

FINAL REPORT

PROJECT TITLE: CITRUS CULTIVATION AND WILDLIFE GRAZING

PROJECT LOCATION: FARM WOLVERTON, PORTION 1 OF FARM 119, SUNDAYS RIVER VALLEY LOCAL MUNICIPALITY, EASTERN CAPE

ASSESSMENT TYPE: VEGETATION SURVEY AND ASSESSMENT



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SPECIALIST STATEMENT DETAIL

This statement has been prepared with the requirements of the Environmental Impact Assessment Regulations and the National Environmental Management Act (107 of 1998), any subsequent amendments and any other relevant National and / or Provincial Policies related to ecological or biodiversity assessments in mind, such as the National Environmental Management: Biodiversity Act (10 of 2004) and National Water Act (36 of 1998).

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I, **Ms Deborah Vromans**, declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs.

Signed:



Date: **13 April 2020 (FINAL)**; 4 March 2020 (Second Draft), 22 January 2016 (First Draft – prior to project modifications).

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EXECUTIVE SUMMARY

Introduction

Habitat Link Consulting Pty Ltd was appointed by DJ & FP Bouwer cc, the Applicant, to undertake an environmental authorisation in terms of Section 24(5) of the National Environmental Management Act (NEMA) (107 of 1998) for intensive cultivation (with wildlife grazing / tourism¹). This vegetation assessment report will therefore provide input into the EIA process.

Terrestrial Habitat (Section 4.2)

The dominant vegetation type is currently natural to near-natural Thicket. Areas that were characteristically impenetrable or very dense, on the slopes and valley areas, are considered Sundays Valley Thicket (SA VegMap 2018); or Sundays Spekboom Thicket (Vlok and Euston Brown, 2002). The flatter plain areas, however, were less dense and more reflective of a mosaic thicket, with larger areas of low growing shrublets, grasses and succulents. These areas of the farm are considered Koedoeskloof Karroid Thicket (Section 6.2; Figure 7).

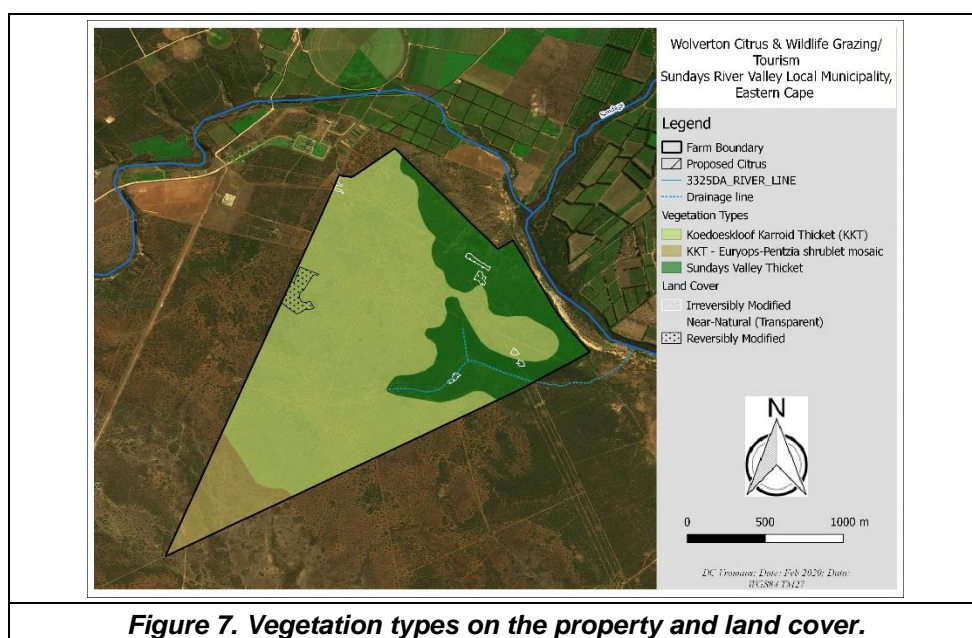


Figure 7. Vegetation types on the property and land cover.

Species of Special/Conservation Concern (Section 4.2)

SPECIES	FAMILY	RED DATA LISTING	PROTECTED BY
<i>Aloe africana</i>	ASPHODELACEAE	Least Concern	PNCO
<i>Anaccampseros arachnoides</i>	ANACAMPSEROTACEAE	Least Concern	PNCO
<i>Carpobrotus edulis</i>	AIZOACEAE	Least Concern	PNCO
<i>Dioscorea elephantipes</i>	DIOSCOREACEAE	Declining	PNCO
<i>Drosanthemum hispidum</i>	AIZOACEAE	Least Concern	PNCO
<i>Delosperma ecklonis</i> (white, orange and pink)	AIZOACEAE	Least Concern	PNCO
<i>Drimia altissima</i>	HYACINTHACEAE	Declining	PNCO
<i>Euryops ericifolius</i>	ASTERACEAE	Endangered	

¹ Wildlife grazing does not require authorization, only the citrus cultivation. Tourism refers to the viewing of wildlife on the property.

SPECIES	FAMILY	RED DATA LISTING	PROTECTED BY
<i>Galenia pubescens</i>	AIZOACEAE	Least Concern	PNCO
<i>Lampranthus lavisii</i>	AIZOACEAE	Least Concern	PNCO
<i>Moraea stricta</i>	IRIDACEAE	Least Concern	PNCO
<i>Malephora lutea</i>	AIZOACEAE	Least Concern	PNCO
<i>Mesembryanthemum aitonis</i>	AIZOACEAE	Least Concern	PNCO
<i>Ruschia orientalis</i>	AIZOACEAE	Least Concern	PNCO
<i>Ruschia tenella</i>	AIZOACEAE	Least Concern	PNCO
<i>Ruschia uncinata</i>	AIZOACEAE	Least Concern	PNCO
<i>Pachypodium bispinosum</i>	APOCYNACEAE	Least Concern	PNCO
<i>Psilocaulon articulatum</i>	AIZOACEAE	Least Concern	PNCO
<i>Sideroxylon inerme</i>	SAPOTACEA	Least Concern	NFA
<i>Trichodiadema decorum</i>	AIZOACEAE	Least Concern	PNCO

Sundays River Valley Critical Biodiversity Areas & Ecological Support Area (Section 3.2 & 4.4)

According to the Sundays River Valley Critical Biodiversity Area (CBA) Map (Skowno and Holness, 2012), the farm is largely Other Natural Area (ONA), with Ecological Support Area (ESA) along the north-eastern / eastern boundary which serves to safeguard the Sundays River (Refer Section 4.5). The NFEPA map was incorporated into the CBA Map.

Refer Section 3.2.2 for the Eastern Cape Biodiversity Conservation Plan (ECBCP) CBA Map, which is superseded by the former as it is a significant refinement of the ECBCP.

Catchment Transformation Thresholds

According to the ECBCP CBA Map, Farm Wolverton falls within Aquatic CBA 2 (A2b) (Figure 9), which means that less than 20 % of the total area of the sub-quatery catchments can be modified (transformed). The available land cover statistics indicates that total modification of land cover in the quatery catchment N40E will be marginally raised to 17.26 %; from 13.21 %. In the sub-quatery catchments, the percentage modification will be raised from 5.3 % to 5.5 % (western) and from 16.1 % to 16.7 % (eastern).

Both the Sundays River Valley CBA Map and the NFEPA map do not provide catchment transformation thresholds. However; and in contrast to the ECBCP transformation thresholds, studies by Allan (2004) showed that streams in agricultural catchments usually remain in a good condition until the coverage of agriculture in the catchment exceeds 30 % - 50 % (Driver et al., 2012 – NFEPA Implementation Manual) (Section 4.3.2).

National Protected Area Expansion Strategy (Section 3.2.4)

The farm does not fall within a focus area.

Ecologically Sensitive Areas / Biodiversity No-Go Areas (Section 4.5)

The Figure below presents the ecologically sensitive areas relative to the farm and proposed infrastructure, which include the aquatic resources, maximum buffer widths, the Ecological Support Area and the no-go area (which represents the general area for the Threatened species). The Declining *Dioscorea elephantipes* will also be avoided, but should be protected from over-browsing.

Based on this map, the proposed citrus should avoid the ESA along the north-eastern/eastern boundary.

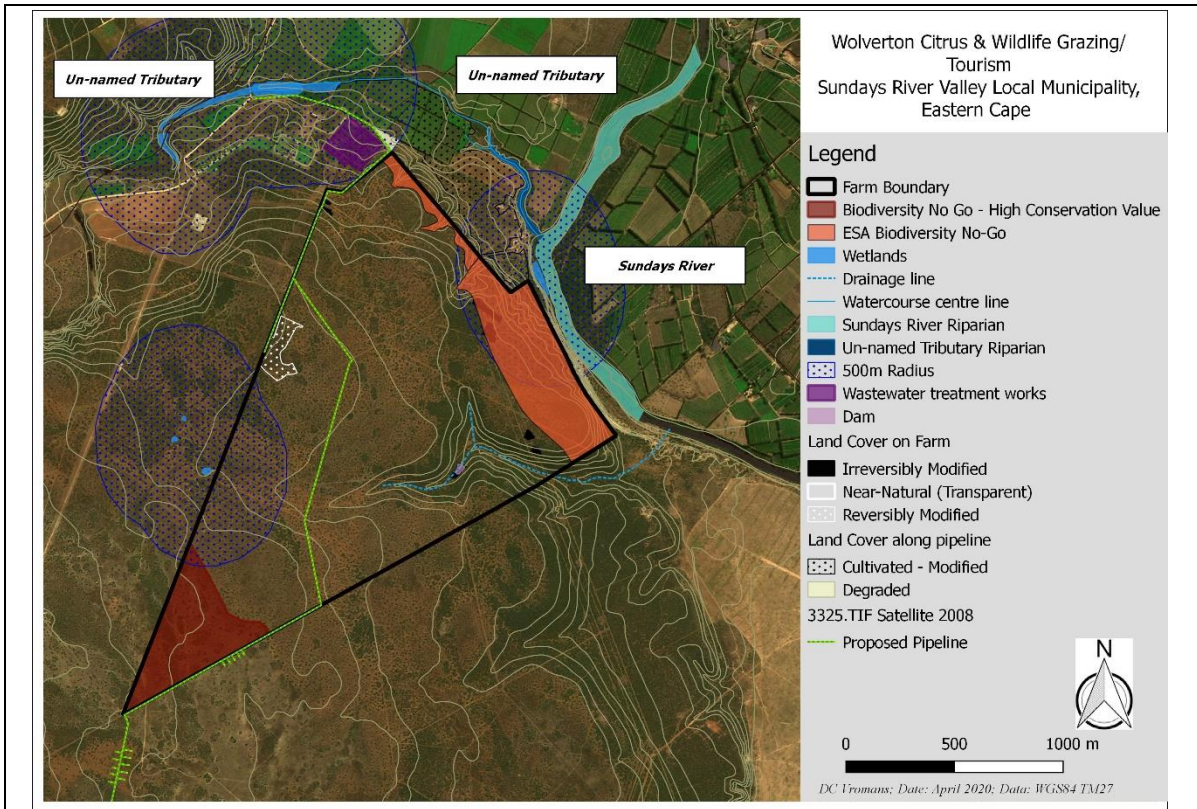


Figure 17: Map indicating ecologically sensitive areas or biodiversity no-go areas. (Note: There are six known locations of the Declining *Dioscoreae* elephantipes, which have not been mapped as sensitive areas, however the proposed citrus and pipeline footprints avoid this species. The associated steep slopes of the drainage area are also sensitive areas but are not mapped due to the significant distance from the proposed citrus).

Impact Assessment (Section 6)

Summary of impacts pre- and post-mitigation

ENVIRONMENTAL IMPACT	DEVELOPMENT PHASE	PRE- MITIGATION		POST MITIGATION	
		Least Concern Species	Threatened Species	Least Concern Species	Threatened Species
<i>IMPACT 1: Loss of vegetation due to clearing (biodiversity loss)</i>	Establishment & Operational	Low (Score -52.5)		Low (Score -47.5)	
<i>IMPACT 2: Potential degradation of vegetation due to over-grazing and over-browsing by stocked wildlife</i>	Establishment	High (Score -80)		Low (Score -44)	
<i>IMPACT 3: Loss of Ecological Support Area due to clearing (biodiversity loss)</i>	Establishment & Operational	Moderate (Score - 65)		No Impact	
<i>IMPACT 4: Loss of floral species of special concern due to clearing (biodiversity loss).</i>	Establishment & Operational	Moderate (-60)	Moderate (-72,5)	Low (-40)	No Impact
Significance Ratings: Low (>26-52.5); Moderate (>52.5 ≤ 78/5); Very High/ Significant (High) (>78.5 - 105)					

A summary of the mitigation measures to be incorporated into the Environmental Management / Monitoring Programme is presented in Section 6.5.

1. SECTION 1: THE PROPOSED DEVELOPMENT: BRIEF INTRODUCTION AND DESCRIPTION

1.1. BRIEF INTRODUCTION

Habitat Link Consulting Pty Ltd was appointed by DJ & FP Boucher cc, the Applicant, to undertake an Environmental Impact Assessment (EIA) in terms of Section 24(5) of the National Environmental Management Act (NEMA) (107 of 1998) for intensive cultivation (and wildlife grazing²/ tourism). Refer to the EIA report for more detail with regards to the listed activities which the proposed development has triggered. This vegetation assessment report will therefore provide input into the EIA process.

1.2. PROJECT LOCATION AND DESCRIPTION

Proposed Location and Property Details

The proposed development is located within the Sundays River Valley Local Municipality (Eastern Cape) on Portion 1 of Farm 119 (Farm Wolverton) (Figure 1 & 2). Farm Wolverton is north-west of the town of Addo and approximately 6 km south-westward of the Addo Elephant National Park (see Figure 7 & 11).

The property measures approximately **362 ha** in extent (Figure 1) (QGIS measurement).

Proposed Development Details

The proposed development is comprised of a citrus agricultural development (25 ha) with associated wildlife viewing (tourism).

The proposed citrus footprint constitutes ~6.9 % of the Farm Wolverton (QGIS measurement, not derived from the title deeds area).

The proposed citrus orchards are located ~308 m westward of the Sundays River and ~317 m westward of the un-named, non-perennial river that is a tributary of the Sundays River (closest points). The water off-take point, for the supply of irrigation water, is located at an existing pipeline off-take, sited within the un-named tributary river.

Table 1 presents a summary of the project description, provided by Habitat Link Consulting; and as it relates to the clearing of vegetation and proximity to aquatic features.

Current wildlife grazing and associated properties

Current land use is wildlife grazing and game viewing. Fences have been removed between the adjacent properties, where another Environmental Impact Assessment is also being conducted, referred to as 'Addo Big 5 Game Reserve'. Both indigenous and extra limital fauna are stocked on Wolverton and the adjacent properties (which measure ~3 999 ha in extent) (See Figure 14, Section 4.3).

² Wildlife grazing does not require authorization, only the citrus cultivation. Tourism refers to the viewing of wildlife on the property.

Table 1. Project description summary

Project component	Disturbance / Development Footprint (Ha)
Location	Portion 1 of Farm 119 (Farm Wolverton); Sundays River Valley Local Municipality (Eastern Cape).
GPS coordinates	33°32'13.50"S 25°38'38.13"E (approximate centre).
Citrus planting (Footprint)	• 22 ha
Associated infrastructure, i.e. internal roads, laydown areas, internal irrigation infrastructure and windbreaks (Footprint).	• 3 ha
Wildlife Grazing (Indigenous and Extra-Limital Species)	<ul style="list-style-type: none"> • Wildlife grazing occurs on the remainder of the property (outside of the citrus orchards), including adjacent properties (referred to as the 'Big 5 Game Reserve'). The fencing has been removed between Wolverton and the adjacent properties (Figure 14, Section 4.3). The wildlife inventory is presented below. • A wildlife management plan was compiled in 2016 for Farm Wolverton, however this would need to be updated to include the entire area used for wildlife. A veld condition assessment to determine the appropriate ecological carrying capacity (and stocking rate) will be important to prevent veld degradation due to overgrazing and over-browsing in the future.
Total Vegetation that will need to be cleared or modified on Farm Wolverton	25 ha of 362 ha 6.9 % of Farm Wolverton

Wildlife stocked on Farm Wolverton and adjacent properties

Species (below)	Indigenous (I) or Extra-Limital (EL)*	Red Listing/ Conservation Status	Properties						TOTAL
			Danie Bouwer - Wolverton	Cyril Rowe	Kudu Ridge	Longhill	Hermanus	Arno Coetzee	
Blesbuck	EL	Least Concern	17			22			39
Blue Wildebeest	EL	Least Concern	24	4					28
Bushbuck	I	Least Concern	4		4	118		2	128
Bushpig	I	Least Concern		1			1	1	3
Duiker	I	Least Concern	52	29	16	118	26	53	294
Eland	I	Least Concern				24	8		32
Giraffe	EL	Least Concern	5			15	5		25
Impala	EL	Least Concern	261	123	74	373	4	68	903
Kudu	I	Least Concern	91	30	7	204	19	99	450
Mountain reedbuck	EL	Endangered				10			10
Nyala	EL	Least Concern	6	23	13	96			138
Red Hartebeest	I	Least Concern						4	4
Sable	EL	Vulnerable	5			12			17
Springbuck	EL	Least Concern	20						20
Warthogs	EL	Least Concern	10	11	1	13	5	31	71
Waterbuck	EL	Least Concern	5	3		10	8	4	30

VEGETATION ASSESSMENT: WOLVERTON CITRUS CULTIVATION & WILDLIFE GRAZING

Species (below)	Indigenous (I) or Extra-Limital (EL)*	Red Listing/ Conservation Status	Properties						TOTAL
			Danie Bouwer - Wolverton	Cyril Rowe	Kudu Ridge	Longhill	Hermanus	Arno Coetzee	
White Blesbuck	EL	Least Concern	7			4			11
Zebra (Plains)	EL	Least Concern	4	8		9	5		26
TOTALS			511	232	115	1 028	81	262	2 229
<i>To be Stocked</i>									
	Lion			I					<i>To be Stocked</i>
	Leopard			I					<i>To be Stocked</i>
	White Rhinoceros			EL					<i>To be Stocked</i>
	Elephant			I					<i>To be Stocked</i>
	Cape Buffalo			I					<i>To be Stocked</i>
* Extra-limital species are those species that do not occur naturally within the region; but are indigenous to South Africa.									

VEGETATION ASSESSMENT: WOLVERTON CITRUS CULTIVATION & WILDLIFE GRAZING

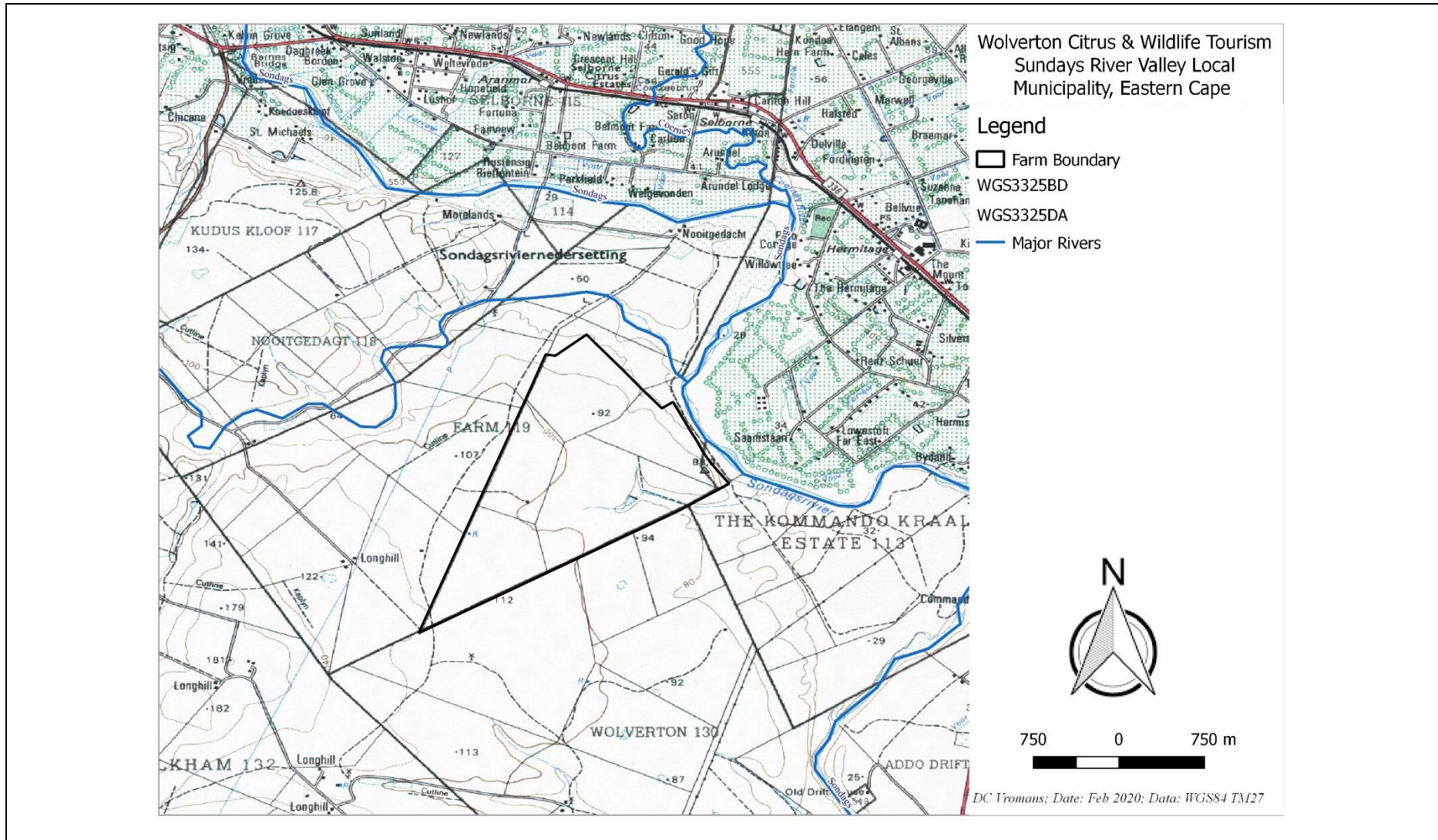


Figure 1. Map indicating the location of Farm Wolverton (Portion 1 of Farm 119), west of the Sundays River, in the Sundays River Valley Local Municipality, Eastern Cape.

