additional roads or tracks would be required in this area for construction of a power-line. Therefore, despite the sensitivity of this area from a conservation perspective, the impacts can be contained if the construction is carefully managed.

In the southern part of the study area there are fewer tracks, however, strategic use of those that exist would mean than no additional tracks would be needed to construct a transmission line along either of the proposed alternative routes.

As seen in Figure 44 the proposed Alternative 1 (preferred) route would have less impact on CBAs and ESA's that the Alternative 2 route. It is the author's view that the CBA/ ESA map is open to careful interrogation and should not simply be accepted as 'gospel'. However, in this instance it provides a valuable indication of the most suitable alignment for the proposed new 132 kV transmission lines which would be Alternative 1. This alignment would miss most of the designated CBAs and would mostly only influence the areas of Grootkop Gravel Apronveld around Bend OBA1. It should be re-iterated, however, that this area is already somewhat compromised by farming (many farms tracks, grazing etc.) and although this apronveld is designated as critically endangered, impacts from power-line construction would probably be less than those exerted by 'acceptable' farming practices.

Alternative 2 would be aligned through a large area of Blombos Asbos Gwarrieveld between Bend 12 and Bend 10 that is designated as a CBA. The only exception is the area around waypoint OE23 which is overgrazed. Taken at face-value the indication therefore is that the Alternative 2 route would be less desirable than the Alternative 1 route.

No threatened (Red List) species were encountered in the survey. This could be attributed to the intensity of sampling but also to the types of vegetation encountered where there are numerous generalist species present. There is always a chance of finding rare or endemic species, especially in special habitats like gravel apronveld so the precautionary principal should be observed in areas such as this and construction activities should be tailored to smallest footprint possible is these areas.

7. Assessment of Impacts

Impacts on the vegetation of the proposed alternative two transmission line routes from the Outeniqua Substations to the Oudtshoorn Substation following the assessment methodology given in Appendix 1.

Three types of impacts are assessed:

- **Direct impacts:** Impacts occurring directly on the vegetation of the site as a result of the proposed construction of a132 kV transmission line from the Outeniqua Substation to Oudtshoorn. .
- **Indirect impacts:**
- **Cumulative impacts**: impacts caused by several projects, strategic actions and existing trends (e.g. loss of habitat of a specific type).

8. Direct Impacts

Apart from the erection of monopole pylons i.e. the footprint of the pylons, the greatest impact would be the access roads to the pylon sites. In many instances tracks and gravel roads exist and no new roads would be required. This is particularly the case for Alternative 1 which is another good reason to select this route.

The impacts on the vegetation and habitat along the proposed routes are considered for two identified potential impacts which are:

- Loss of vegetation type and habitat including plant species due to the power-line construction and maintenance

- Loss of ecological processes e.g. fire, plant-animal interactions, plant-habitat interactions.

These impacts are applied to the different vegetation types according to the classification by Vlok *et al.* (2005) for the vegetation of the Little Karoo.

8.1 Loss of Subtropical Thicket: Kandelaars Arid Spekboomveld and De Rust Sandolien-Spekboomveld

If the **Alternative 1** (preferred) route is selected there would not be a great loss of Kandelaars Arid Spekboomveld and De Rust Sandolien Spekboomveld and the impact is rated as **MEDIUM NEGATIVE** which could be mitigated to **LOW NEGATIVE** by slight changes in alignment to avoid sensitive areas such as high concentration of *Aloe ferox* or 'heuweltjies'. A minimal number additional of access roads (if any) would be required for construction purposes (Table 4).

Table 4. Loss of Subtropical Thicket: Kandelaars Arid Spekboomveld and De Rust Sandolien-Spekboomveld due to the proposed **Alternative 1** construction of a 132 kV transmission line from the Outeniqua Substation to Oudtshoorn.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Regional	Regional
Duration	Long-term	Long-term
Intensity	Moderate	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	**Medium negative**	**Low negative**
Cumulative impact	Low negative	Low negative
Nature of Cumulative impact	Loss of Subtropical Thicket: Kandelaars Arid Spekboomveld and De Rust Sandolien-Spekboomveld	
Degree to which impact can be reversed	Moderate	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium to High	

Slightly More Kandelaars Arid Spekboomveld and De Rust Sandolien Spekboomveld could be negatively affected by power-line construction on the **Alternative 2** route. The impact would be similar but due to the geography of the area i.e. the presence of more dissected kloofs and microhabitats forming ESAs it is believed that this route would have a **HIGH NEGATIVE** impact on these two vegetation types which could be mitigated to **MEDIUM NEGATIVE** with careful placement of the monopole pylons. Access would not be a problem in most instances because well-defined farm tracks exist and no new tracks would be required (Table 5).