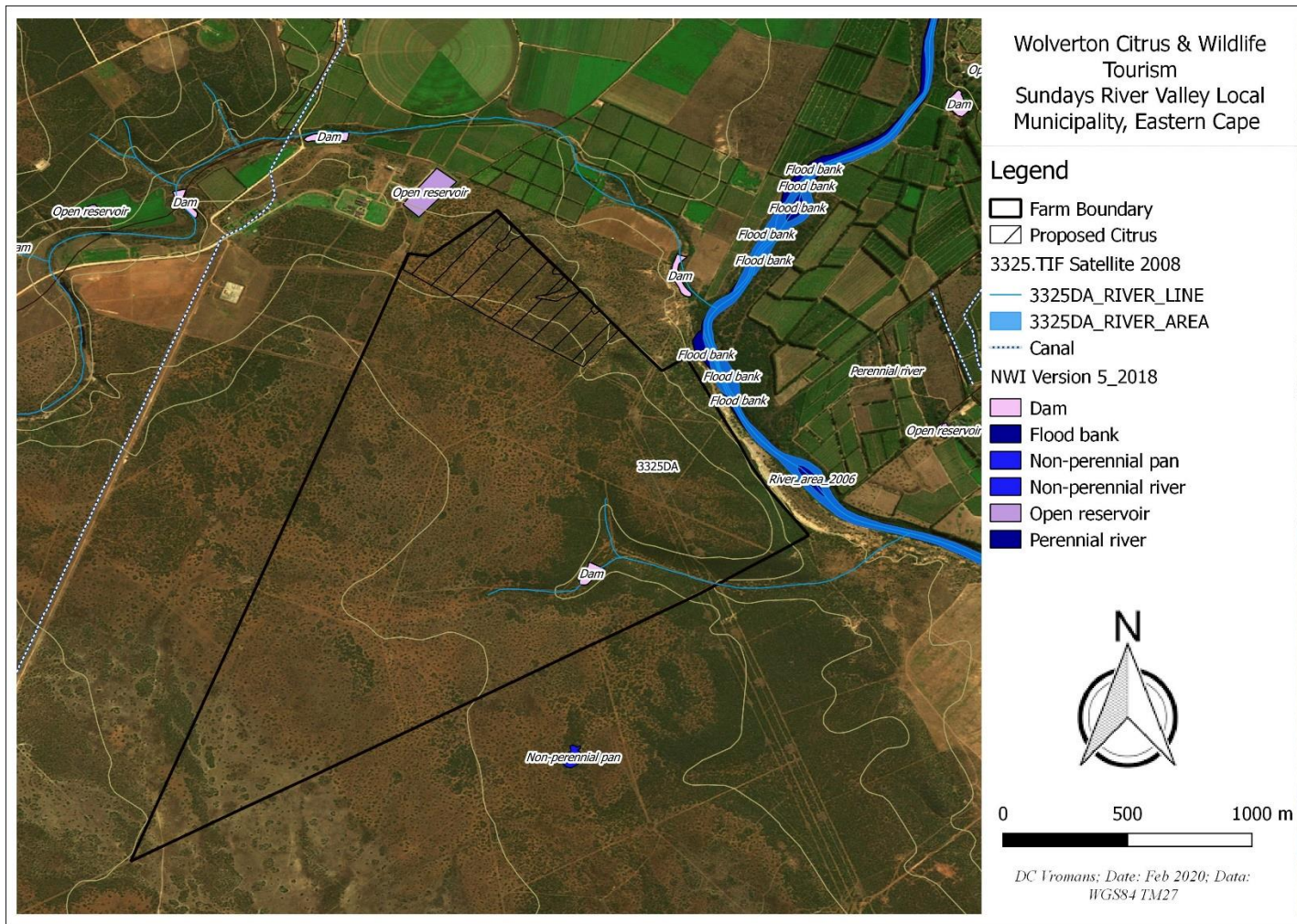
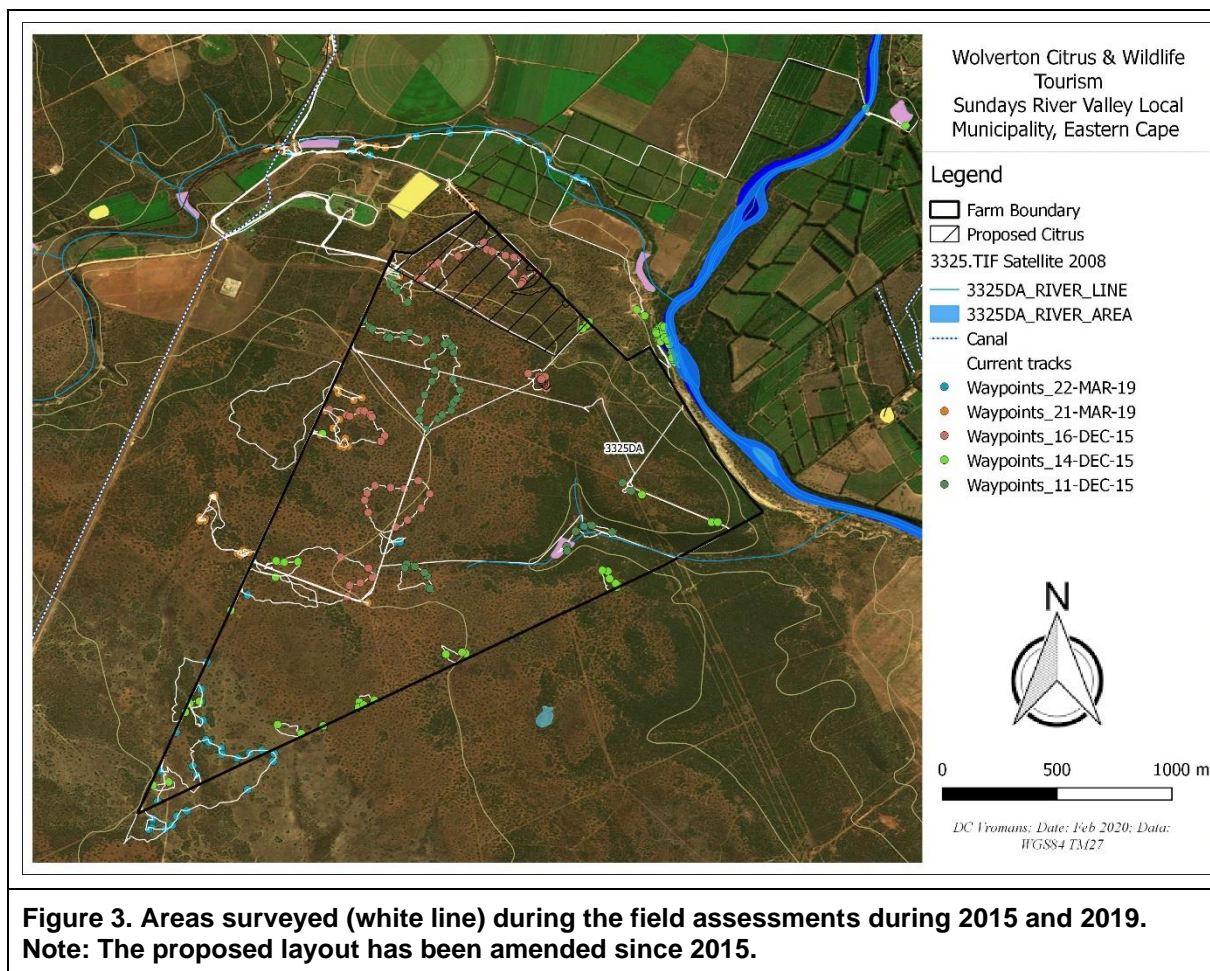


Figure 2. Map indicating the proposed agricultural layout on Farm Wolverton (Portion 1 of Farm 119) (2008 Satellite imagery), including the National Wetland Inventory (NWI) Map (Version 5 of 2018).

2. SECTION 2: ASSESSMENT METHODOLOGY

A 3-day field survey and assessment was conducted over the period 11 – 16 December 2015 in order to assess the vegetation on site. The objective was to determine vegetation type(s) or habitat(s) and plant species composition (key species, protected and threatened species). In addition, to determine if any wetlands or drainage areas (watercourses) occur on the site, and within 500 m and 100 m of the proposed agricultural areas.

A second 2-day site assessment was conducted 21 - 22 March 2019 due to a modification in the project description. The amendment included a change in the proposed water supply pipeline alignment. As a result, a few additional wetlands were mapped within the 500 m radius of the boundary of the property. However, the amended pipeline route was discarded; and avoided the 500m radius of the three wetlands (no. 1 – 3), which were surveyed to the west of the farm. Refer to the Specialist Aquatic Assessment. See Figure 3 for the survey waypoints and tracks below.



Vegetation and Floristics

As much of the site and proposed footprints were surveyed on foot, with a particular focus on areas where vegetation types appeared to be distinct from one another, for example: to the south-west, along drainage areas, in kloofs and on the higher lying plateaus. The available vegetation maps were also consulted to inform survey areas.

Literature was consulted to determine vegetation type (correlated to that identified on site), presence of special habitats and ecosystem status, including potential presence of species of conservation concern

(not identified during the field survey due to the impenetrable thicket). The distribution of species of conservation concern in the region has been mapped by the Maputoland-Pondoland-Albany Hotspot study (SANParks metadata, 2010) according to their location in a Quarter Degree Square (i.e. an area of approximately 30 km by 30 km covered by one 1:50 000 South African topographical map. These biodiversity features were mapped with Quantum GIS (Version 2.18), as well as level of degradation or sensitivity of the study site noted.

The Sundays River Valley Critical Biodiversity Areas (SRV CBA) Map, also referred to as the Addo CBA Map, was consulted to assist with determining the ecological importance of the area (Skowno and Holness, 2012), as well as the Eastern Cape Biodiversity Conservation Plan (ECBCP) CBA Map (Berliner and Desmet, 2007). The Subtropical Thicket Ecosystem Programme (STEP) biodiversity map (2003) is superseded by both former maps and was therefore not consulted with regards to the determination of CBAs as it is out-dated. Notably, however, most of the STEP data was integrated into the systematic biodiversity planning process for generation of the ECBCP (Refer Berliner and Desmet, 2007), and therefore the SRV CBA Map. The SRV CBA Map supersedes the ECBCP and is thus being used to update the ECBCP, which is currently being implemented for the Province. It should also be noted that the National Freshwater Ecosystem Priority Assessment (NFPEPA) is an aquatic update of the ECBCP; and was used in the development of the Sundays River Valley CBA Map.

Although the National Land Cover Map (2013/2014) and ECBCP land cover (2000) were consulted and/or presented in the report, the land cover for the SRV CBA Map was produced at a finer-scale; and is thus more accurate. However, the field survey aimed to improve on the accuracy of the land cover at the site level. The NPAES (2008) and the ECPTA provincial protected area expansion strategy (2012) maps were consulted to determine the ecological importance of the site and surrounds. The SRV CBA Map also identified focus areas for expansion of the Addo Elephant National Park (a project led by South African National Parks to address expansion and protection of the park as one of its mandates), which are not necessarily aligned with the former expansion strategies. The Addo Elephant National Park (AENP) buffer zone was also consulted to determine the location of the proposed development relative to Priority Natural Areas, Catchment Protection Areas and Viewshed Protection Areas, as identified in the AENP management plan (2015-2025) (Section 3.3.5).

2.1. LIMITATIONS OF THE ASSESSMENT

Limitations of the assessment are as follows:

1. One baseline assessment or field visit was conducted, which limits the amount of floral biota identified on site. Plant identification is improved with fertile specimens, which are not present for all species. *Although two field surveys were conducted, the second one was done due to the change in pipeline routing, and thus specific areas assessed were different to the original areas assessed.*
2. The impenetrable thicket vegetation limited access in a smaller portion of the farm, however, the field survey areas are considered to be representative of the site.
3. In 2015, riparian delineations were done largely via a desktop analysis, although areas closest to the previously proposed dam and pipeline crossing were surveyed (2015), as well as along the eastern boundary of the property (as depicted on Figure 3 waypoints and survey tracks).
4. In 2019, the riparian delineation of the un-named tributary river was surveyed via foot.
5. Depth to groundwater is unknown.
6. All calculations (distance and area) were done in GIS.
7. Some inaccuracy in the hand-held Global Positioning System and Geographical Information System (GIS) is expected.

3. SECTION 3: AVAILABLE DATA - LITERATURE REVIEW

Available literature on ecological features was sourced. It is important to note that the results section (Section 4), serves to ground-truth this data; and thus it should be consulted for on-site information.

3.1. TERRESTRIAL ECOSYSTEMS: VEGETATION AND FLORISTICS

3.1.1. Available Broad-Scale Vegetation Maps

Refer Table 2 for the vegetation types that have been mapped on the Farm (pre-transformation/modification).

Note: The new SA VegMap (2018) has replaced the Sundays Thicket with the STEP vegetation unit, Sundays Valley Thicket. Further, it has also replaced portions of Sundays Thicket with the STEP vegetation unit, Koedoeskloof Karroid Thicket. New vegetation descriptions however have been provided (sourced via the BGIS Website).

Table 2. Vegetation types mapped on Farm Wolverton and along the Sundays River (pre-transformation/ modification)

VEGETATION TYPE	SOURCE	ECOSYSTEM STATUS	BIODIVERSITY TARGET	PROTECTION LEVEL
Mapped on Farm Wolverton				
Sundays Valley Thicket Thicket (Old Veg Name: Sundays Thicket)	SA VegMap (2018)	SA Veg: Least Threatened STEP: Least Threatened	SA Veg: 19 % STEP: 22 %	Moderately Protected
Sundays Spekboom Thicket	STEP Vegetation Map (2002)	Vulnerable	18 %	Not available (STEP)
Koekoeskloof Karroid Thicket	SA VegMap (2018) STEP Vegetation Map (2002)	Least Threatened	SA Veg: 19 % STEP: 17 %	Not Protected

3.1.1.1. National South African Vegetation Map (2018) (Pre-Transformation)

The South African Vegetation Map (Mucina and Rutherford, 2006; amended 2018) indicates that the Farm supports Sundays Valley Thicket and Koedoeskloof Karroid Thicket (Figure 4). These are STEP vegetation units. Previously the vegetation unit was Sundays Thicket.

Mapped on the Farm

Sundays Valley Thicket (Grobler et al., 2018)

According to Grobler et al (2018) Sundays Valley Thicket is an amalgamation of STEP map - Gamtoos Thicket (16 %), Sundays Thicket (82 %); 2012 VegMap –Gamtoos Thicket (17 %), Sundays Thicket (83 %). It is thus largely comprised of the previous Sundays Thicket description in Mucina and Rutherford (2006).

This unit occurs mostly on deep, usually red, loamy to clayey soils that are derived from the Sondagsrivier and Kirkwood formations. It is a dense, medium-sized to tall (3 - 5 m) thicket in which the woody tree and shrub component, and the succulent component, are well developed, with many spinescent species. Dominant taxa include, for example: *Portulacaria afra*, *Euclea undulata*, *Pappea capensis* and *Schotia afra*; others comprising of *Azima tetraacantha*, *Brachylaena ilicifolia*, *Cadaba aphylla*, *Capparis sepriaria* var. *citrifolia*, *Carissa bispinosa*, *Ehretia rigida*, *Gymnosporia capitata*, s,

Plumbago auriculata, *Putterlickia pyracantha*, *Searsia longispina* and *Scutia myrtina*. *Aloe africana*, *Euphorbia caerulescens* and *Crassula* species are common.

Sundays Valley Thicket is **Least Threatened** with a national biodiversity target of 19%. The protection level is 'moderately protected'.

Koedoeskloof Karroid Thicket (Grobler et al., 2018)

A mosaic of low thicket (2 - 3 m) consisting of bush clumps in a matrix of grassy karroid shrubland. The bush clumps comprise species typical of Sundays Valley Thicket, with *Portulacaria afra* dominant and the emergent *Euphorbia triangularis* occasional. On rocky soils, the grass component of the matrix vegetation is pronounced, while in deeper soils the shrub component is pronounced. It is supported on flat to moderately undulating plains; in loamy-clayey soils, but also shallow rocky soils, predominantly on the Sundays River and Kirkwood Formations.

It is **Least Threatened** with a national biodiversity target of 19%. The protection level is 'not protected'.

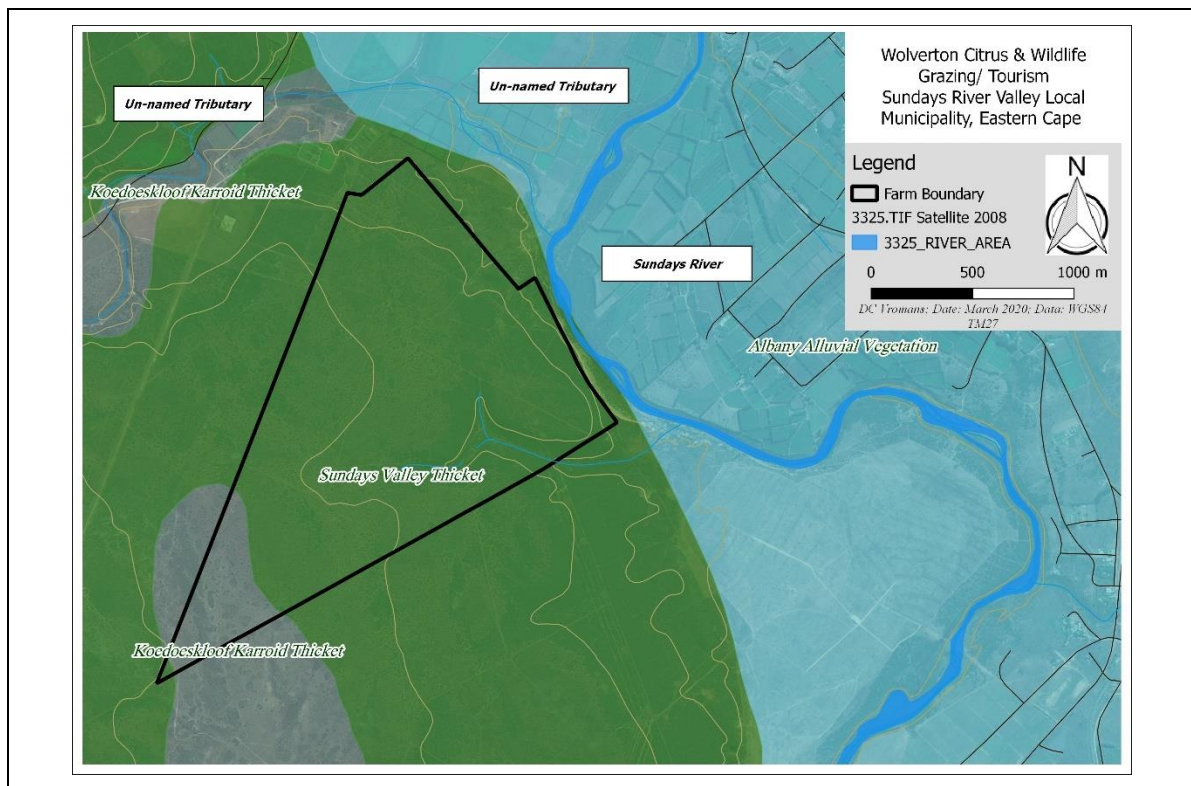


Figure 4. The South African Vegetation Map 2018 delineates Sundays Valley Thicket and Koedoeskloof Karroid Thicket on the farm, with Albany Alluvial Vegetation along the Sundays River and tributary to the north /north-east (Mucina and Rutherford, 2006; amended 2018) (pre-transformation/ modification).

3.1.1.2. Subtropical Thicket Ecosystem Programme (STEP) Map (2002) (Pre-Transformation)

The Subtropical Thicket Ecosystem Programme (STEP) Vegetation Map (2002) delineates largely Sundays Spekboom Thicket, with Koedoeskloof Karroid Thicket to the western portion of the farm (Figure 5). Sundays Doringveld is mapped along the Sundays River.

All units are variants of Sundays Thicket; and are essentially the Sundays Valley Thicket and Albany Alluvial Vegetation as mapped by the SA Vegetation Map (above). The STEP vegetation map classified the Thicket vegetation in more detail, and was utilized by the South African Vegetation Map 2018.

Mapped on the Farm

Sundays Spekboom Thicket

Rainfall and soil conditions result in variable species composition with deeper alluvial soils supporting more *Portulacaria afra* and other succulent species. In higher rainfall sites, *Euclea undulata*, *Pappea capensis*, *Putterlickia verrucosa*, *Rhigozum obovatum*, *Rhus pterota*, *Rhus longispina* and *Schotia afra* are common, whereas in more arid areas succulents abound, such as *Euphorbia caerulescens* (previously *ledienii*) and *Portulacaria afra*.

According to the biodiversity targets set by the Subtropical Thicket Ecosystem Programme's (STEP) systematic conservation plan (Cowling et al., 2002) Sundays Spekboom Thicket is assigned an ecosystem status of **Vulnerable**.

Koedoeskloof Karroid Thicket

Thicket clumps are typical of Sundays Spekboom Thicket. The matrix is succulent karoo dominated by *Pteronia incana* and grasses (*Aristida spp.*, *Digitaria eriantha*). *Drimia elata* is abundant. At present there is still a great diversity of shrubs, succulents and geophytes (e.g. *Aloe ferox*, *Drimia elata*, *Felicia filifolia*, *Mestoklema tuberosum*, *Pteronia incana* and *Rosenia humilis*) (Vlok and Euston-Brown, 2002).

According to the biodiversity targets set by the STEP systematic conservation plan (Cowling et al., 2002), the unit is assigned an ecosystem status of **Least Threatened**.

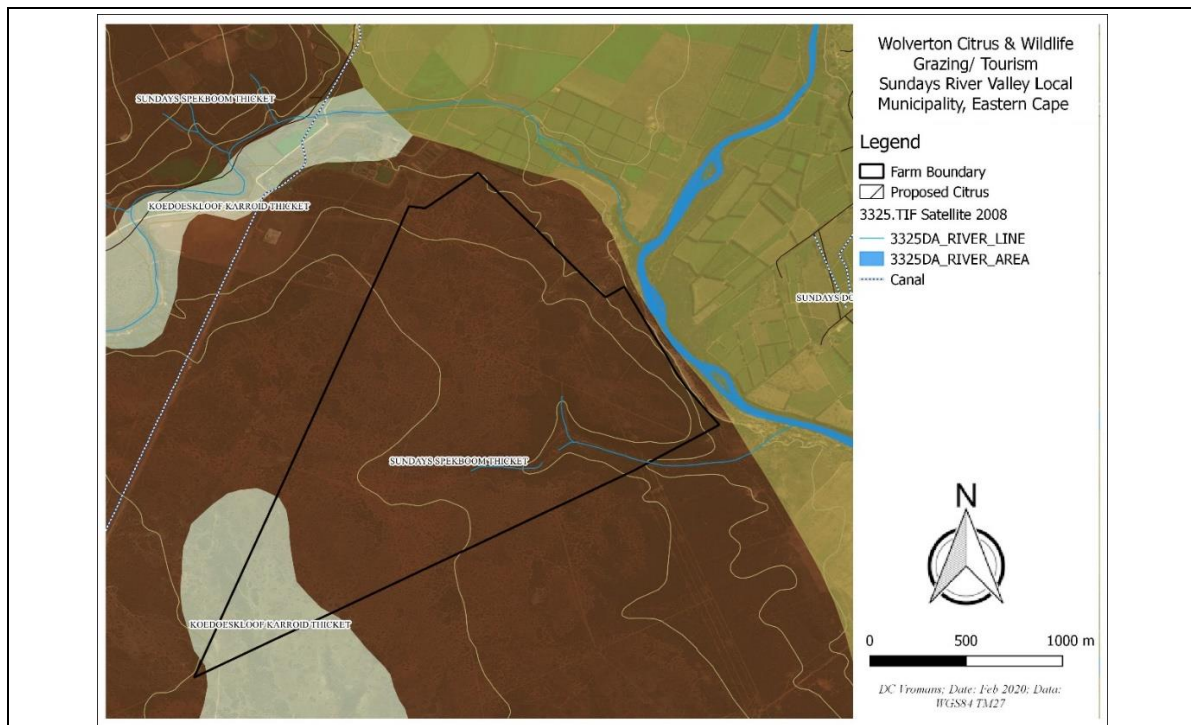


Figure 5. STEP vegetation map delineates Sundays Spekboom Thicket and Koedoeskloof Karroid Thicket on the farm, with Sundays Doringveld also along the Sundays River and tributary to the north/ north-east (pre-transformation/ modification).

3.1.2. Species of Conservation Concern

The following threatened species were mapped by the Maputoland-Pondoland-Albany Hotspot study (SANParks metadata, 2010) in the respective quarter degree grids.

None of these species were recorded at the surveyed site, however, every inch of the site was not surveyed due to the impenetrable thicket and extensive area. As a result, those species indicated as 'potentially occurring' are referenced.

SPECIES	QUARTER DEGREE GRID	CONSERVATION STATUS	HABITAT (SANBI threatened species programme)	LIKELIHOOD OF PRESENCE
<i>Encephalartos horridus</i>	3325DA	Endangered	Xeric thicket, often on rocky quartzite outcrops. Port Elizabeth to Uitenhage.	Possible, but unlikely as numerous thicket, shady areas surveyed.
<i>Euryops ericifolius</i>	3325DA	Endangered	Fynbos. Port Elizabeth to Uitenhage.	Recorded in western portion of the farm.
<i>Haworthia aristata</i>	3325DA	Endangered	Albany Thicket. Port Elizabeth to Kommadagga.	Not likely.
<i>Haworthiopsis (Haworthia) attenuata attenuata</i>	3325DA	Endangered	Not evaluated. Similar to species above.	Not likely.
<i>Hypodiscus procurrens</i>	3325DA	Endangered	Western Cape.	Not likely.
<i>Syncarpha recurvata</i>	3325DA	Endangered	Albany Thicket, Fynbos. Calcrete.	Possible but not recorded.
<i>Apodolirion macowanii</i>	3325DB	Vulnerable	Clay soils, valley bushveld. Six locations known.	Possible.
<i>Argyrolobium barbatum</i>	3325DB	Vulnerable	Albany Thicket Bushveld, limestone outcrops.	Possible but not recorded.
<i>Ruschia leptocalyx</i>	3325DB	Endangered	Fynbos	According to SANBI threatened species, it occurs in the Western Cape. Although numerous other Aiozaceae species were recorded, therefore unlikely.

3.2. AVAILABLE BROAD-SCALE SYSTEMATIC BIODIVERSITY PLANS

Systematic biodiversity plans or maps that have been produced for the region, in which the farm portion is located, include:

- The Sundays River Valley (SRV) Critical Biodiversity Area (CBA) Map (Skowno and Holness, 2012), which supersedes the Eastern Cape Biodiversity Conservation Plan's (ECBCP) (2007) and Subtropical Thicket Ecosystem Programme (STEP) Biodiversity Map (2002).
- The Eastern Cape Biodiversity Conservation Plan's (ECBCP) CBA Map (Berliner and Desmet, 2007).
- The Maputoland-Pondoland-Albany Hotspot's (MPAH) Biodiversity Map (2010).
- The National and Provincial Protected Areas Expansion Strategies (2008/2012).

3.2.1. The Sundays River Valley (SRV) Critical Biodiversity Areas (CBA) Map (2012)

The SRV CBA Map (with associated land use guidelines), is the central component of the SRV Biodiversity Sector Plan (BSP). The SRV BSP was prepared to accompany and further explain the CBA Map for the Sundays River Valley Local Municipality (Vromans et al., 2012). The SRV CBA Map is also referred to as the Addo CBA Map (refer SANBI BGIS).

The SRV CBA Map versus the ECBCP CBA Map

The SRV CBA Map is based on the ECBCP; and is thus not a new systematic plan. A refined and updated CBA Map was developed through integrating existing and new data (Refer Skowno & Holness, 2012), which resulted in some modifications. Its greatest value lies in the fact that it significantly improved upon the accuracy of the land cover data (i.e. modification/ transformation levels versus near-natural/ intact habitat) and integrated the more up to date National Freshwater Ecosystem Priority Assessment data (NFEPA; with priority wetlands, catchment and rivers). The ECBCP CBA Map (2007) is thus superseded by the SRV CBA Map (2012) (refer SANBI BGIS), since the former is out-dated and not as fine-scale as the latter (1:20 000).

In addition, the ECBCP is currently being updated and will incorporate the SRV CBA Map as it stands unless the land cover indicates otherwise i.e. if a CBA is indicated as 'cultivation or settlement' in the latest land cover map it will not be classed as CBA in the updated ECBCP (Pers. Comments: Dr Philip Desmet). This will need to be verified once the newly revised ECBCP is finalized / gazetted.

Key limitations of the SRV CBA Map

- i. The scale of land cover was done at 1:20 000. Ground-truthing was, therefore, required (Refer 'evaluation' below).
- ii. Land cover was based on 2006 agricultural land cover data, and 'on screen' digitizing of built up areas (urban, mines, quarries) in 2012.
- iii. Degradation levels are an underestimate (due to the use of outdated STEP and ECBCP data; and the lack of new data).
- iv. Although the systematic biodiversity planning methodology attempts to avoid known conflicting land uses, such as agriculture, it is unable to adequately avoid high potential agricultural land, which is determined via fine-scale data; that was unavailable (and which is usually not available). Thus, it is the biodiversity sector's input into land use planning and decision making, which does not adequately take socio-economic demands into consideration.

3.2.1.1. SRV CBA Map relative to the Farm

According to the Sundays River Valley (SRV) Critical Biodiversity Area (CBA) Map (Skowno and Holness, 2012), the farm is largely Other Natural Area (ONA), with Ecological Support Area (ESA) along the north-eastern / eastern boundary which serves to safeguard the Sundays River (Figure 6). The dam on the drainage line is No Natural Area Remaining, meaning it is modified, which is the case, as it did not present with wetland habitat.

The surrounding land is Other Natural Area (ONA), while Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) are represented by the Sundays River and its tributary. The ESA represent a 500 m buffer.

3.2.1.2. SRV CBA Map relative to the N40E Quaternary Catchment

Consulting the catchment data allows one to assess cumulative impacts at the strategic level, noting that quaternary catchments are the basic unit for water use management in South Africa. It is effectively a tool to address the impact of land use change on rivers and wetlands. However, it also allows us to determine the level of transformation at the cumulative level. The land cover data is consulted at sub-quaternary catchment level in Section 4.4 (to relate to the ECBCP transformation thresholds per sub-quaternary).

Only approximately 1.7 % of the N40E quaternary catchment is designated as Protected Area (PA), largely representing the Addo Elephant National Park to the east (Table 3, Figure 7). According to the GIS statistics (WGS84 TM25), ~62 % of the N40E catchment is designated as CBA, ESA, and PA. Most of the No Natural Areas Remaining include much of the agricultural land in the Sundays River Valley,

to the east, following the Sundays River. The landscape to the far west, represents the mountainous landscape which is, for the most part, not suitable for agriculture, barring river floodplains.

In the Sundays River Valley Municipality, the level of transformation in the municipal area is ~13.3 %, while ~24.8 % of the land is formally protected, ~30.6 % is classed CBA, ~22 % is designated as ESA and ~9.4 % is classified as Other Natural Area (Vromans et al., 2012).

Table 3. CBA Map statistics for the N40E catchment (WGS84 TM25 calculations).

CBA Map Category	Hectares	Percentage
Protected Area (PA)	851,79	1,7
CBA	10 448,09	20,5
ESA	20 398,59	40,0
Other Natural Area (ONA)	12 812,36	25,1
No Natural Remaining (NNR)	6 498,41	12,7
TOTAL N40E CATCHMENT	51 009,24	100
CBA, ESA, PA	31 698,47 ha	62,1 %

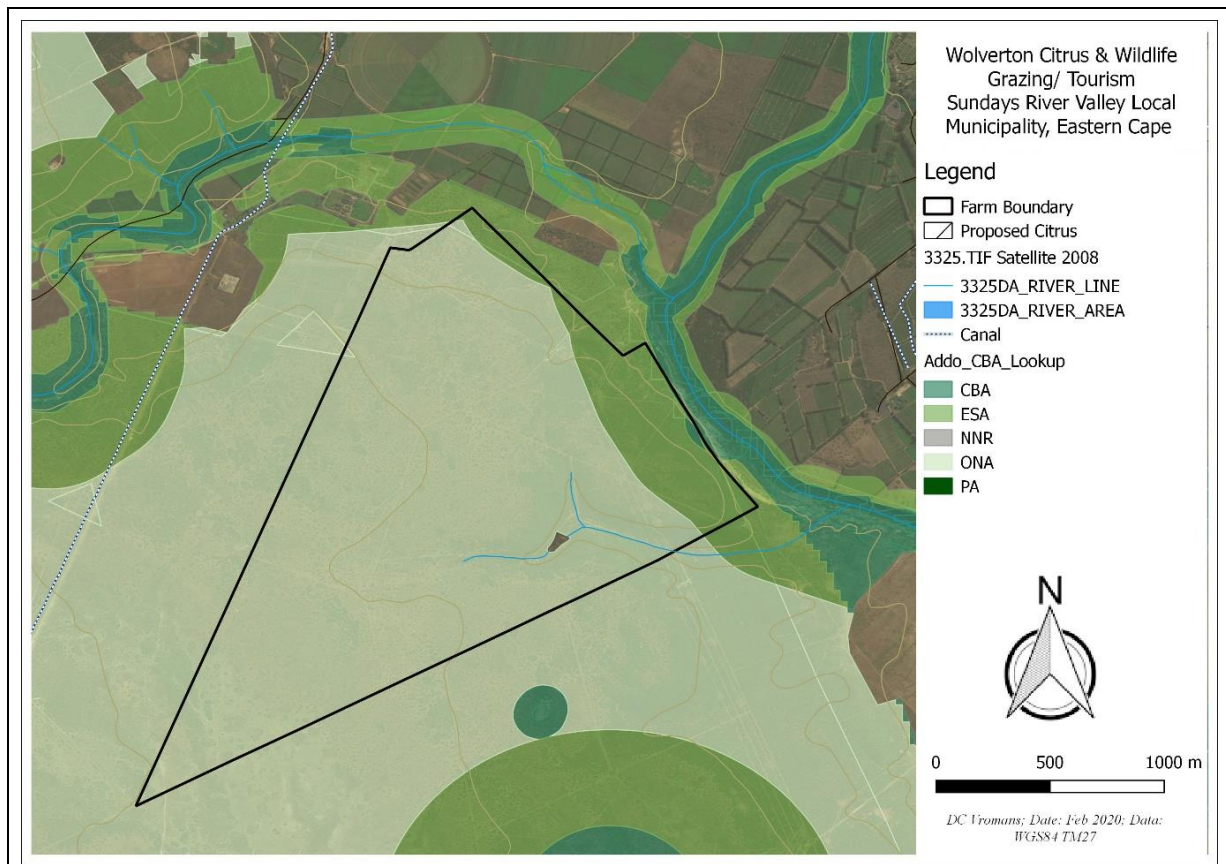
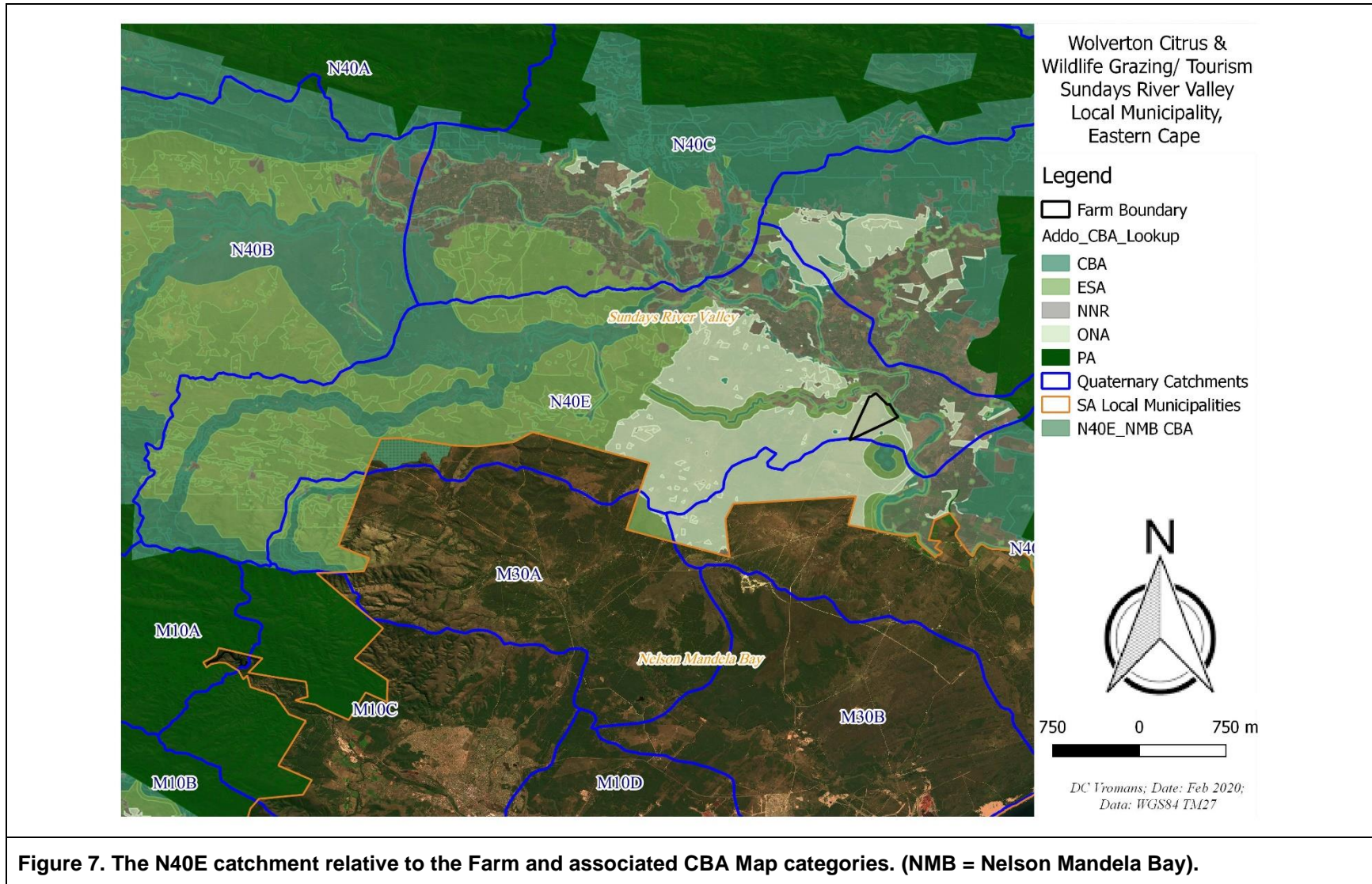


Figure 6. Map indicating Other Natural Areas (ONA) and Ecological Support Areas (ESAs) on Farm Wolverton, including ESA along the un-named tributary river and CBA along the Sundays and tributary rivers.

3.2.1.3. Land Use and Land Use Management Guidelines

- Other Natural Areas and No Natural Areas Remaining are favourable sites for development, as long as sustainable development is promoted (ecologically, socially and economically).
- CBAs and ESAs are recommended sites for low impact/ low intensity developments types, not intensive agriculture.
- Supporting infrastructure, such as water supply pipelines, can be conditionally permitted in CBA and ESA (indicated as 'restricted', meaning conditional). This means essential irrigation infrastructure could be permitted if the impact is not significant and will not result in the deterioration of CBA or ESA. Although the land use guidelines state general avoidance of sensitive habitats by infrastructure, such as rivers, crossing for linear infrastructure, such as irrigation pipelines and roads, these cannot always be avoided.



3.2.2. The Eastern Cape Biodiversity Conservation Plan (ECBCP) Critical Biodiversity Areas (CBA) Map (2007)

Although the SRV CBA Map supersedes the ECBCP (refer SANBI BGIS website) and is at a finer scale, the ECBCP must be consulted as it represents the systematic biodiversity plan adopted by the competent authority (DEDEAT), which identifies listed activities requiring Environmental Authorisation in CBA (as advised by DEDEAT). Furthermore, the ECBCP was consulted for the recommended transformation thresholds for the sub-quatery catchments (of the N40E quaternary catchment).

Note Regarding the Updated ECBCP CBA Map (2017/18): The updated version of the 2007 ECBCP has not been gazetted; and thus not finalized. It is therefore not utilized in this assessment.

Key limitations of the ECBCP CBA Map

- i. ECBCP is a provincial scale assessment, with data such as STEP at a scale of 1:100 000, expert mapping at 1:250 000 etc. Ground-truthing is, therefore, required. (Refer 'evaluation' below).
- ii. Land cover reflects patterns around 2000 i.e. it is out-dated.
- iii. The updated NFEPA wetlands data was not available at the time to better reflect wetlands or priority catchments (due to outdated land cover etc.).
- iv. Degradation is not accurately mapped and is an underestimate.
- v. Since the SRV CBA Map is based on the ECBCP, point (iv) of its key limitations also apply (Section 6.6.1).

3.2.2.1. ECBCP CBA Map relative to the Farm

The terrestrial CBA Map, displayed below, classifies the majority of the land as Other Natural Area, whereas portions of the proposed cultivation areas, to the north-west are CBA 2 (ecological corridor) (Figure 8).

In terms of the Aquatic CBAs, Farm Wolverton falls within two sub-quatery catchments (of N40E), which are classified as Aquatic CBA 2 (A2a and A2b) (Figure 9).

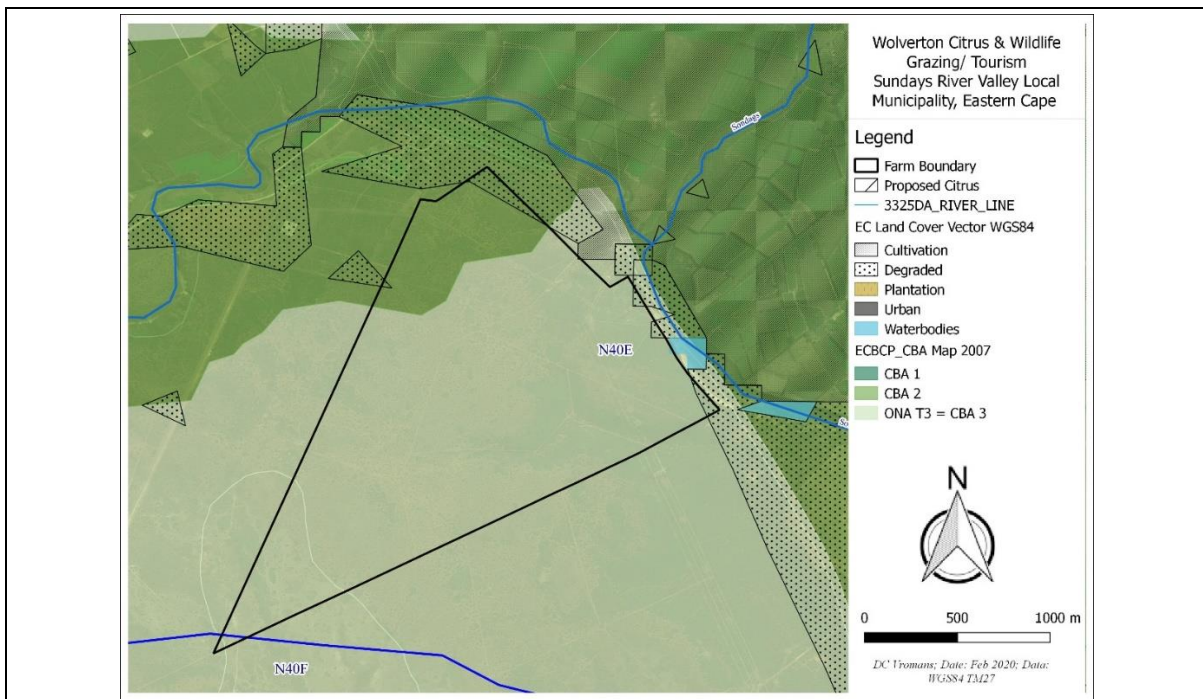


Figure 8. The Eastern Cape Biodiversity Conservation Plan (ECBCP) classifies the majority of the farm as Other Natural Area, whereas a portion to the north is CBA 2 (ecological corridor).