Table 5. Loss of Subtropical Thicket: Kandelaars Arid Spekboomveld and De Rust Sandolien-Spekboomveld due to the proposed **Alternative 2** construction of a 132 kV transmission line from the Outeniqua Substation to Oudtshoorn.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Regional	Regional
Duration	Long-term	Long-term
Intensity	Moderate	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	**High negative**	**Medium negative**
Cumulative impact	Low negative	Low negative
Nature of Cumulative impact	Loss of Subtropical Thicket: Kandelaars Arid Spekboomveld and De Rust Sandolien-Spekboomveld	
Degree to which impact can be reversed	Moderate	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium to High	

8.2 Loss of Arid Thicket Mosaics: Blossoms Asbos Gwarrieveld

Blossoms Asbos Gwarrieveld would be affected in the southern part of the study area along an existing servitude Eskom route with in **Alternative 1**. It would be desirable to keep all future impacts of the proposed 132 kV transmission lines within this servitude.

In this way the impact will be **MEDIUM NEGATIVE** and could be mitigated to **LOW NEGATIVE** by keeping to existing tracks for construction purposes (Table 6).

Table 6. Loss of Arid Thicket Mosaics: Blossoms Asbos Gwarrieveld due to the proposed **Alternative 1** construction of a 132 kV transmission line from the Outeniqua Substation to Oudtshoorn.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Regional	Regional
Duration	Long-term	Long-term
Intensity	Moderate	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	**Medium negative**	**Low negative**
Cumulative impact	Low negative	Low negative
Nature of Cumulative impact	Loss of Arid Thicket Mosaics: Blossoms Asbos Gwarrieveld	
Degree to which impact can be reversed	Moderate	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium to High	

If the **Alternative 2** route was selected it would require a completely new servitude to be established through Blossoms Asbos Gwarrieveld in the southern part of the study area. This would be undesirable because new access tracks would be required and areas that have not been previously affected by transmission lines would then be impacted. In addition the route would traverse a CBA which in itself indicated that the construction of transmission lines along the Alternative 2 rout could have negative implications. The impact would be **HIGH NEGATIVE** and could be mitigated to **LOW NEGATIVE** if strong mitigation measures were implemented but avoidance of this route would be the most desirable course to follow (Table 7).

Table 7. Loss of Arid Thicket Mosaics: Blossoms Asbos Gwarrieveld due to the proposed **Alternative 2** construction of a 132 kV transmission line from the Outeniqua Substation to Oudtshoorn.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Regional	Regional
Duration	Long-term	Long-term
Intensity	Moderate	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	**High negative**	**Low negative**
Cumulative impact	Low negative	Low negative
Nature of Cumulative impact	Loss of Arid Thicket Mosaics: Blossoms Asbos Gwarrieveld	
Degree to which impact can be reversed	Moderate	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium to High	

8.3 Loss of Gannaveld: Kandelaars Gannaveld and Oudtshoorn Gannaveld

Kandelaars Gannaveld occurs in lowland situations where the proposed **Alternative 1** route would have a **LOW NEGATIVE** impact on the vegetation type due to the extent of its occurrence, secondly since it is not a highly sensitive vegetation type and thirdly to the already existing moderate to high level of disturbance which would probably not be significantly increased by construction of the proposed transmission lines. These conditions would hold true for the Alternative 2 transmission line route as well (Table 8).

Table 8. Loss of Kandelaars Gannaveld due to the proposed **Alternative 1** and **Alternative 2** construction of a 132 kV transmission line from the Outeniqua Substation to Oudtshoorn.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Regional	Regional
Duration	Long-term	Long-term
Intensity	Low	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	**Low negative**	**Low negative**
Cumulative impact	Low negative	Low negative
Nature of Cumulative impact	Loss of Kandelaars Gannaveld	
Degree to which impact can be reversed	Medium	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	Medium	

Oudtshoorn Gannaveld has virtually all been lost to agriculture and other disturbances within the study area. The result is that the proposed transmission line (which would be common for both Alternatives 1 & 2) where Oudtshoorn Gannaveld would have been found would have a **VERY LOW NEGATIVE** impact (Table 9). No mitigation would be required.

Table 9. Loss of Oudtshoorn Gannaveld due to the proposed **Alternative 1** and **Alternative 2** (common route) construction of a 132 kV transmission line from the Outeniqua Substation to Oudtshoorn.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Regional	Regional
Duration	Long-term	Long-term
Intensity	Low	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	**Very Low negative**	**Very Low negative**
Cumulative impact	Low negative	Low negative
Nature of Cumulative impact	Loss of Oudtshoorn Gannaveld	
Degree to which impact can be reversed	Medium	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	Medium	

8.4 Loss of Gravel Apronveld: Grootkop Gravel Apronveld

As describe above Grootkop Gravel Apronveld occurs mainly in the northern part of the study area. It is a sensitive vegetation type but has been poorly managed within the study area resulting in significant existing impacts due to livestock grazing (cattle, goats, sheep & ostriches). Numerous tracks are also found. The result is that the Grootkop Gravel Apronveld in the study area, although mapped as a CBA, is already strongly negatively impacted.