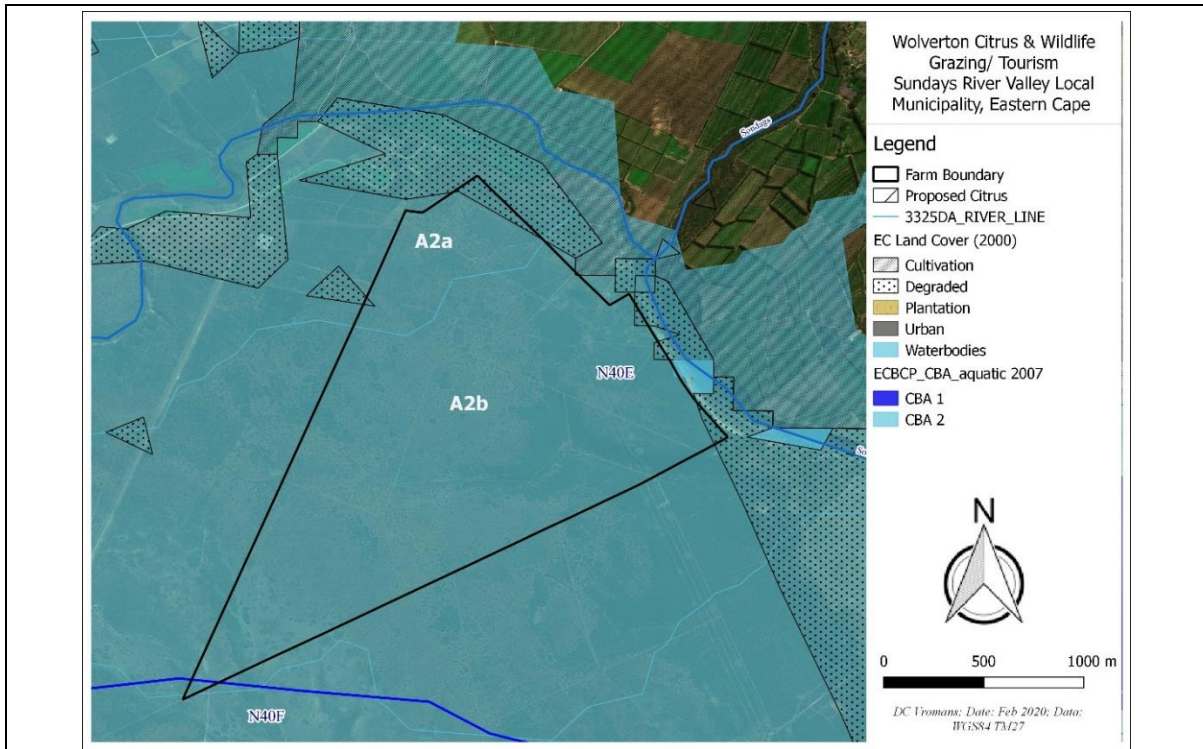


Figure 9. The Eastern Cape Biodiversity Conservation Plan (ECBCP) classifies the farm as Aquatic CBA 2, which includes A2b and A2a (along the un-named non-perennial river).

3.2.2.2. Land Use and Land Use Management Guidelines

The land use recommendations for the associated categories are presented in Table 4 below, while the recommended transformation thresholds for Aquatic CBA sub-quaternary catchments is in Table 5.

Table 4. Terrestrial biodiversity land management classes (BLMC), Recommended Land Use Objectives and Land Use (Berliner and Desmet, 2007).

CBA MAP CATEGORY	BLMC	RECOMMENDED LAND USE OBJECTIVE	RECOMMENDED LAND USE
CBA 2	BLMC 2: Near Natural Landscapes	Maintain biodiversity in near natural state with minimal loss of ecosystem integrity. No transformation of natural habitat should be permitted.	Conservation, communal livestock and game farming
Other Natural Areas	BLMC 3: Functional Landscapes	Manage for sustainable development, keeping natural habitat intact in wetlands (including wetland buffers) and riparian zones. Environmental authorisations should support ecosystem integrity.	Conservation, communal livestock and game farming, Commercial livestock ranching. Conditional: Dry land cropping, irrigated cropping, dairy farming, timber, settlement.

Recommended Transformation Threshold (<15% - <20%): Aquatic CBA 2a and 2b Sub-Quaternary Catchments

The recommended transformation threshold for Aquatic CBA 2a and 2b **sub-quaternary** catchments is <15% and <20% of the total area of the sub-quaternary catchment. The generic buffer recommendations, pre-site verification, are also provided in Table 5.

Table 5. Aquatic CBA with recommended transformation thresholds and aquatic buffers (Berliner and Desmet, 2007).

CBA MAP CATEGORY	BLMC	RECOMMENDED TRANSFORMATION THRESHOLD
Aquatic CBA 2a	ABLMC 2	<15% of total area of sub-quaternary catchment
Aquatic CBA 2b	ABLMC 2	<20% of total area of sub-quaternary catchment
AQUATIC FEATURE	GENERIC BUFFER RECOMMENDATION	
Wetlands	50m	Currently there is no accepted priority ranking system for wetlands. Until such a system is developed, it is recommended that a 50 m buffer be set for all wetlands.
Mountain streams and upper foothills of all 1:500 000 rivers	50m	These longitudinal zones generally have more confined riparian zones than lower foothills and lowland rivers and are generally less threatened by agricultural practices.
Lower foothills and lowland rivers of all 1:500 000 rivers	100m	These longitudinal zones generally have less confined riparian zones than mountain streams and upper foothills and are generally more threatened by agricultural practices. These larger buffers are particularly important to lower the amount of crop-spray reaching the river.
All remaining 1:50 000 streams	32m	Generally smaller upland streams corresponding to mountain streams and upper foothills, smaller than those designated in the 1:500 000 rivers layer. They are assigned the riparian buffer required under South African legislation. <u>Important definitions to consider are therefore:</u> <u>Mountain Streams</u> are characterised by steep-gradients dominated by bedrock and boulders, locally cobble or coarse gravels in pools; reach types include cascades, bedrock fall, step-pool; approximately equal distribution of 'vertical' and 'horizontal' flow components. Characteristic gradient is 0.04–0.99 (SANBI, 2009). <u>Upper Foothill Rivers</u> are characterised by moderately steep, cobble-bed or mixed bedrock-cobble bed channels, with plain-bed, pool-riffle or pool-rapid reach types; length of pools and riffles/rapids is similar. Characteristic gradient is 0.005–0.019 (SANBI, 2009). <u>River channels:</u> These are comprised of an active channel - a channel that is inundated at sufficiently regular intervals to maintain channel form and keep the channel free of established terrestrial vegetation. These channels are typically filled to capacity during bankfull discharge (i.e. during the annual flood, except for intermittent rivers that do not flood annually) (SANBI, 2009).

3.2.2.3. ECBCP CBA Map relative to the N40E Catchment

As indicated above, Farm Wolverton falls within two sub-quaternary catchments (of N40E), which are classified as Aquatic CBA 2 (A2a and A2b) (Figure 9 above).

This means that less than 15 % - 20 % of the total area of the sub-quaternary catchments can be modified (transformed) respectively (Berliner and Desmet, 2007). The farm is near-natural thicket (Section 4.2 and 4.3) (which was also indicated as such in the ECBCP land cover map). Refer Section 4.3.2, Table 9) which indicates that approximately 13.21 % of the quaternary catchment N40E has been modified, while 24.2 % has been degraded.

On Farm Wolverton, ~**25 ha** of vegetation will need to be cleared; or ~**6.9 %** of the farm. This would increase the total modified area of the quaternary catchment N40E to 13.31 % (Refer Section 4.3.2, Table 9).

Approximately 19.7 ha is proposed for citrus in the western catchment (A2a), and the remaining 6.3ha will be cleared in the eastern catchment (A2b). Thus, the percentage modified is raised from 5.3 % to 5.6 % (western) and from 16.1 % to 17.9 % (eastern catchment). This suggests that the catchments are still within the transformation thresholds, based on the available data. See Section 4.3.2 (Table 10).

Both the Sundays River Valley CBA Map and the NFEPA map do not recommend the use of catchment transformation thresholds. However; and in contrast to the above, studies by Allan (2004) showed that streams in agricultural catchments usually remain in a good condition until the coverage of agriculture in the catchment exceeds 30 % -50 % (Driver et al., 2012 – NFEPA Implementation Manual) (Section 4.1).

3.2.3. The Maputoland-Pondoland-Albany (MPAH) Hotspot Biodiversity Conservation Plan, 2010

The Maputoland-Pondoland-Albany Hotspot (MPAH) extends from Mozambique to Jeffreys Bay, including the majority of Swaziland. The MPAH systematic conservation plan mapped 72 key biodiversity areas and 12 biodiversity corridors for priority conservation action. The biodiversity corridors are important for long term protection of threatened species and ecosystem function, particularly due to future predicted climate change impacts. A sub-set of the 72 key biodiversity areas were prioritized for conservation action through the MPAH project. The distribution of the threatened species was mapped according to their location in a Quarter Degree Square (i.e. an area of approximately 30 km by 30 km covered by one 1:50 000 South African topographical map) (Section 3.2.2).

3.2.3.1. Important biodiversity features relative to the Farm

- Several Species of Conservation Concern / threatened species were mapped within the associated quarter degree square (Section 3.2.2).
- The Albany biodiversity corridor extends across the farm; and represents the Albany Centre of Endemism. The area has a high concentration of threatened species along the coast and near urban areas. The Albany Corridor is ranked number 6 out of the 12 corridors.
- The Sundays River CBA Map 2012, however, supersedes this plan as the biodiversity features and land cover data were mapped at a finer, more accurate scale; and mapping was undertaken more recently than the MPAH (as per the ECBCP). This can be observed in the 2008 satellite imagery in Figure 10 below, which shows intensive agriculture within the corridor.

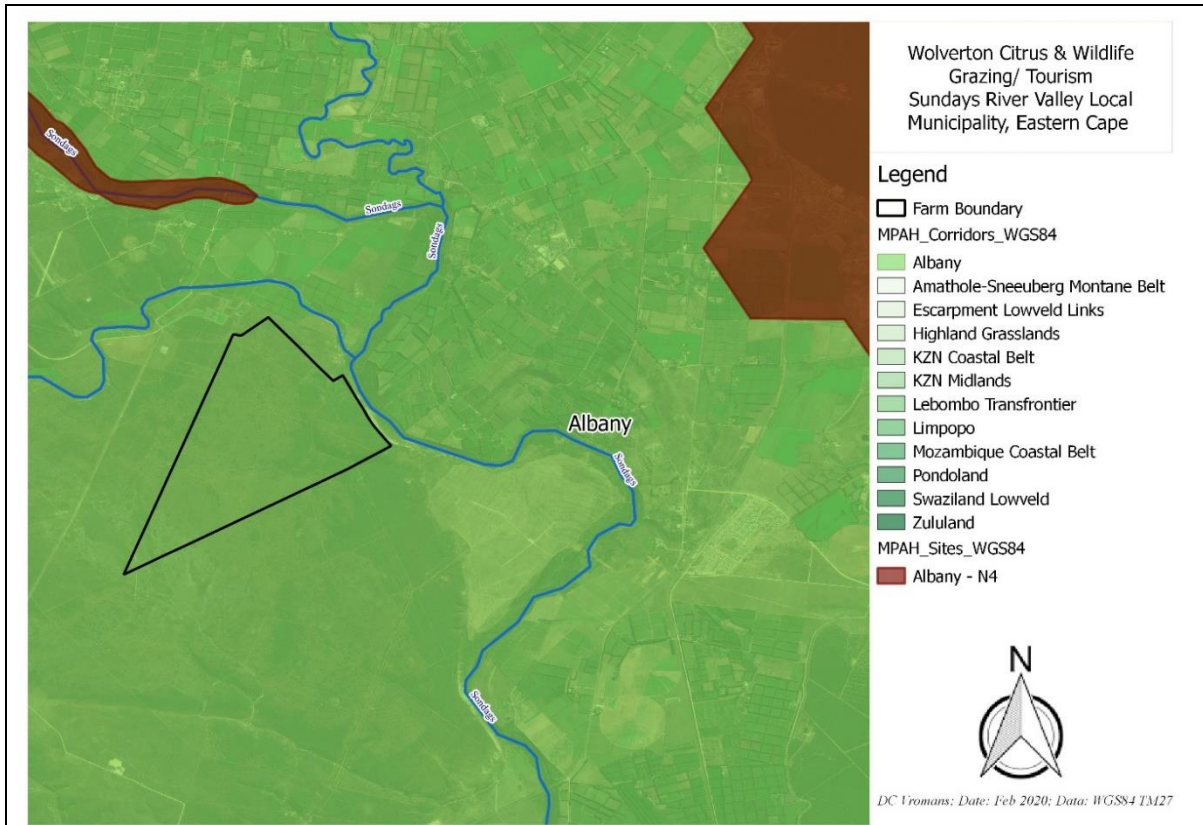


Figure 10. Map indicating the Maputoland-Pondoland-Albany Hotspot (MPAH) Albany Corridor (without modification levels shown).

3.2.4. The National and Provincial Protected Area Expansion Strategy (2008; 2012)

Target areas (focus areas) for expansion of the Protected Area network in South Africa were identified through a systematic biodiversity planning process undertaken as part of the development of the 2008 National Protected Area Expansion Strategy (NPAES), as well as the 2012 provincial Protected Area Expansion Strategy. The Farm is situated approximately ~6km south-westward of the Addo Elephant National Park (AENP) boundary, and thus the protected area expansion strategy maps were consulted.

3.2.4.1. Expansion areas relative to the Farm

- The Farm does not fall within a focus area.

Note: The SRV CBA Map demarcated Priority Natural Areas for expansion of the AENP, which represent CBA. These areas were not identified on the Farm.

3.2.5. The National Strategy on Buffer Zones for National Parks (2012)

The National Strategy on Buffer Zones for National Parks sets out a strategy for the establishment and management of buffer zones around national parks. This permits South African National Parks to better meet their objectives. The Addo Elephant National Park Management Plan (2015 – 2025) has thus identified a buffer zone around the park. The park buffer zone consists of three categories, namely, Priority Natural Area, Catchment Protection Area and Viewshed Protection Area.

Priority Natural Areas are key pattern and process areas that are required for the long-term persistence of biodiversity in and around the park, which includes future park expansion areas. Catchment Protection Areas are important for maintaining key hydrological processes within the park. Viewshed Protection Areas are located where new developments are likely to impact on the aesthetic quality of the visitor's experience in the park.

According to the AENP Management Plan, the buffer zone guides the park to assess, and where necessary, respond to EIAs where land use changes could impact on the park (SANParks, 2015). As far as can be determined, the AENP buffer zones (i) have not been established by publication in the Gazette, (ii) are not integrated into the SRVM SDF as a Special Control/ Natural Area; and (iii) have not been declared as a Protected Environment in terms of the National Environmental Management: Protected Areas Act (57 of 2003). Thus, the AENP buffer zones are not legislated in terms of the strategy.

3.2.5.1. The Addo Elephant National Park (AENP) buffer zones relative to the Farm

The farm falls within the AENP Viewshed Protection Area, and it appears some Priority Natural Area occurs along the boundary (Figure 11). The latter is likely the CBA along the Sundays River, as mapped by the SRV CBA Map (Section 3.3.1).

Viewshed protection areas are only broadly indicative of sensitive areas, as many areas within this zone, at the fine-scale, would be perfectly suited for development (AENP, 2015-2025).

Note: The SRV CBA Map demarcated Priority Natural Areas for expansion of the AENP, which represent CBA. The Farm does not fall within these 'AENP expansion areas'.

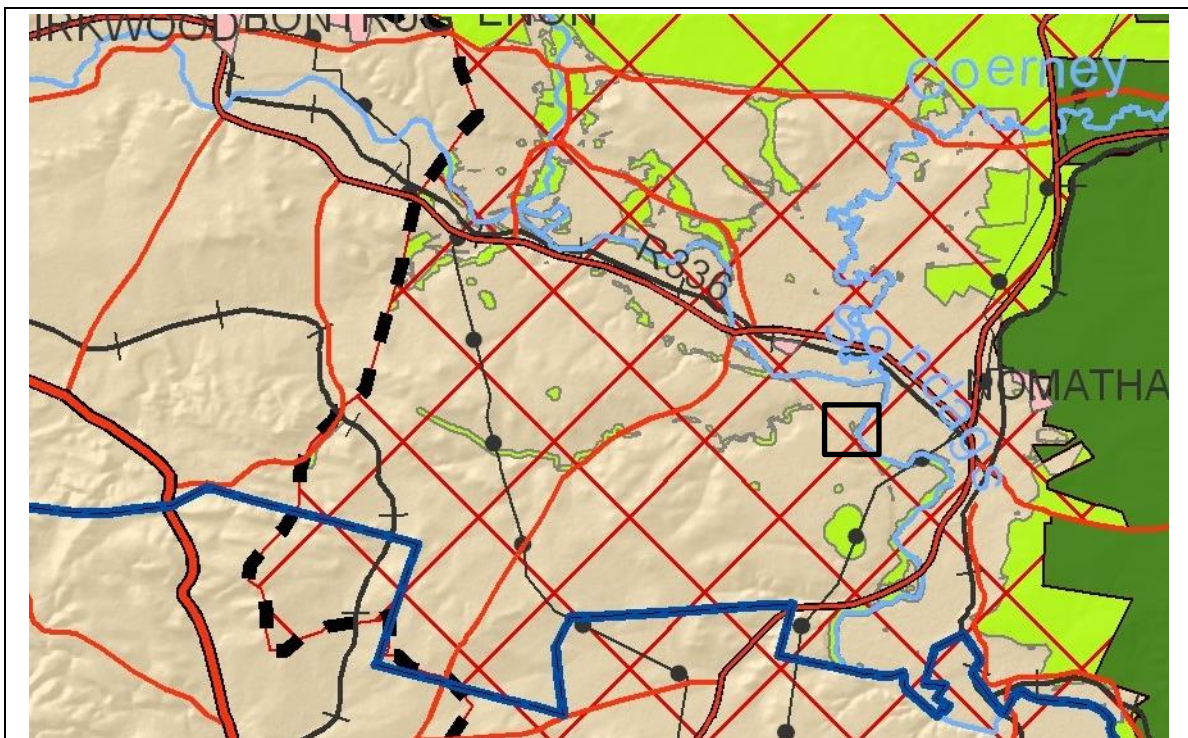


Figure 11. The Addo Elephant National Park Buffer Zone relative to the Farm (black square).

4. SECTION 4: GROUND-TRUTHING RESULTS

4.1. BIOPHYSICAL ENVIRONMENT: GENERAL CLIMATE, TOPOGRAPHY AND GEOLOGY

The climate of Addo is arid to semi-arid, receiving approximately 281 mm – 338 mm of rainfall per annum. However, according to farmers in the area, rainfall is highly unpredictable, and even records of 600mm have been recorded. Rainfall occurs throughout the year, with lowest rainfall readings in July (13 mm), during winter, and the highest in March (35 mm), during autumn, although rainfall is relatively high during spring and summer. During the winter months, the monthly distribution of average daily maximum temperatures is 20.7°C (July) to 28.2°C during summer (February).

The topography of Farm Wolverton is a combination of, mostly, flat upper plateaus and lower lying valley areas and spurs that slope towards the Sundays River along the north-eastern / eastern boundary. The plateaus are more extensive than the sloped areas or kloofies. Along the eastern boundary, the slopes develop into vertical cliffs in places, particularly where the Sundays River flows passed and along this boundary.

The predominant geology of the study site is the Sundays River Formation (Uitenhage Group), with greenish grey mudstone, as well as intermediate and low-level fluvial terrace gravel (1:250 000 Geological Series Map, Port Elizabeth 3324). The 1:100 000 lithology describes the Sundays River Formation as comprising grey shale, siltstone and sandstone.

Overlying clay and underlying limestone were observed on the property, as well as areas with limestone at the surface. The soil analysis report should be consulted for detailed soil characteristics.

4.2. RESULTS TERRESTRIAL VEGETATION AND FLORISTICS - SITE ASSESSMENT OBSERVATIONS

4.2.1. Vegetation Pattern or Vegetation Types

Vegetation on the Farm

The dominant vegetation type was natural to near-natural Thicket (Plate 1). Areas that were characteristically impenetrable or very dense are considered Sundays Valley Thicket (Mucina and Rutherford, 2018) or Sundays Spekboom Thicket (Vlok and Euston Brown, 2002); whereas Koedoeskloof Karroid Thicket occurred on the higher lying plains (Mucina and Rutherford, 2018; Vlok and Euston Brown, 2002). The STEP descriptions appear to represent the vegetation on site better.

Figure 12 below presents the vegetation map for farm Wolverton. The Sundays Valley Thicket/ Sundays Spekboom Thicket thus occurred in the valleys and sloped areas. Vegetation on the higher lying and flatter plain areas however were less dense and more reflective of a mosaic thicket. These areas supported larger areas of low growing shrublets, grasses and succulents, and are considered Koedoeskloof Karroid Thicket i.e. Sundays Valley Thicket mosaic with grassy Karoo.

Summary results of vegetation types on Farm Wolverton:

VEGETATION TYPE	SOURCE	ECOSYSTEM STATUS	BIODIVERSITY TARGET	PROTECTION LEVEL
Sundays Valley Thicket Thicket	SA VegMap (2018)	Least Threatened	SA Veg: 19 % STEP: 22 %	Moderately Protected

VEGETATION TYPE	SOURCE	ECOSYSTEM STATUS	BIODIVERSITY TARGET	PROTECTION LEVEL
(Old Veg Name: Sundays Thicket)		STEP: Least Threatened		
Sundays Spekboom Thicket	STEP Vegetation Map (2002)	Vulnerable	18 %	Not available (STEP)
Koekoeskloof Karroid Thicket	SA VegMap (2018) STEP Vegetation Map (2002)	Least Threatened	SA Veg: 19 % STEP: 17 %	Not Protected

Although variable, the Koekoeskloof Karroid Thicket areas generally supported the dominant species *Crassula capitella*, *Euryops anethoides*, *Leucas capensis*, *Eustachys paspalloides*, *Pentzia incana*, *Selago corymbosa*, *Themeda triandra*, *Felicia filifolia*, *Euphorbia maurtiana* and *Chrysocoma ciliata*. Variability was evident in that some areas supported dense concentrations of *Aloe ferox*, ygies (e.g. *Ruschia tenelle* and *R. unicata*), the grass *Themeda triandra* or *Aspalathus setacea*. *Jatropha capensis*, *Olea europaea* subs. *africana* and *Cussonia spicata* were more common in the thicket clumps compared to the Sundays Valley Thicket unit described below, whereas *Portulacaria afra* was less common. Generally, the thicket species described below grew in the matrix clumps. Consequently, *P. afra* was not dense throughout the farm, but is a reliable indicator.

In the south-western portion of the Farm, limestone was more evident, and although general species composition was not significantly different, of note, was the presence of the Endangered shrublet, *Euryops ericifolius*; along with *Pentzia inacana*. Thicket clumps tended to be less; and more dispersed. This variability of the Koekoeskloof Karroid Thicket can be attributed to the unit falling on a complex mix of soils (Vlok and Euston-Brown, 2002). The general area that supported more limestone near the surface and the *E. ericifolius* is indicated on the vegetation map for Wolverson Farm (Figure 12).

Sundays Valley Thicket areas were defined by the impenetrable nature of the bush, thus a change in structure; and the increase in typical, thicket species, many spinescent in character. The dominant species included: *Azima tetrachantha*, *Brachylaena ilicifolia*, *Euclea undulata* *Pappea capensis*, *Schotia afra*, *Gymnosporia polycantha*, *Portulacaria afra*, *Putterlickia pyracantha*, *Rhigozum obovatum*, *Searsia longispina* and *Sideroxylon inerme* (Milkwood). *Roepora (Zygophyllum) morgsana* was not common but present. *Aloe africana*, *Euphorbia caerulescens (previously ledienii)*, *Jasminum angulare*, *Ptaeroxylon obliquum*, *Euphorbia fimbriata* and *Sarcostemma viminalis* were present, but not as common. Several *Crassula* and *Asparagus* species were recorded with some Aizoaceae (Mesembryanthemaceae) species too. *Sanseveria hyacinthoides* and *Justicia protracta* were common in the under-storey shade. *P. afra* was present in varying densities in the thicket clumps throughout the farm.

A patch of land has been modified due to the dumping of sediment (or sludge) from the Nelson Mandela Bay Municipality wastewater treatment works. During the 2015 survey, the area was overgrown with alien weeds, such as *Cirsium vulgare* and *Datura ferox*, including other species such as *Phragmites australis*, *Pennisetum clandestinum* (kikuyu). *P. australis* has originated from the sediment supplied, either as seed or rhizomes. During the 2019 survey, *P. australis* was absent. A limestone quarry has also been established adjacent thereto and some selective clearing has taken place, including some bull-dozing (see Section 4.4.1).

Refer Addendum 1 for the plant inventory.

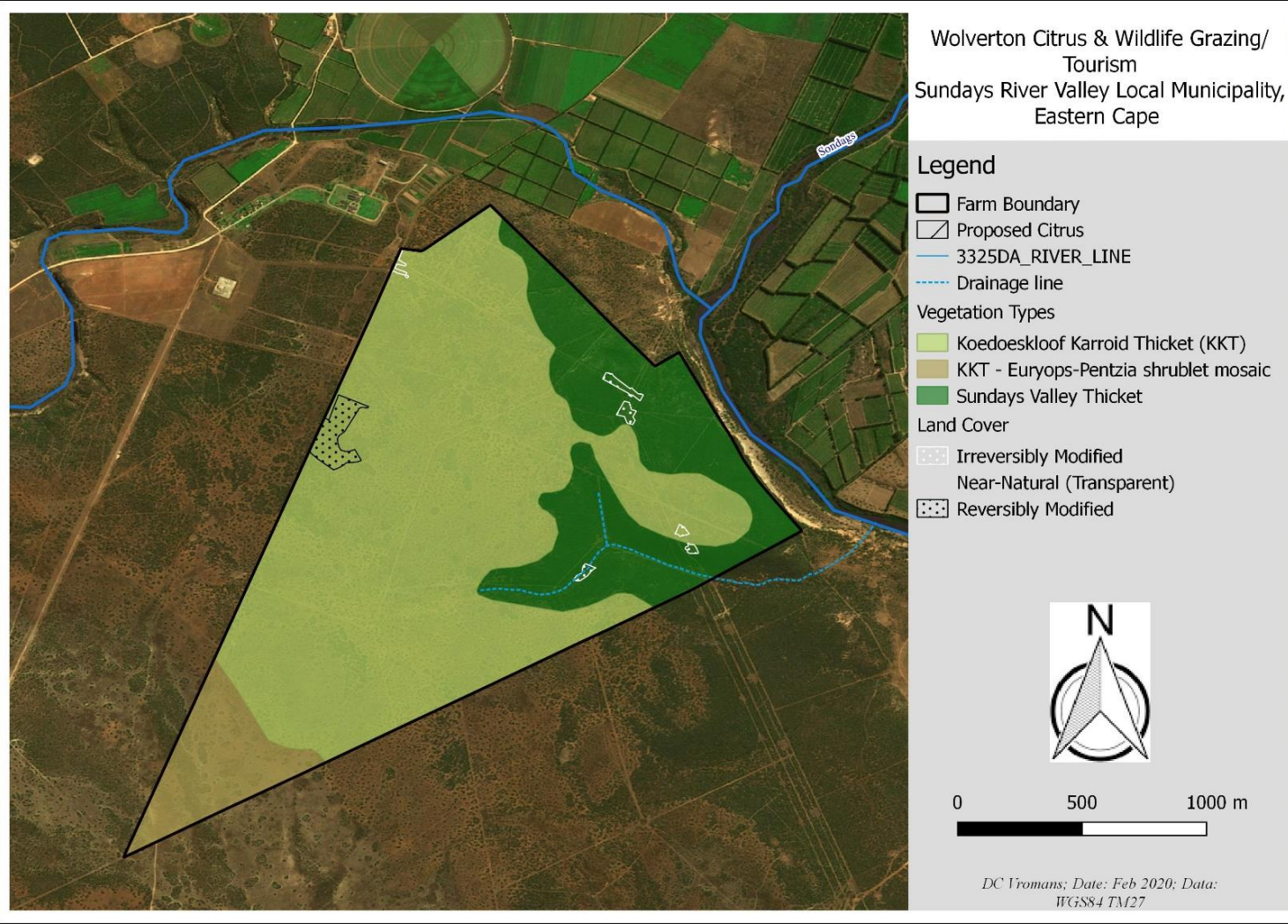


Figure 12. Vegetation map for Farm Wolverton, with land cover. (KKT = Koedoeskloof Karroid Thicket).

4.2.1.1. Alien Invasive Plants (AIP)

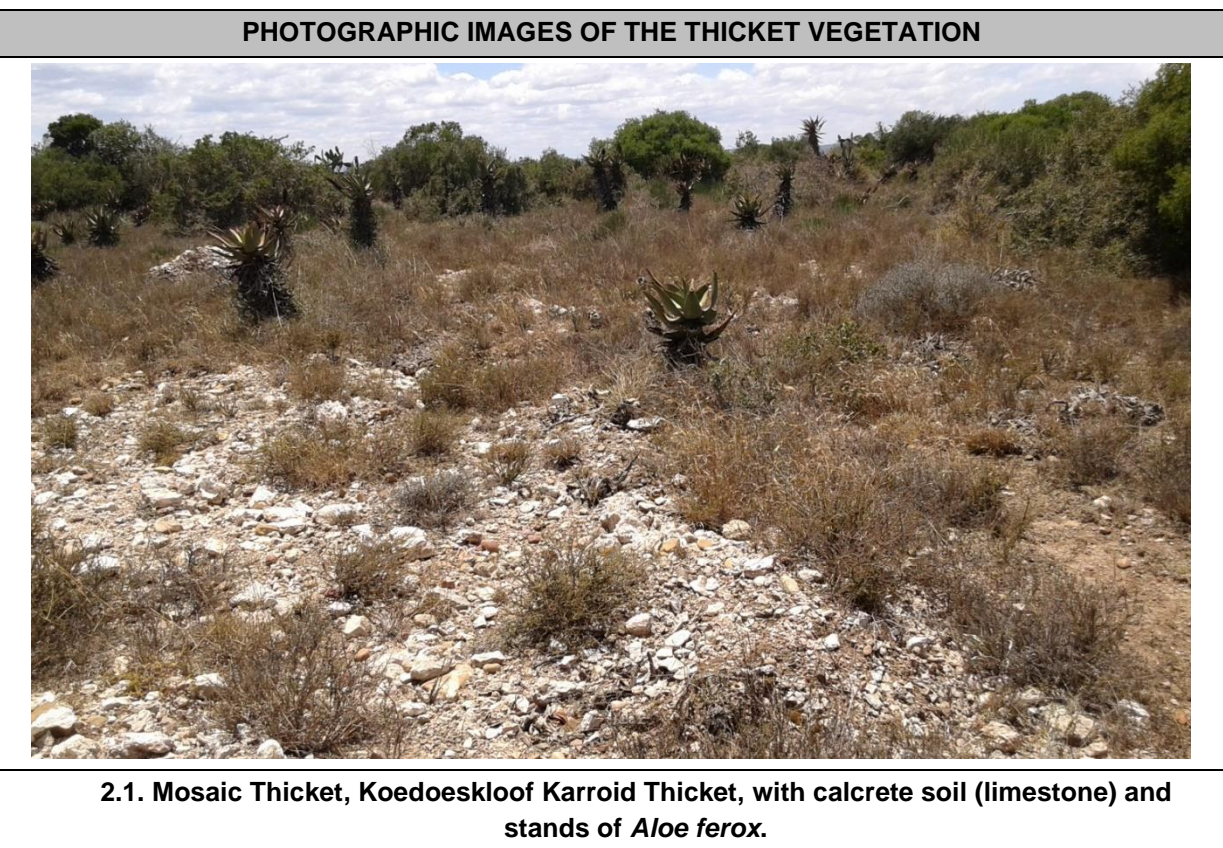
Alien invasive plants (AIP) have been declared in terms of the National Environmental Management: Biodiversity Act (10 of 2004) (NEMBA), Alien and Invasive Species (AIS) List (2016), as well as the Conservation of Agricultural Resources Act (CARA) (43 of 1998) (Regulation 15 and 16). The NEMBA 2016 listing has superseded the CARA listing.

Opuntia ficus-indica (Prickly Pear) and *Opuntia aurantiaca* were the key alien invasive plants recorded on site; but were not present in high densities (> 60% cover). Refer to Table 6 below for the list of alien invasive plants and associated category.

Table 6. Alien invasive plants recorded on site

DECLARED ALIEN INVASIVE PLANTS	CARA CATEGORY	NEMBA ALIEN AND INVASIVE SPECIES LIST CATEGORY (JULY 2016)
<i>Argemone ochroleuca</i>	Category 1, which must be destroyed.	Category 1b <i>prohibits the spreading or allowing the spread of any specimen of the species, and prohibits importing it into SA; breeding, growing, moving and selling. A person is exempt from having in possession or exercising physical control over the specimen. In other words, these species must be controlled and wherever possible, removed and destroyed³. Trade and planting are prohibited.</i>
<i>Cirsium vulgare</i>		
<i>Datura ferox</i>		
<i>Opuntia ficus-indica</i>		
<i>Opuntia aurantiaca</i>		

Plate 1. Photographic images of the thicket vegetation.



³ According to the brochure “Do the NEMBA regulations affect you?” compiled by DEA.

PHOTOGRAPHIC IMAGES OF THE THICKET VEGETATION



2.2. Mosaic Thicket, Koedoeskloof Karroid Thicket, with large areas of *Themedia triandra*.



2.3. Mosaic Thicket, Koedoeskloof Karroid Thicket, with patches of *Ruschia uncinata*; and underlying calcrete and surface limestone. The Endangered *Euryops ericifolia* was observed in the south-western corner where the surface limestone was clearly visible. This area is a no-go.

PHOTOGRAPHIC IMAGES OF THE THICKET VEGETATION



2.4. Largely impenetrable Sundays Thicket on the slopes and in the valley areas.

4.2.2. Species of Conservation Concern (SCC)

One threatened and two declining species were recorded. *Euryops ericifolius*, an Endangered shrublet was recorded in the south-western portion of the farm, falling outside of the proposed agricultural areas, where limestone was more evident. *Dioscorea elephantipes* (Elephants Foot) was recorded, and according to the Applicant, there are 6 known individuals on the farm which fall outside of the agricultural footprint. This species is declining. *Drimia altissima* was recorded within phase 1 citrus area and beyond the other agricultural areas as well, a Declining species. Several protected species were recorded, all of which are of Least Concern (Table 7, Plate 2).

The Aiozaceae or vygies were abundant in the open, sunny areas. *Sideroxylon inerme* trees were abundant. A fair number of *Aloe africana* were recorded. *Pachypodium bispinosum* was fairly common on the edge of thicket clumps and open areas.

All the species, apart from *Sideroxylon inerme*, are protected by the provincial Nature and Environmental Conservation Ordinance (19 of 1974) (PNCO). These species will require a license from the Provincial Environmental Affairs Department to be removed. A rescue and translocation, and/or rehabilitation plan is usually required. *Sideroxylon inerme* (Milkwood) is protected under the National Forest Act (84 of 1998). Removal of this tree requires a license from the Department of Forestry (of the Department of Agriculture, Forestry and Fisheries).

Disphyma crassifolium was recorded in the salt marsh outside the farm, and *Drosanthemum lique* at its edge as well. Both are protected vygies.

Table 7. Threatened, Declining and Protected species recorded on site

- PNCO = Provincial Nature Conservation Ordinance = Nature and Environmental Conservation Ordinance (19 of 1974). Note that the scheduled species in terms of the Eastern Cape Conservation Bill have not been indicated as the species list that is regulated by the Department of Economic Development, Environmental Affairs and Tourism is in terms of the 1974 PNCO. This is because the Bill has not been gazetted.
- NFA = National Forest Act (84 of 1998).

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SPECIES	FAMILY	RED DATA LISTING	PROTECTED BY
1. <i>Aloe africana</i>	ASPHODELACEAE	Least Concern	PNCO
2. <i>Anaccampseros arachnoides</i>	ANACAMPSEROTACEAE	Least Concern	PNCO
3. <i>Carpobrotus edulis</i>	AIZOACEAE	Least Concern	PNCO
4. <i>Dioscorea elephantipes</i>	DIOSCOREACEAE	Declining	PNCO
5. <i>Drosanthemum hispidum</i>	AIZOACEAE	Least Concern	PNCO
6. <i>Delosperma ecklonis</i> (white, orange and pink)	AIZOACEAE	Least Concern	PNCO
7. <i>Drimia altissima</i>	HYACINTHACEAE	Declining	PNCO
8. <i>Euryops ericiofolius</i>	ASTERACEAE	Endangered	
9. <i>Galenia pubescens</i>	AIZOACEAE	Least Concern	PNCO
10. <i>Lampranthus lavisii</i>	AIZOACEAE	Least Concern	PNCO
11. <i>Moraea stricta</i>	IRIDACEAE	Least Concern	PNCO
12. <i>Malephora lutea</i>	AIZOACEAE	Least Concern	PNCO
13. <i>Mesembryanthemum aitonis</i>	AIZOACEAE	Least Concern	PNCO
14. <i>Ruschia orientalis</i>	AIZOACEAE	Least Concern	PNCO
15. <i>Ruschia tenella</i>	AIZOACEAE	Least Concern	PNCO
16. <i>Ruschia uncinata</i>	AIZOACEAE	Least Concern	PNCO
17. <i>Pachypodium bispinosum</i>	APOCYNACEAE	Least Concern	PNCO
18. <i>Psilocalon articulatum</i>	AIZOACEAE	Least Concern	PNCO
19. <i>Sideroxylon inerme</i>	SAPOTACEA	Least Concern	NFA
20. <i>Trichodiadema decorum</i>	AIZOACEAE	Least Concern	PNCO

Plate 2. Photographic images of the protected species on site.

PROTECTED BY THE NATURE AND ENVIRONMENTAL CONSERVATION ORDINANCE (19 OF 1974) AND NATIONAL FOREST ACT (84 OF 1998)



Aloe africana



Dioscorea elephantipes (Elephants Foot)



Euryops ericifolius – in situ on Farm Wolverton.



Euryops ericifolius – sample taken for accurate identification at the herbarium in Grahamstown.

PROTECTED BY THE NATURE AND ENVIRONMENTAL CONSERVATION ORDINANCE (19 OF 1974) AND NATIONAL FOREST ACT (84 OF 1998)



Delosperma ecklonis (white)



Delosperma ecklonis (pink)



Delosperma ecklonis (orange)



Drosanthemum hispidum



Lampranthus lavisii



Malephora lutea



Maerua stricta



Mesembryanthemum aitonis (very common, weedy pioneer)

PROTECTED BY THE NATURE AND ENVIRONMENTAL CONSERVATION ORDINANCE (19 OF 1974) AND NATIONAL FOREST ACT (84 OF 1998)



Ruschia sp.



Ruschia orientalis



Pachypodium bispinosum



Sideroxylon inerme



Trichodiadema decorum



Psilocaulon articulatum

PROTECTED BY THE NATURE AND ENVIRONMENTAL CONSERVATION ORDINANCE (19 OF 1974) AND NATIONAL FOREST ACT (84 OF 1998)



Drimia altissima (Photograph from previous assessment)

4.3. LAND COVER, LAND USE ACTIVITIES AND ASSOCIATED LAND USE IMPACTS

4.3.1. Land Cover Patterns on Farm Wolverton

Currently land cover on Farm Wolverton is largely natural to near-natural land cover i.e. Thicket vegetation (Figure 13). A relatively small portion of the farm is modified due to access tracks, powerline servitudes, small clearings and the deposition of sediment (sludge), which is discharged from the Nelson Mandela Bay Municipal wastewater treatment works. In addition, a limestone borrow pit is situated adjacent thereto and some clearing has taken place to expand the limestone borrow pit. According to the Applicant, rehabilitation of the borrow pits will be undertaken after usage.

Approximately 98 % of the farm is natural to near-natural and the remaining ~2 % is modified. Refer Figure 13 and Table 8 below for the land cover map and statistics.

The pipeline route will follow existing access tracks (irreversibly modified land) for the most part and will be aligned with modified and degraded land cover. The degraded area is along the eastern extreme of the route (see Plate 2).

Current land use is wildlife grazing and game viewing. Fences have been removed between the adjacent properties, where another Environmental Impact Assessment is being conducted, referred to as 'Addo Big 5 Game Reserve'. Both indigenous and extra limital fauna are stocked on the property, and these adjacent properties (which measure approximately 3 999ha in extent) (Figure 14). According to the project Applicant, game were previously stocked on the farm, and since the change in land ownership, which resulted in reduced stocks, an improvement in the land has been observed. This can be confirmed by the large, dense stands of *Themeda triandra* on various portions of the farm. *T. triandra* usually decreases when over-grazing occurs.

Table 8. Land cover on Farm Wolverton

Description	Land Cover	Describe Land Cover	Hectare (Ha)	Hectare (ha) & Percentage (%)
Koedoeskloof Karroid Thicket	Irreversibly Modified	Solar panels and road	0,27	<i>Modified:</i> 5.69ha 1.6%
Sundays Valley Thicket	Irreversibly Modified	Road and powerline servitude	0,46	
Sundays Valley Thicket	Irreversibly Modified	Dam unlikely to be rehabilitated	0,29	
Sundays Valley Thicket	Irreversibly Modified	Clearing powerline unlikely to be rehab	0,17	
Koedoeskloof Karroid Thicket	Irreversibly Modified	Clearing powerline unlikely to be rehab	0,18	
Sundays Valley Thicket	Irreversibly Modified	Road servitude unlikely to be rehab	0,54	
Koedoeskloof Karroid Thicket	Reversibly Modified	Borrow pit and selective clearing and bulldozing	3,78	
Koedoeskloof Karroid Thicket - High Limestone	Near-Natural	Natural to near-natural	27,65	<i>Near-Natural:</i> 356.31ha 98.4%
Sundays Valley Thicket	Near-Natural	Natural to near-natural	82,23	
Koedoeskloof Karroid Thicket	Near-Natural	Natural to near-natural	246,43	
TOTAL			362,00	

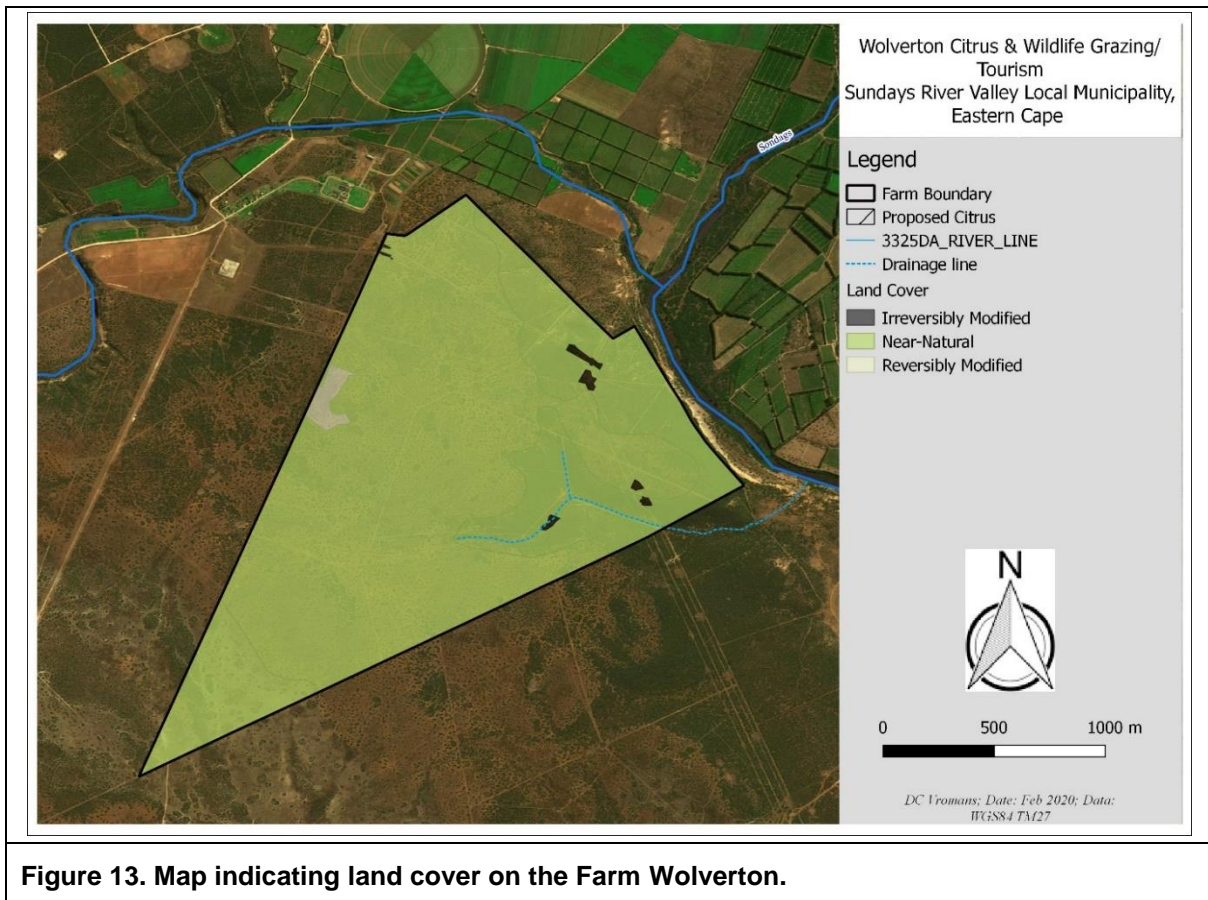


Figure 13. Map indicating land cover on the Farm Wolverton.