The Alternative 1 and Alternative 2 routes would converge in the area of Grootkop Gravel Apronveld. Given the nature of transmission lines which only affect the vegetation with respect to placement of pylons and the many access options along existing tracks (no new tracks would be required) the potential impact of the proposed Alternative 1 & Alternative 2 power-line routes on Grootkop Gravel Apronveld is rated as **LOW NEGATIVE** without and with mitigation (Table 10).

Table 10. Loss of Grootkop Gravel Apronveld due to the proposed **Alternative 1** and **Alternative 2** (common route) construction of a 132 kV transmission line from the Outeniqua Substation to Oudtshoorn.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Regional	Regional
Duration	Long-term	Long-term
Intensity	Low	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	**Low negative**	**Low negative**
Cumulative impact	Low negative	Low negative
Nature of Cumulative impact	Loss of Grootkop Gravel Apronveld	
Degree to which impact can be reversed	Medium	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	Medium	

8.5 Loss of ecological processes

Unlike fynbos vegetation which is prone to fires many habitats within the little karoo are not fire-prone or if fires occur they happen at long intervals. Approximately half of the area (the northern half) involved in this study supports vegetation that is not flammable. Fire is therefore not important as an ecological driver and with climate in relation to soils being the main driving factors. The impacts of grazing are also important with overgrazing by livestock, especially ostriches, being extremely deleterious.

The Asbos Gwarrieveld mosaic in approximately the southern half of the study area is more flammable than the spekboomveld and apronveld vegetation types. However, even in this part fires occur at much lower frequency than in fynbos and the vegetation is not strongly fire-adapted. The greatest loss is conversion of Asbos Gwarrieveld, which occurs on shale-derived soils, to pastures. This results in fragmentation of the landscape with ecological connectivity being impaired.

Field observations indicate that the plant communities are not highly negatively influenced by the presence of power-lines. Vegetation cover and general condition under the existing 400 kV and 132 kV transmission lines between Outeniqua Substation and Dysselsdorp is good. Ecological processes are also not negatively influenced with birds, insects and mammals freely interacting in a healthy ecosystem. The most negative impacts arise from agriculture and it is believed that these would far outweigh any negative impacts of power-lines. Impacts on ecological processes are therefore rate in general over the study area as **LOW NEGATIVE** (Table 11).

Table 11. Loss of ecological processes – Alternatives 1 and 2

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Regional	Regional
Duration	Long-term	Long-term
Intensity	Low	Low
Probability	Highly probable	Highly probable
Confidence	High	High
Significance	Low negative	Low negative
Cumulative impact	Low negative	Low negative
Nature of Cumulative impact	Loss of ecological processes due to construction of Eskom transmission lines	
Degree to which impact can be reversed	Medium	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Low	

9. Mitigation Measures

- The most important mitigation measure would be to <u>avoid causing disturbance wherever possible</u>. In other words vegetation that does not require removal either for placement of monopoles or for access tracks should not be disturbed.
- Wherever possible existing tracks and roads should be used. They should be properly managed i.e. they should have water-bars where necessary to curb runoff and prevent erosion.

- If new tracks are required these should be carefully planned in conjunction with the respective landowners to ensure that they are properly constructed and can also serve the needs of the local farmers.
- No ‘Search and Rescue’ is advocated as a general requirement. However, rehabilitation of areas that are disturbed during construction and would not be required for future maintenance should be carried out.
- After construction, weedy species such as *Galenia africana (kraalbos)* should be monitored in disturbed places and where necessary selectively removed to promote diverse re-vegetation rather than dominance of one or a few species.
- Extreme care must be taken to ensure that no fires are started by construction crews that can spread into areas of flammable vegetation such as Blossoms Asbos Gwarrieveld.

10. Indirect Impacts

The major indirect impact will be an improvement in the electrical power distribution network in the Oudtshoorn / Dysselsdorp district.

11. Cumulative Impacts

The type of construction envisaged for the transmission lines as described will not result in a significant cumulative loss of any particular habitat type or vegetation type. Cumulative losses are rated as LOW NEGATIVE overall.

12. Conclusions

Six vegetation types or units were identified in the study area following the classification of Vlok *et al.* (2005). Most of these vegetation types are not botanically sensitive, however, this should not be misunderstood to mean that they are not conservation-worthy. They contribute importantly to the ecosystem of the Eastern Little Karoo. It does mean, however, that they can tolerate reasonable levels of infrastructure development such as transmission lines.

A comparison of the botanical data collected for the proposed two alternative transmission line routes described above together with the mapped CBA information and impact assessment shows that Alternative 1, the preferred route, would be the most desirable route to follow.

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