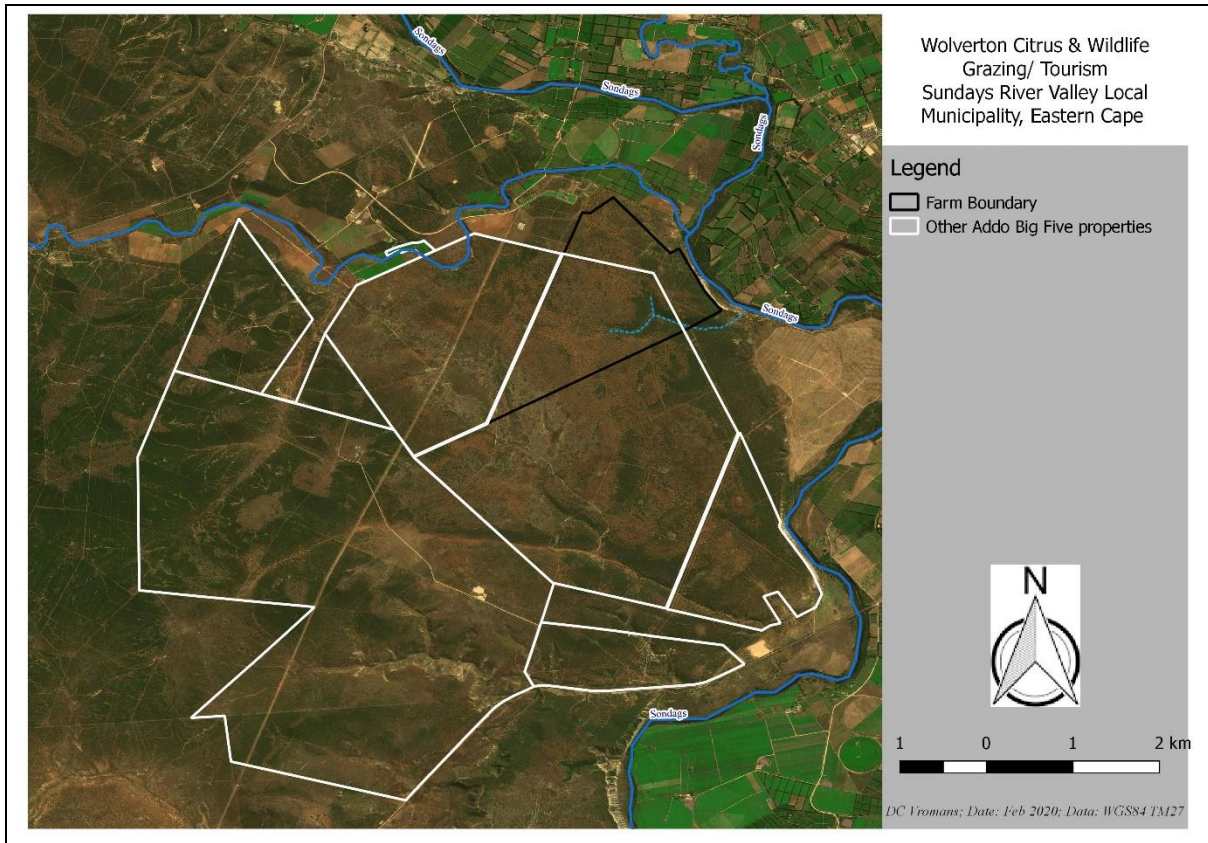


Figure 14. Map indicating the wildlife grazing area on Farm Wolverton and adjacent properties representing Addo Big 5 Game Reserve.

4.3.2. Land Cover Patterns within the Larger Catchments

Motivation for consulting catchment land cover

Consulting the catchment data allows one to assess cumulative impacts at the strategic level, noting that quaternary catchments are the basic unit for water use management in South Africa. The land cover data is consulted at sub-quaternary catchment level in order to relate to the ECBCP transformation thresholds per sub-quaternary. It relates to both vegetation and aquatic impacts; namely how much vegetation (ha) can be removed within a catchment before it impacts on rivers and wetlands. Thus, it provides a measure of the limits to vegetation removal and the potential impact on the aquatic resources. It is therefore required, according to the author (of this report), that it should be assessed in both the vegetation and aquatic assessments.

Source of land cover data

These statistics were derived from the land cover maps metadata generated for the Sundays River Valley Critical Biodiversity Area (SRV CBA) Map (Skowno and Holness, 2012) and the Nelson Mandela Bay land cover map (Stewart, 2009). The National Land Cover Map (DEA, 2013) has been presented for comparison purposes. The former maps however were done at a finer scale and are used in the calculations. That said, the differences are minimal.

It must be noted however, that the data are likely to be under-estimates due to being out-dated and not fully ground-truthed. Only a small portion of the Nelson Mandela Bay data was used in the lower portion of the catchment, which is mostly natural to near-natural land cover. It should also be borne in mind that the Sundays River Valley is undergoing or has undergone several environmental impact assessment

processes due to the growing citrus economy in the region. Consequently, land cover patterns will change.

N40E quaternary catchment data

From a cumulative perspective, approximately 13.2 % of the quaternary catchment N40E (which is the basic unit for water use management in South Africa) has been modified, while 23.8 % is degraded (Table 9; Figure 15).

On Farm Wolverton, approximately **25 ha** of vegetation will need to be cleared; or ~6.9% of the farm. This would increase the total modified area of the quaternary catchment N40E to 13.26 % (Table 9), from 13.21 %.

Bear in mind that this does not reflect potential future cumulative loss in the catchment, which cannot be accurately determined without the relevant data. However, the Sundays River Valley CBA Map (Section 4.4 below) designates much of the catchment as CBA and ESA (Figure 7), **which was incorporated into the municipal Spatial Development Framework⁴ and Integrated Development Plan. The CBA Map attempts to avoid significant cumulative loss of biodiversity.**

Table 9. Land cover statistics for quaternary catchment N40E (GIS metadata Sundays River Valley and Nelson Mandela Bay land cover data)

Land Cover	Hectares	Percentage	Proposed 25ha Agriculture (Ha)	Proposed 25ha Agriculture (%)
Natural	32,118.08	62.97	32,093.08	62.92
Degraded	12,150.64	23.82	12,150.64	23.82
Modified/Transformed	6,740.52	13.21	6,765.52	13.26
TOTALS	51,009.24	100.00	51,009.24	100.00

Sub-quaternary catchments data

The land cover statistics for the western sub-quaternary catchment indicates that approximately 5.31% has been modified whereas 16 % of the eastern sub-quaternary catchment has been modified (Table 10, Figure 16).

Approximately 19.7 ha is proposed for citrus in the western catchment, and the remaining 6.3 ha is required in the eastern catchment. Thus, the percentage modified is raised from 5.3 % to 5.5 % (western) and from 16.1 % to 16.7 % (eastern catchment). Note that the eastern sub-quaternary catchment is substantially smaller in extent compared with the western sub-quaternary catchment.

Table 10. Land cover statistics for the western and eastern sub-quaternary catchments of N40E (GIS metadata Sundays River Valley land cover data)

Land Cover	Hectares	Percentage	Proposed Agriculture (ha)	Proposed Agriculture (%)
WESTERN SUB-QUATERNARY CATCHMENT			Additional 19.7ha citrus	
Natural	8,013.35	90.65	7,993.65	90.43
Degraded	357.25	4.04	357.25	4.04

⁴ As part of a SANParks biodiversity project, the Sundays River Valley Biodiversity Sector Plan was submitted to independent town planning consultants for the revision of the Spatial Development Framework and assistance provided with incorporation into the IDP (in 2012).

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Land Cover	Hectares	Percentage	Proposed Agriculture (ha)	Proposed Agriculture (%)
Modified	469.17	5.31	488.87	5.53
TOTALS	8839.77	100.00	8,839.77	100.00
EASTERN SUB-QUATERNARY CATCHMENT			Additional 6.3 citrus	
Natural	832.02	75.59	825.72	75.02
Degraded	90.81	8.25	90.81	8.25
Modified	177.89	16.16	184.19	16.73
TOTALS	1,100.72	100.00	1,100.72	100,00

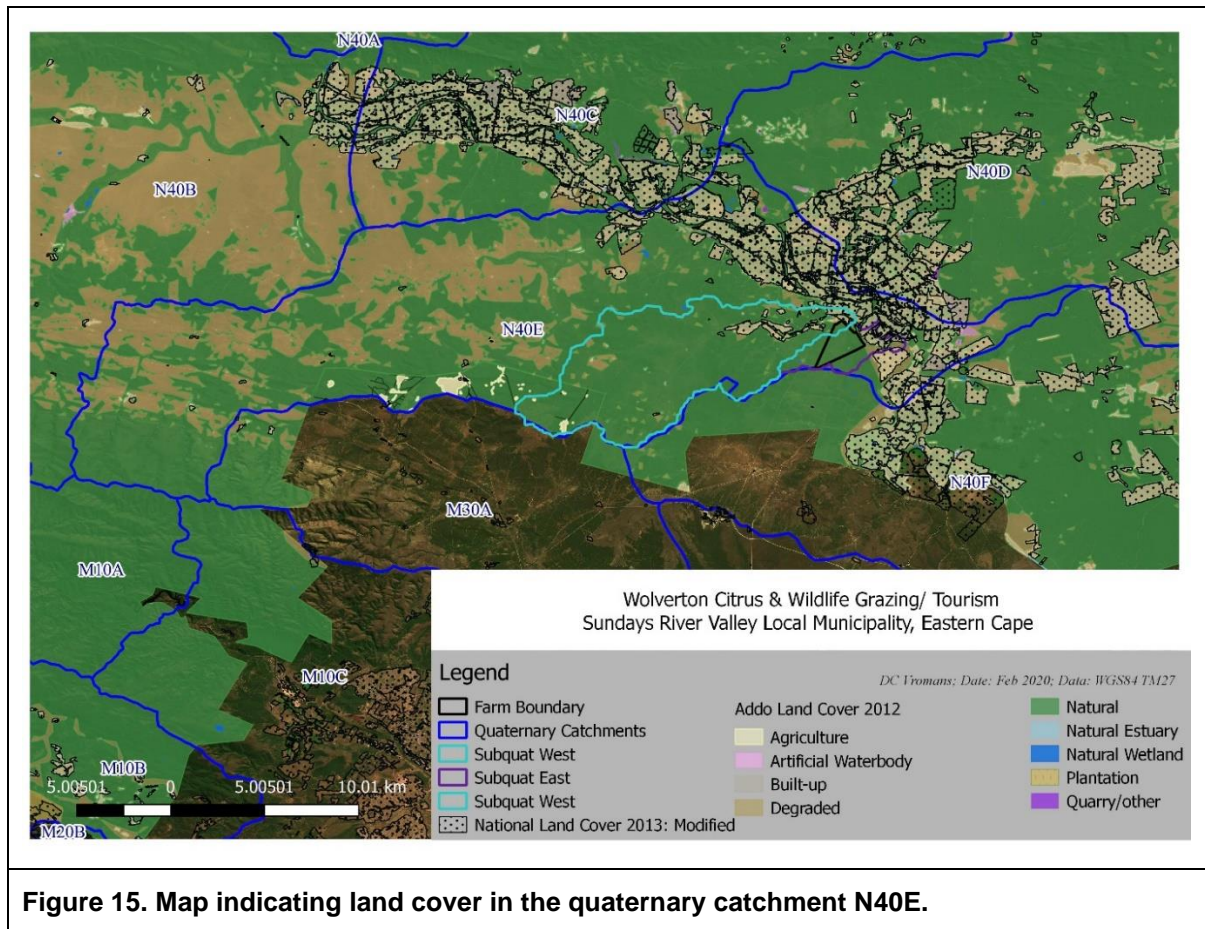


Figure 15. Map indicating land cover in the quaternary catchment N40E.

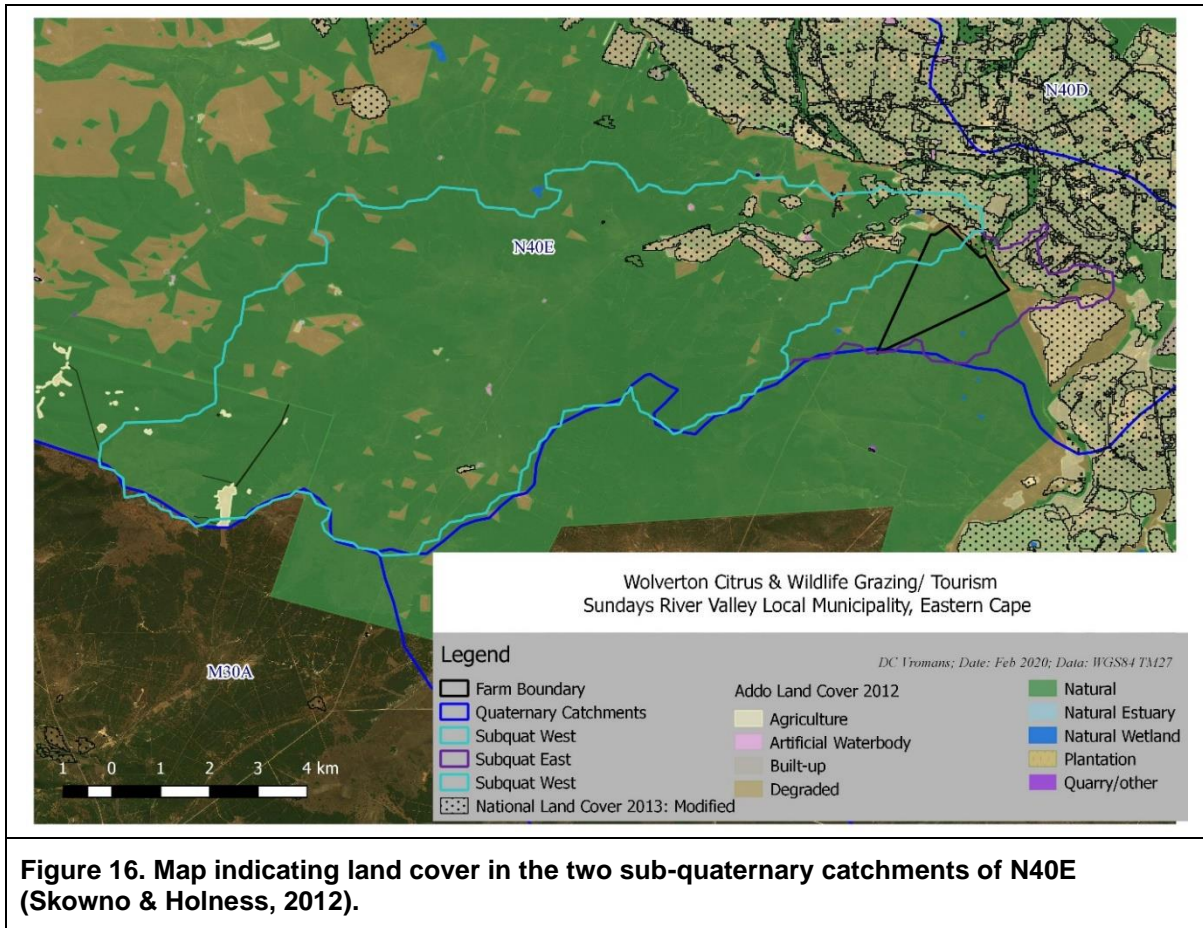


Figure 16. Map indicating land cover in the two sub-quaternary catchments of N40E (Skowno & Holness, 2012).

4.4. RESULTS: CRITICAL EVALUATION AND SITE VERIFICATION OF CBA MAPS

4.4.1. Critical evaluation of the SRV CBA Map based on site observations

Based on the site survey and assessment, there were no reasons to conclude that the entire farm should have been mapped as a Critical Biodiversity Area or Ecological Support Area. Refer to Section 4.6 for the ecologically sensitive areas, which largely include buffer areas around the Sundays River (or ESAs), the 1:50 000 drainage area and associated slopes and the biodiversity no-go area to the south-west.

4.4.2. Critical evaluation of the ECBCP CBA Map based on site observations

Based on the finer detail or improved accuracy of the SRV CBA Map (1:20 000), and the fact that it took into consideration, to some degree, the requirement for agriculture in the region (see statement below), the SRV CBA Map is considered the more accurate CBA Map.

The ECBCP CBA Map (2007) is very land hungry, especially for large CBA 2. The SRV CBA Map aimed to refine the ECBCP and thus ‘shuffled’ the CBA into a slightly more optimal footprint (especially in terms of corridors and linkages), while retaining targets. Consequently, there was a fair amount of rationalisation and alignment with what was happening in the landscape (Pers. Comm. Dr S. Holness, Systematic Conservation Planner).

Conclusion

Only those areas that were considered to be accurately mapped as CBA and ESA in the SRV CBA Map, are considered correct, based on the criteria (Section 3.3.1), i.e. vegetation type and threatened status, process areas (aquatic buffers) and land cover condition, which were verified during the site assessment. **The Ecological Support Area along the eastern/ north-eastern boundary were however more logically re-shaped to follow the topography and thus the small kloofies were incorporated into the ESA (Refer Figure 17).**

4.5. COMBINED RESULTS: ECOLOGICALLY SENSITIVE AREAS, BIODIVERSITY NO-GO AREAS AND BIODIVERSITY OFFSETS

Ecologically sensitive areas, biodiversity No-Go areas and biodiversity offsets were identified based on both the vegetation and the aquatic assessments, which also included an evaluation of the CBA Maps (Sections 4.4 above).

Ecological sensitivity and biodiversity No-Go areas were determined using the criteria described in Table 11 below. Refer to Figure 17 for the ecologically sensitive areas relative to the Farm.

Table 11. Criteria used to determine ecologically sensitive areas

CRITERIA	RECORDED DURING THE SITE ASSESSMENT
1. Wetlands & associated buffers	<ul style="list-style-type: none"> No presence of wetlands on the farm, only salt marsh along the Sundays River and to the east of the eastern boundary. Distances from the proposed development are from 300 m to 1.5 km. These are all at effective distances or positions in the landscape to prevent potential impacts from taking place (see Aquatic Specialist Report and Figure 17 below). Riverine wetland along the un-named river, at the existing water off-take point of the water supply pipeline. A buffer is therefore not applicable.
2. Watercourse areas (includes streams and 1:50 000 drainage areas) and associated riparian & buffer areas	<ul style="list-style-type: none"> 1 drainage area dissects the farm to the south, but the proposed agricultural areas avoid the drainage area, the steep valley slopes and the ECBCPs 32 m buffer (although notably it is not a typical stream, but rather a drainage area that would therefore not apply). The proposed citrus is ~636 m away and potential stormwater run-off will drain in the opposite direction. The steep slopes associated with the drainage area are ecologically sensitive areas, but are not mapped, rather the contours are shown, as these areas fall far beyond the proposed citrus orchards. The Sundays River and tributary riparian areas fall outside of the farm boundary however, an Ecological Support Area 'buffer area' as indicated in the Sundays River Valley CBA Map should apply (see below).
3. CBAs and ESAs (includes special/ threatened habitats)	<ul style="list-style-type: none"> Ecological Support Area (ESA) (500m 'natural buffer' beyond the Sundays River and tributary, which also fall within the farm boundary). The Sundays River and its tributary (at the off-take point only) are CBA. The ESA and CBA along the north-eastern / eastern boundary can act as a natural corridor (although fencing will restrict larger fauna).
4. High conservation value areas due to high species diversity,	<ul style="list-style-type: none"> <i>Refer below i.e. presence of rare species.</i>

CRITERIA	RECORDED DURING THE SITE ASSESSMENT
unique species, rare species etc.	
5. Presence of threatened species of conservation concern (Critically Endangered, Endangered, Vulnerable, Rare)	<ul style="list-style-type: none"> • <i>Euryops ericifolius</i>, an Endangered shrublet was recorded in the south-western portion of the farm, falling outside of the proposed agricultural area. A no-go area is indicated on Figure 17 in the vicinity of these plants. • <i>Note that this species occurs fairly widely outside of the farm boundaries, in fairly extensive patches.</i> • <i>Dioscorea elephantipes</i> (Elephants Foot) was recorded, and according to the Applicant, there are 6 known individuals on the farm. All individuals fall outside of the agricultural footprint. The position of the <i>D. elephantipes</i> were not provided as these will be avoided. The project Applicant is investigation placing microchips in the plants for protection (Personal comments received in 2015).
6. Biodiversity Target Areas	<ul style="list-style-type: none"> • The biodiversity targets (19%) of both vegetation types are exceeded. See explanation below (Table 12 and 13).
7. Degree of intactness of the vegetation cover	<ul style="list-style-type: none"> • The Farm is mostly in a good condition.
8. Avoiding conflicting land uses i.e. avoiding areas not suitable for citrus/ crop production (e.g. steep soils, slopes)	<ul style="list-style-type: none"> • Steep slopes particularly along the drainage line and the Sundays River should not be cultivated. • These have not been indicated as steep slopes/ ecologically sensitive areas on the sensitivity map (Figure 17) as they are <u>not</u> proposed to be cultivated or are covered by the CBA and ESA above. The available 5 m contours however are shown, which demonstrate the steeper inclines.
9. Consolidating agricultural areas proximate to the existing cultivated areas; but avoiding hydrological process areas and potential corridor areas.	<ul style="list-style-type: none"> • Existing cultivation does not occur on the Farm. • However, modification of land cover has occurred to the north of the Farm. The proposed citrus is adjacent to this. • Limited citrus is proposed on the farm, and thus the farm can continue to act as a wildlife corridor, especially since fencing has been removed between adjacent properties.

4.5.1. Biodiversity Target and Biodiversity No-Go Areas: Explanation and Calculations

The biodiversity target for Sundays Valley Thicket is 19 % (15.9 ha); and for Koedoeskloof Karroid Thicket it is 19 % (52.9 ha) (Refer Table 12). Therefore, at minimum, these targets should be retained on the property.

The proposed development will clear near-natural vegetation covering approximating 25⁵ha. After clearing, the remaining Sundays Valley Thicket will be ~86.7 % (72.58 ha) and for Koedoeskloof Karroid Thicket, roughly 93 % (258.73 ha) (Table 13). The recommended biodiversity targets (15.9ha and 52.9ha) are therefore exceeded, meaning much more extensive areas (or target areas) will be retained post-development.

The south-western portion of the farm (~27.6ha), where there is surface limestone that supports the Endangered plant, is a recommended biodiversity No-Go area. This area represents 6.7 % of the property.

The total area of the property that will not be developed measures ~336.9 ha or 93 %.

⁵ Although a small amount of vegetation has historically been cleared in the proposed citrus area, for access roads etc., the 25ha has been retained as a worse-case scenario.

Table 12. Original extent of vegetation types supported on the Farm pre-transformation, with approximate area (hectares and percentage), including the required biodiversity targets (hectares and percentage).

Vegetation Type	Original Extent (natural) (ha)	Currently Modified (ha)	Current Extent (Natural) (ha)	National Biodiversity Target (%)	Biodiversity Target of Original Extent (ha)
Sundays Valley Thicket (Sundays Spekboom Thicket)	83,69	1,46	82,23	19	15,9
Koedoeskloof Karroid Thicket	278,31	4,23	274,08	19	52,9
TOTAL	362	5,7	356,3	38,0	68,8

Table 13. Remaining vegetation (hectares and percentage) post agriculture for the proposed development

Vegetation Type	Original Extent (natural) (ha)	Current Extent (ha)	Proposed to be cleared that is Near-Natural (ha)	Remaining Extent that is Near-Natural (ha)	Remaining Extent that is Near-Natural (%)
Sundays Valley Thicket (Sundays Spekboom Thicket)	83,69	82,23	9,65	72,58	86,7
Koedoeskloof Karroid Thicket	278,31	274,08	15,35	258,73	93,0
TOTAL	362	356,31	25	331,31	91,5

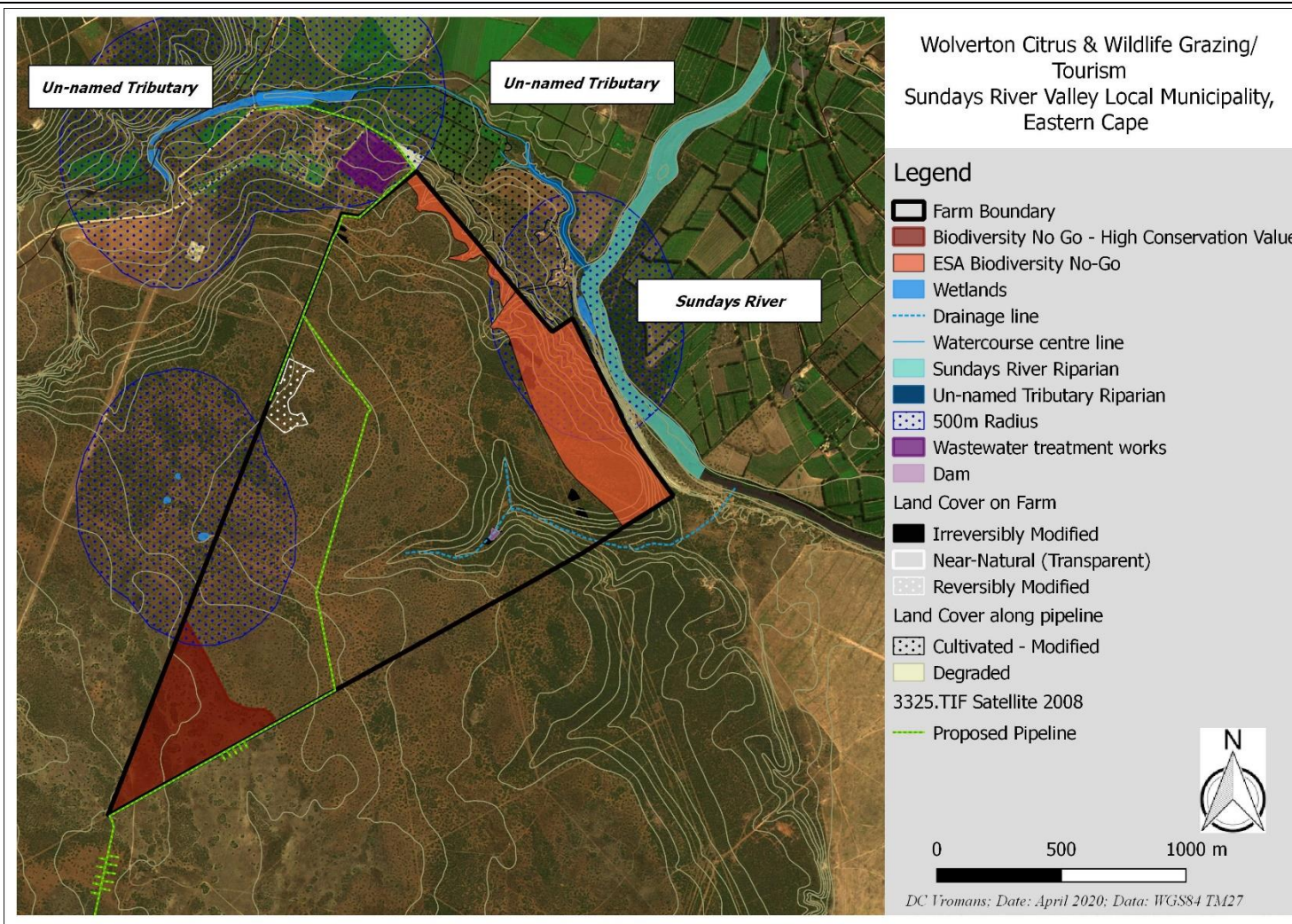


Figure 17. Ecologically Sensitive Areas or Biodiversity No-Go Areas on Farm Wolverton. The 500m radius from a wetland is also shown. (Note: There are six known locations of the Declining *Dioscoreae elephantipes*, which have not been mapped as sensitive areas, however the proposed citrus footprint avoids this species. The steep slopes along the drainage line are also sensitive areas, but are not mapped, rather the contours shown, as these areas fall far beyond the proposed citrus orchards).

5. SECTION 5: LEGISLATIVE CONTEXT

The key legislation that triggered the ecological assessment, including vegetation and aquatic surveys, is the National Environmental Management Act (107 of 1998) and the National Water Act (36 of 1998), respectively.

The National Water Act (36 of 1998) guided the delineation of potential wetlands and riparian habitat; or the vegetation associated with these habitats. Refer to the Specialist Aquatic Assessment report for the detail in this regard.

A summary of the relevant legislation that relates to potential ecological impacts that may accrue from the proposed development:

LEGISLATION AND OBJECTIVE	LEGISLATIVE IMPLICATIONS FOR THE PROPOSED DEVELOPMENT
<p>THE CONSTITUTION (108 OF 1996)</p> <p>The South African Constitution is the supreme law of the land and ensures that: '<i>... everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected for the benefit of present and future generations.</i> It requires that development is sustainable.</p>	<p>Measures must be implemented that 1) prevent pollution and ecological degradation; 2) promote conservation; and 3) secure ecologically sustainable development and use of natural resources, while promoting justifiable economic and social development'.</p>
<p>NATIONAL WATER ACT (NWA) 36 OF 1998</p> <p>The NWA is concerned with the overall management, equitable allocation and conservation of water resources in South Africa. It controls and manages water use in terms Section 39 General Authorisation (GA) regarding water abstraction from a natural water resource 21(a), water storage 21(b), wastewater discharge and irrigation 21(e, f, g, h), impact on watercourses, altering or altering a watercourse 21(c and i) and the determination of the Reserve. The GA determines registration or licensing requirements.</p> <p>A Water Use Licensing Application (WULA) or GA is processed where a proposed development lies within 500m of wetland habitat or within 100m of a river (watercourse) (in the absence of a 1:100 year flood line and delineated riparian area), in terms of Section 21(c) (impeding or diverting flow in a watercourse) and 21(i) (altering the beds and banks etc. of a watercourse).</p> <p>A WULA is usually processed for the taking and storage of >2 000m³ of surface water in the N-Catchment (Sundays River Catchment) (Section 21(a) and (b)),</p>	<p>Measures must be implemented that prevent pollution and ecological degradation of aquatic resources i.e. rivers and wetlands. No wetlands occur on the farm, while the Sundays River lies to the east.</p> <p><u>Section 21ic & 21i:</u> Refer to the Aquatic Assessment. Salt marsh wetland lies within 500 m of the proposed citrus orchards. Three wetlands lie within 500 m of the north-western boundary of the farm, but beyond 500 m of any new infrastructure. <i>Refer to the Specialist Aquatic Assessment report for the detail in this regard.</i></p> <p><u>Section 21ia & 21b:</u> Refer to the Aquatic Assessment. There are no proposed dams (Section 21b). However, the proposed project requires water supply, which is under an existing water use entitlement that involves a water transfer (Section 21a). An approved</p>

LEGISLATION AND OBJECTIVE	LEGISLATIVE IMPLICATIONS FOR THE PROPOSED DEVELOPMENT
<p>even if via the irrigation canal and not a local river source (as per other similar agricultural applications).</p> <p>Section 144: For the purposes of ensuring that all persons who might be affected have access to information regarding potential flood hazards, no person may establish a township unless the layout plan shows, in a form acceptable to the local authority concerned, lines indicating the maximum level likely to be reached by floodwaters on average once in every 100 years. In other words, the developer must delineate the 1:100-year flood line on a map when establishing a township.</p> <p>Section 4.13: Wastewater storage dams and wastewater disposal sites must be located - (a) outside of a watercourse; (b) above the 100-year flood line, or alternatively, more than 100m from the edge of a water resource or a borehole which is utilised for drinking water or stock watering, whichever is further; and (c) on land that is not, or does not, overlie, a major aquifer (identification of a major aquifer will be provided by the DWS upon written request).</p>	<p>water transfer from another property needs to be provided to the Department. This is usually in the form of a letter from the Lower Sundays River Water User Association indicating the source of water (property), water volume and where (property) the water will be used. It should be a permanent transfer, and if not, this will likely require a additional documentation as part of the application to DWS. The associated water use entitlement documentation must be provided.</p> <p>The water use proposal is as follows: Wicklow Trust (Mr Rennie Price), has water use rights at the proposed take off point, however, Wicklow's account indicates that there are no spare water use entitlements in reserve. DJ Bouwer's (the Applicant for this EIA) water use account indicates that there is water use entitlements in reserve. Therefore Wicklow and DJ Bouwer will reach an agreement, where DJ Bouwer will transfer the water use entitlements in reserve to Wicklow for the purposes of the proposed citrus development and in return a portion of Wicklow's capacity at the take off point, will transferred to DJ Bouwer for the purposes of irrigating land for wildlife stocked (irrigated areas are not located on Farm Wolverton but on adjacent land). Confirmation of this will be required in writing from the LSRWUA. Written confirmation is required from a qualified specialist for the water requirements for the irrigation of the grazing land.</p> <p>Section 21g: Waste storage and disposal sites and township developments are not components of this application.</p>
<p>NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA) 107 OF 1998</p> <p>The NEMA provides for overarching principles that should inform South Africa's environmental management and governance. The NEMA is mainly regarded as a reasonable legislative measure required from the State in order to fulfil the environmental right (Section 24) of the Constitution. It requires development to be socially, environmentally and economically sustainable. The Environmental Impact Assessment (EIA) Regulations, gazetted in terms of Section 24, trigger an authorisation process for certain activities.</p>	<p>The activity requires an Environmental Impact Assessment (EIA). Refer to the EIA Report for the listed activities.</p> <p>This report serves to inform the process.</p>
<p>NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (NEMBA) 10 OF 2004</p>	<p>The ECBCP is a precursor to a bioregional plan. It is a systematic biodiversity plan which has been adopted by the competent authority (DEDEAT) and thus triggers listed activities which require assessment and Environmental Authorisation. All proposed developments should consider</p>

LEGISLATION AND OBJECTIVE	LEGISLATIVE IMPLICATIONS FOR THE PROPOSED DEVELOPMENT
<p>The Act provides for the protection of listed endangered ecosystems and restricts activities according to the categorization of the area (not just by listed activity as specified in the Environmental Impact Assessment regulations). It promotes the application of appropriate environmental management tools to protect biodiversity. Chapter 3 allows for the publication of bioregional plans. Chapter 5 of the Act refers to the introduction and control of alien invasive species. The Threatened or Protected Species Regulations, in terms of Section 97 (Chapter 8), requires an authorisation process to be followed.</p>	<p>the ECBCP. The majority of the farm is classified as Other Natural Area, whereas a portion to the north is CBA 2 (ecological corridor). (Section 3.2.1 and 4.4). The associated sub-quaternary catchments are Aquatic CBA 2.</p> <p>The SRV CBA Map is a precursor to a bioregional plan and should supersede the ECBCP as it is a more detailed (finer scale) and more up-to-date map of biodiversity (that is based on the ECBCP systematic plan). Furthermore, it is being integrated into the revision of the 2007 ECBCP. The only modifications to the SRV CBA Map will involve updating the land cover (Pers. Comments: Dr P Desmet). This would however need to be verified. Therefore, any natural habitat that has been removed should be reflected as such in the revised ECBCP. As a result, the SRV CBA Map should be consulted to inform decision-making. The site does not fall within a CBA, while ESA have been demarcated along the north-eastern boundary. The south-western corner is assessed as a CBA (or no-go area) in terms of this assessment (Section 4.6) due to the area supporting an Endangered species.</p> <p>Any threatened or protected species cannot be removed without an authorisation. No NEMBA species were found.</p> <p>Alien species invasion should be controlled. <i>Cirsium vulgare</i>, <i>Datura ferox</i> and <i>Opuntia ficus-indica</i> were found on site (Section 4.3).</p>
<p>NATIONAL FORESTS ACT (NFA) 84 OF 1998</p> <p>Any area that has vegetation that is characteristic of a closed and contiguous canopy is defined as a 'forest' and as a result falls under the authority of the Department of Forestry. The removal of any indigenous or protected trees or clearing of any woodland, thicket or forest requires a permit.</p>	<p>Numerous <i>Sideroxylon inerme</i> (Milkwood) were recorded on site, which will require a license to be removed (Section 4.3.2).</p>
<p>CAPE NATURE AND ENVIRONMENTAL CONSERVATION ORDINANCE (19 OF 1974)</p>	

LEGISLATION AND OBJECTIVE	LEGISLATIVE IMPLICATIONS FOR THE PROPOSED DEVELOPMENT
<p>The Ordinance allows for conservation of the natural environment; and the protection of wildlife. Certain biota are scheduled and therefore protected. A permit must be obtained from Department of Economic Development, Environment Affairs and Tourism (DEDEAT), Provincial Environment Affairs (Biodiversity Unit), to remove or destroy any plants listed in the Ordinance.</p>	<p>Several protected species were recorded, which will require a license to be removed (Section 4.3.2).</p>
<p>ENVIRONMENT CONSERVATION ACT (ECA) 73 OF 1989</p> <p>Section 20 of the Act requires for the appropriate disposal of waste and licensed waste disposal site, although any new waste licenses are subject to approval via the National Environmental Management: Waste Act (NEMWA).</p>	<p>All wastes (general and hazardous) generated should be disposed of at an ECA licensed waste disposal site, if applicable, by the contractor/developer. "If applicable" - because: In terms of Section 81 of the NEMWA, permits issued in terms of ECA Section 20 are still valid unless a NEMWA permit has been requested by the Authority. If so, the licensed site will be NEMWA licensed.</p> <p>Waste disposal is not a component of the application, although any waste generated via agricultural activities should comply with any required storage and disposal mechanisms. For example: hazardous and chemical wastes (includes empty containers) should be disposed of at registered landfill sites; and not buried or burnt on site.</p>
<p>NATIONAL ENVIRONMENTAL MANAGEMENT: PROTECTED AREAS ACT (NEMPA) 57 OF 2003</p> <p>The Act provides for the declaration of Protected Areas (PAs) in three forms (Chapter 3), namely Special Nature Reserves (Part 2), Nature Reserves (Part 3) and Protected Environments (Part 4). National Parks are the equivalent of National Protected Areas. Section 10 states that a Protected Area, declared in terms of provincial legislation, is either a nature reserve or protected environment.</p>	<p>The Addo Elephant National Protected Area (AENP), a formal protected area, is sited approximately 6 km to the north-east, therefore comment from SANParks is required.</p> <p>South African National Parks has a vested interest in the expansion of Protected Areas in terms of the National Protected Area Expansion Strategy, however, the site does not fall within a focus area for expansion. (Section 3.3.4). It does however fall within the Viewshed Protection Area in terms of the AENP Buffer Zones (See Section 3.3.5).</p>
<p>CONSERVATION OF AGRICULTURAL RESOURCES ACT (CARA) 43 OF 1983</p>	

LEGISLATION AND OBJECTIVE	LEGISLATIVE IMPLICATIONS FOR THE PROPOSED DEVELOPMENT
<p><i>[to be replaced by the Sustainable Use of Agricultural Resources Bill]</i></p> <p>Section 6 of the Act, relates to the prescription of measures which all land users have to comply with, e.g. the prohibition of modifying run-off flow patterns; the control of invader plants; and the restoration of eroded land. Section 7 protects any vleis, marsh, water sponge or watercourse.</p> <p>A list of alien invasive species has been regulated.</p>	<p>This Act applies to the proposed cultivation site as an agricultural application. An agricultural permit will be required to cultivate virgin soil.</p> <p>The NEMA and NWA also effectively deal with the potential impacts of proposed developments in relation to erosion, alien invasive plants and impacts on aquatic resources. No wetland will be ploughed but a 1:50 000 drainage area occurs to the south of the property. It will not be impacted on or ploughed.</p> <p>Alien invasive plants occur on site e.g. <i>Opuntia ficus-indica</i>, <i>Cirsium vulgare</i>, <i>Datura indica</i>. These should be removed and their spread controlled (Section 4.3).</p>

6. SECTION 6: ECOLOGICAL RISK/IMPACT ASSESSMENT

6.1. IMPACT ASSESSMENT METHODOLOGY

Issues were assessed in terms of the following criteria:

CRITERIA	CATEGORIES	EXPLANATION
Overall nature	Negative	Negative impact on affected biophysical or human environment.
	Positive	Benefit to the affected biophysical or human environment.
Type	Direct	Are caused by the action and occur at the same time and place.
	Indirect Secondary or	Are caused by the action and are later in time or farther removed in distance; but are still reasonably foreseeable. May include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.
	Cumulative	Is the impact on the environment, which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.
Extent: Spatial Extent over which impact may be experienced (E)	Site (1)	Immediate area of activity incorporating a 50m zone which extends from the edge of the affected area.
	Local (2)	Area up to and/or within 10km of the 'Site' as defined above.
	Regional (3)	Entire community, drainage basin, landscape etc.
	National (4)	South Africa.
Duration of impact (D)	Very Short-term (1)	Impact would last for the duration of activities such as land clearing, land preparation, fertilising, weeding, pruning and thinning. Quickly reversible. (0–1 years).
	Short-term (2)	The lifetime of the impact will be of a short duration (2-5 years).
	Medium-term (3)	Impact would last for the duration of project activity, such as harvesting. Reversible over time (>5 - <15 years).
	Long-term (4)	Impact would continue beyond harvesting/ extraction of the trees (> 15 years).
	Permanent (5)	Impact would continue beyond decommissioning.
Severity (S)	Negative	Based on separately described categories examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning or slightly alters the environment itself. <ul style="list-style-type: none"> • 0 is small and will have no meaningful effect on the environment; • 2 is minor and will not result in an impact on processes; • 4 – 5 is low and will cause a slight impact on processes;
	Positive	

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CRITERIA	CATEGORIES	EXPLANATION
		<ul style="list-style-type: none"> • 6 is moderate and will result in processes continuing but in a modified way; • 8 is high (processes are altered to the extent that they temporarily cease); • 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
Reversibility (R)	Completely Reversible (0)	The impact can be completely reversed with the implementation of correct mitigation and rehabilitation measures.
	Partly Reversible (0.5)	The impact can be partly reversed providing mitigation measures are implemented and rehabilitation measures are undertaken
	Irreversible (1)	The impact cannot be reversed, regardless of the mitigation or rehabilitation measures.
Irreplaceable Loss (I)	Resource will not be lost (0)	The resource will not be lost or destroyed provided mitigation and rehabilitation measures are implemented.
	Resource may be partly destroyed (0.5)	Partial loss or destruction of the resource will occur even though all management and mitigation measures are implemented.
	Resource cannot be replaced (1)	The resource cannot be replaced no matter which management or mitigation measures are implemented.
Probability of occurrence (P)	Unlikely (1)	<40% probability. Very improbable (probably will not happen).
	Possible (2)	40% probability. Improbable (some possibility, but low likelihood).
	Probable (3)	>70% probability. Probable (distinct possibility).
	Highly Probable (4)	>80 %. Highly probable (most likely).
	Definite (5)	>90% probability. Definite (impact will occur regardless of any prevention measures).
Mitigation Potential [i.e. the ability to manage or mitigate an impact given the necessary resources and feasibility of application.]	High Completely Mitigatable or	<p>Relatively easy and cheap to manage. Specialist expertise or equipment is generally not required.</p> <p>The nature of the impact is understood and may be mitigated through the implementation of a management plan or through 'good housekeeping'. Regular monitoring needs to be undertaken to ensure that any negative consequences remain within acceptable limits.</p> <p>The significance of the impact after mitigation is likely to be low or negligible.</p>
	Moderate Partially Mitigatable or	<p>Management of this impact requires a higher level of expertise and resources to maintain impacts within acceptable levels. Such mitigation can be tied up in the design of the Project.</p> <p>The significance of the impacts after mitigation is likely to be low to moderate.</p> <p>May not be possible to mitigate the impact entirely, with a residual impact(s) resulting.</p>
	Low Unmitigatable or	<p>Will not be possible to mitigate this impact entirely regardless of the expertise and resources applied.</p> <p>The potential to manage the impact may be beyond the scope of the Project.</p> <p>Management of this impact is not likely to result in a measurable change in the level of significance.</p>
Impact Significance	Negligible (0-26)	Negligible alterations of the environment and can be easily avoided by implementing appropriate mitigation measures.

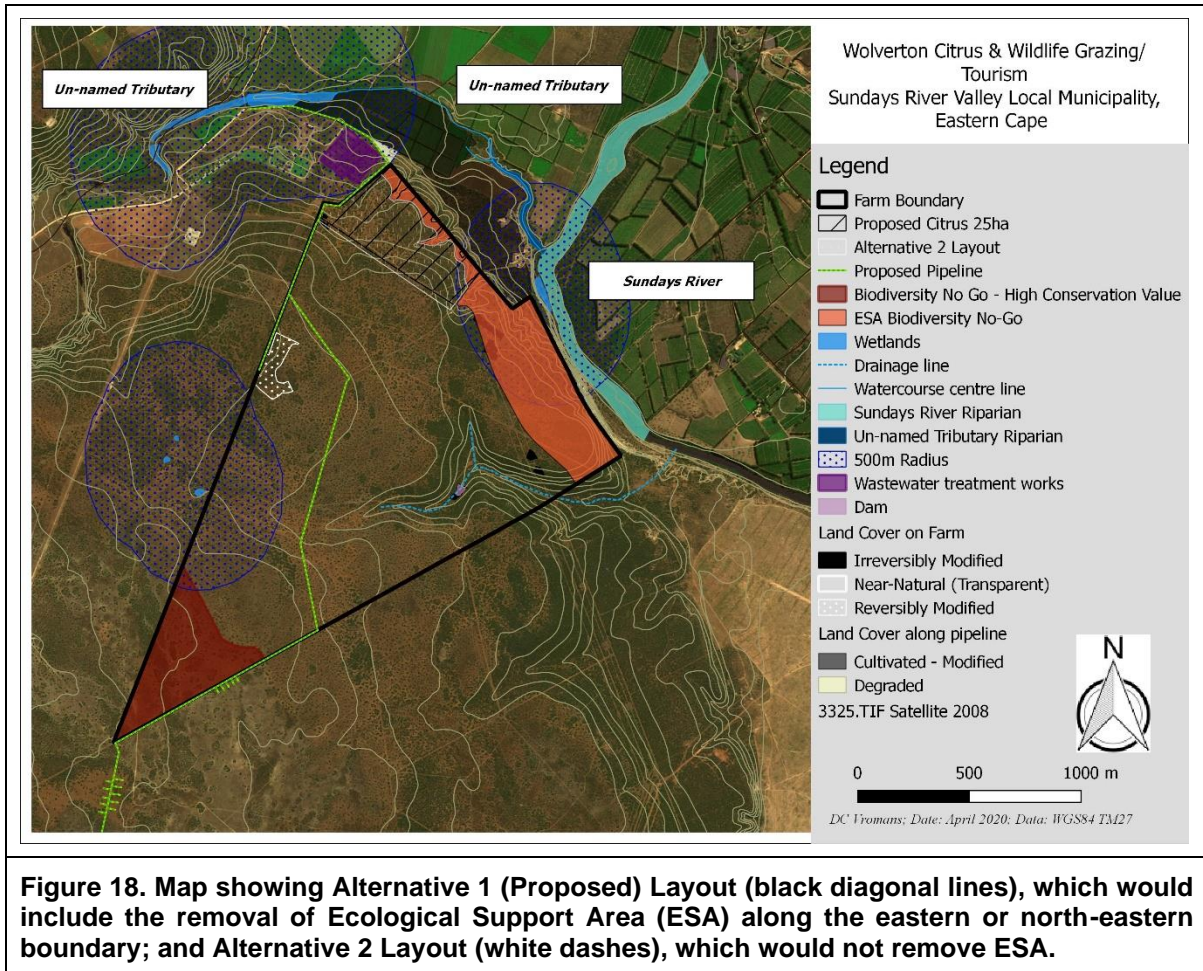
CRITERIA	CATEGORIES	EXPLANATION
[Dur+Ext+R+I+Sev] X Probability	Low (>26-52.5)	Largely of HIGH mitigation potential, <u>after</u> considering the other criteria. Low to very low (the impact/risk may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making)
	Moderate (>52.5 ≤ 78/5)	Largely of MODERATE or partial mitigation potential <u>after</u> considering the other criteria. Medium (the impact /risk will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated).
	Very High/ Significant /Substantial (High) (>78.5 - 105)	Largely of LOW mitigation potential <u>after</u> considering the other criteria. Very high (the impact/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating).

6.2. FINAL PROPOSED PROJECT LAYOUT AND ALTERNATIVES

Two Alternatives are assessed (Figure 18), namely:

- **Alternative 1 Layout:** Alternative 1 layout is that which is proposed by the Applicant. It includes removing a portion of Ecological Support Area along the north-eastern boundary, on sloped land; but excludes the steep slopes of the small kloofies.
- **Alternative 2 Layout:** This is represented in the recommended Biodiversity No-Go Map, which includes the Ecological Support Area along the north-eastern boundary, the high conservation value area to the south-west and the drainage area (with associated steep slopes). The associated steep slopes are not delineated (but the contours shown) as the proposed citrus is at a great distance from the drainage area, i.e. ~ 636 m.

The alternative layouts are presented in Figure 18 below; for ease of reference.



6.3. ASSESSMENT OF IDENTIFIED IMPACTS

Regarding ECBCP Transformation Thresholds

ECBCP transformation thresholds

The ECBCP transformation thresholds for aquatic CBA 2 (A2a & b) were assessed in Section 4.4.2 against the proposed agriculture (25ha). The percentage modification is raised from 5.3 % to 5.5 % (western 2a catchment) and from 16.1 % to 16.7 % (eastern 2b catchment) (See Section 4.3.2, Table 10). This demonstrates that the proposed agriculture, based on the available land cover data, will not result in exceeding the 15 % transformation threshold in the western catchment and the 20 % transformation threshold in the eastern sub-quaternary catchment (Table 10, Section 4.3.2). With respect to the quaternary catchment, modification will be raised from 13.21 % to 13.26 % (Table 9, Section 4.3.2).

These calculations are based on the available land cover data which is probably out-dated. Although it should be noted that much of the western portion of the quaternary catchment is mountainous and less accessible for development purposes, and the Present Ecological State data shows that the Bezuidenhouts River, the major river in the catchment, is Largely Natural (Class B).

It should be noted that the NFEPA Map does not indicate the farm as a priority catchment, which was integrated and 'reflected' in the Sundays River CBA Map, whereas the NFEPA implementation manual states that research indicates that streams in agricultural catchments usually remain in good condition

until the extent of agriculture in the catchment exceeds 30 % - 50 %. (Allan, 2004 cited in Driver et al., 2012). Consequently, the ECBCP Aquatic CBAs or thresholds were not assessed in the impact section below (as it relates to vegetation loss in the catchment and cumulative impacts).

The following impacts were identified and assessed, namely:

IMPACTS	DEVELOPMENT PHASE	DIRECT / INDIRECT
Impact 1: Loss of vegetation and associated habitat due to clearing (biodiversity loss).	Construction	Direct
Impact 2: Potential degradation of vegetation due to over-grazing and over-browsing by stocked wildlife (biodiversity loss)	Operation	Direct
Impact 3: Loss of Ecological Support Area due to clearing (biodiversity loss).	Construction	Direct
Impact 4: Loss of floral species of special concern due to clearing (biodiversity loss).	Construction	Direct

The impacts were assessed as follows:

6.3.1. Impact 1: Loss of vegetation and associated habitat due to clearing

<i>Impact 1 - Loss of vegetation and associated habitat due to clearing</i>		
<p>Nature: The proposed development is comprised of a citrus agricultural development (25 ha/ 6.9% of the property) with associated wildlife viewing (tourism). See Figure 18.</p> <p>Vegetation will therefore need to be cleared on site, removing Koedoeskloof Karroid Thicket (~15.45ha) and some Sundays Valley Thicket (~9.65ha) (See Section 4.5.1, Table 13). Approximately 6.9 % of the natural vegetation cover on Farm Wolverton is proposed to be cleared for citrus development, which is considered LOW i.e. < 30%.</p> <p>The biodiversity target areas for these vegetation types will be safeguarded and significantly exceeded (See Section 4.5 for the target explanations). Thus, contributing to a LOW severity impact.</p> <p>The proposed development is a low impact development. The total area of the farm that will not be developed measures ~336.9 ha or 93 % of the farm.</p>		
Project phase: Establishment phase (clearing and planting crops), as well as the operational or farming phase (although additional loss should not occur in the latter phase).		
Criteria	Without mitigation	With mitigation
Extent	Site (Score 0.5)	Site (Score 0.5)
Duration	Permanent (Score 5)	Permanent (Score 5)
Magnitude	Low (Score 4)	Low (Score 3)
Probability	Definite (Score 5)	Definite (Score 5)
Reversibility	Partly Reversible (Score 0.5)	Partly Reversible (Score 0.5)
Irreplaceable loss of resources	Partially Replaceable (Score 0.5)	Partially Replaceable (Score 0.5)
Significance [Dur+Ext+R+I+ Sev] X Probability	Low (Score -52.5)	Low (Score -47.5)
Status (positive or negative)	Negative	
Degree of Confidence	High	
Can impacts be mitigated/reduced	Yes	

Impact 1 - Loss of vegetation and associated habitat due to clearing

RECOMMENDED MITIGATION MEASURES

- Retain the No-Go areas along the north-eastern boundary; as well as at the south-western boundary, as per Figure 17 (Section 4.5).
- Maintain remaining land as proposed and remove only the required amount of vegetation for citrus purposes.
- Plant indigenous windbreaks, if feasible. See below regarding indigenous windbreaks.
- Rehabilitation of disturbed areas post establishment with indigenous species, if necessary (as this should be avoided if bullet 2 above is implemented) and where the pipeline is buried. Plants however can be used in the 'rehabilitation' of other disturbed areas on the farm or other land owned by the Applicant. Indigenous trees could potentially be purchased and planted in the disturbed areas, and immature trees translocated from the clearing process.
- Rehabilitation of limestone borrow pit sites, post closure, to be undertaken with indigenous species.
- Control and management alien invasive plants, such as *Opuntia ficus-indica* etc.
- Audit reporting by the Environmental Control Officer during construction / clearing of orchard areas.
- Compliance with regulations pertaining to the Conservation of Agricultural Resources Act (43 of 1983), where applicable.

Indigenous windbreaks:

- Available information on indigenous windbreaks for citrus cultivation (in South Africa and in the region) could not be found (and is potentially not available)⁶. Windbreaks are required to be high, up to 20 m high. Given this height requirement, most of the potential indigenous species tend to grow in moister regions and will likely require the additional irrigation water to establish and reach maximum height. The following examples are provided and should be discussed with the applicant in terms of suitability for citrus cultivation:

Species not indigenous to the vegetation unit, but indigenous to South Africa, which could be considered by the applicant:

- *Ptaeroxylon obliquum*. This species occurs in Sundays Thicket and can reach up to 20 m in height. It has a moderate to fast growth rate. Additional water may enhance its ability to reach 20 m.
- *Celtis africana*. Reaching heights of up to 30 m. This species is usually deciduous away from the coast.
- *Brachylaena glabra*. Reaching heights of up to 18 m.
- *Ekebergia capensis*. Fast growing and reaching heights of up to 20 m to 30 m. Usually evergreen but can be semi-deciduous in drier climates, which would be unfavourable, however, the additional irrigation water may prevent this.
- *Ocotea bullata*. Quite fast growing and reaching heights of up to 30 m. This is a protected tree in terms of the National Forest Act.
- *Vachellia (Acacia) xanthophloea*. Large tree (10 – 25 m). This tree has been planted in the Sundays River Valley as a windbreak. The species is usually associated with water, and could assist with uptake of the additional run-off from irrigation or possibly compete for water. The applicant advised that the leaves are small and growth is not as compact, which reduces its screening ability (i.e. to prevent wind penetration).
- *Cunonia capensis*. A fast-growing tree, up to 30 m. This species enjoys moist conditions and could possibly compete for water.
- *Pittosporum viridifolium*. Fast growing tree from 10 m – 30 m. Additional water may ensure 20 m height. Protected tree in terms of the National Forest Act.
- *Vepris lanceolata*. Moderate to fast growing tree, 5m – 20 m. Additional water may ensure 20 m height.

⁶ Library internet searches of Stellenbosch University, Rhodes University and Nelson Mandela Bay Metropolitan University, and a general internet search.

Impact 1 - Loss of vegetation and associated habitat due to clearing

- If the growth form is not suitable, other smaller species could be planted to ensure protection near the ground e.g. *Plumbago auriculata*, *Tecoma capensis*. Alternatively, consider synthetic mesh materials (although this may be more financially onerous).
- Issues of windbreak species competing for water, acting as a refuge for false codling moth, slow growth rates, growth form and height will need to be considered and should ideally be discussed with the citrus farmer(s) who should have specific knowledge regarding certain requirements. For example, *Cassuarina cunninghamina* (non-indigenous windbreak used in the region) is known to compete with citrus for water, thereby affecting production. An indigenous tree that occurs in Sundays Thicket or at least on the farm, *Olea europaea* subsp. *africana*, is known to be a host, while *Podocarpus latifolius*, which is used in the Western Cape, is a host (Stotter, 2009). *Crassula ovata*, *Podocarpus falcatus* *Schotia afra*, *Ziziphus mucronata* and *Diospyros* species, including the alien invasive, *Ricinus communis*, are also known to be a secondary host (US Department of Agriculture, 2010; Stotter, 2009).
- Alternative **indigenous** species as otherwise recommended could be used.

CUMULATIVE IMPACTS

With respect to cumulative impacts on the farm WOLVERTON: LOW impacts due to the limited modification of indigenous vegetation present on the farm. As per project specific impact above.

With respect to cumulative impacts of land uses within the N40E catchment: Potential cumulative impacts of citrus cultivation in the N40E catchments provides a background to informing the potential cumulative impact of the project specific impacts combined with current and potential future impacts. Some data (even if not accurate) rather than no data is considered more informative.

Based on the land cover data, approximately 13.2 % of the quaternary catchment N40E has been modified / transformed, whereas 23.8 % is degraded (Section 4.3.2). The western sub-quaternary catchment is ~5.31% modified whereas ~16 % of the eastern sub-quaternary catchment is modified. The data are likely to be under-estimates. The current cumulative impacts in terms of vegetation loss at the quaternary catchment level is likely to be LOW (<30%).

The following mitigation measures are not the responsibility of the Applicant, but serve to inform the cumulative impact assessment:

- Maintain biodiversity pattern and process targets on individual properties proposed for development in the future and/or comply with the CBA Map (where applicable). This should include recommended site-verified aquatic buffers, if relevant to a site. (**Catchment mitigation measure not within the control of the Applicant**).
- Ensure revision of the CBA Map to compensate for losses every 5 years. (**Catchment mitigation measure not within the control of the Applicant**).
- Support expansion of the Protected Area network in terms of the National Environmental Management: Protected Areas Act. (**Catchment mitigation measure not within the control of the Applicant**).
- Ensure sustainable development and comply with the municipal urban edge and rural development policies (**Catchment mitigation measure not within the control of the Applicant**).

Post Mitigation:

The potential future cumulative impacts cannot be ascertained with certainty. However, based on the Sundays River Valley CBA Map which aims to avoid significant cumulative impacts at the landscape and catchment level, the CBA Map demarcates ~62% of the sub-quaternary catchment as Protected Area, Critical Biodiversity Area and Ecological Support Area (Section 3.2.1, Table 3, Figure 7).

Future cumulative impacts in the sub-quaternary and quaternary catchment will potentially be **MEDIUM (≥30% - 60%), worse-case scenario, to LOW (<30% modified), best-case scenario**, if the above mitigation measures are adopted.

Note: The cumulative impacts have not been presented in the format as per the project specific format above for brevity purposes (since these are catchment mitigation measures). Importantly, the land

<i>Impact 1 - Loss of vegetation and associated habitat due to clearing</i>
<i>cover provides the indicator of level of transformation /impact, although the calculations would result in the rating provided (pre- and post-mitigation).</i>
RESIDUAL IMPACTS
Possible impact on the remaining catchment due to changes in run-off characteristics from the cultivated areas (cumulative).

6.3.2. Impact 2: Potential degradation of vegetation due to over-grazing and over-browsing by stocked wildlife (biodiversity loss)

<i>Impact 2 - Potential degradation of vegetation due to over-grazing and over-browsing by stocked wildlife</i>		
<p>Nature: Both indigenous and extra-limital wildlife are stocked on the property and adjacent properties. The adjacent properties measure ~3 999ha (fencing has been dropped). See the listing of wildlife in Section 1.2; and Figure 14 (Section 4.3) for the area that the wildlife utilize (graze).</p> <p>There are more extra-limital species than indigenous species stocked. Over-grazing and over-browsing by wildlife is a concern if the recommended stocking rate does not comply with the ecological carrying capacity of the vegetation on site. This is particularly the case for extra-limital species that can outcompete indigenous species, or which can have devastating impacts if the stocking density is too high for the vegetation. Impala, for example, are known to graze/browse in degraded areas; thus reducing the potential for these areas to restore. The ecological carrying capacity and associated stocking rates is usually determined via detailed veld condition assessments, which should take place on a regular basis into the future.</p> <p>A Wildlife Management Plan was developed for Wolverton Farm in 2016. This needs to be updated to include the entire area under wildlife grazing i.e. Wolverton and the 'Addo Big 5' properties.</p>		
Project phase: Operations		
Criteria	Without mitigation	With mitigation
Extent	Site (Score 1)	Site (Score 1)
Duration	Permanent (Score 5)	Permanent (Score 5)
Magnitude	High (Score 9)	Low (Score 4)
Probability	Definite (Score 5)	Probable (Score 4)
Reversibility	Partly Reversible (Score 0.5)	Partly Reversible (Score 0.5)
Irreplaceable loss of resources	Partially Replaceable (Score 0.5)	Partially Replaceable (Score 0.5)
Significance [Dur+Ext+R+I+Sev] X Probability	High (Score -80)	Low (Score -44)
Status (positive or negative)	Negative	
Degree of Confidence	High	
Can impacts be mitigated/reduced	Yes	
RECOMMENDED MITIGATION MEASURES		
<ul style="list-style-type: none"> • A wildlife grazing plan to be developed for the entire area that is being stocked with wildlife i.e. Farm Wolverton and the Addo Big 5 Game Reserve. A veld condition assessment should inform the ecological carrying capacity of the vegetation and stocking rate, to prevent veld degradation. • The Applicant is encouraged to investigate protected area status for the combined properties, in terms of the National Protected Areas Act, with support from the Eastern Cape Parks and 		

Impact 2 - Potential degradation of vegetation due to over-grazing and over-browsing by stocked wildlife

Tourism Agency. Extra-limital species (i.e. species indigenous to South Africa but not the region) are not permitted in the Nature Reserve category; but are allowed within the Protected Environment category, on condition that regular veld condition assessments are undertaken to inform stocking rates and prevent veld degradation.

- Regular veld condition assessments to determine the ecological carrying capacity and associated stocking rate to prevent veld degradation into the future.
- Compliance with regulations pertaining to the Conservation of Agricultural Resources Act (43 of 1983), where applicable.

CUMULATIVE IMPACTS

With respect to cumulative impacts on the farm WOLVERTON: LOW impacts due to the limited modification and degradation of indigenous vegetation present on the farm.

With respect to cumulative impacts of land uses within the N40E catchment: Potential cumulative impacts of citrus cultivation in the N40E catchments provides a background to informing the potential cumulative impact of the project specific impacts combined with current and potential future impacts. Some data (even if not accurate) rather than no data is considered more informative.

Stocking of wildlife on farms and game reserves is a common land use practice in the region. Extra-limital species are a common wildlife species stocked. Degradation based on current land cover data is ~23.8%. This is likely an under-estimate.

The current cumulative impacts in terms of vegetation degradation at the quaternary catchment level is possibly **LOW (<30%) (best-case scenario) to MODERATE (worse-case scenario)**.

The following mitigation measures are not the responsibility of the Applicant, but serve to inform the cumulative impact assessment:

- As per impact 1 above, including:
- Wildlife management plans should be informed by veld condition assessments that determine the ecological carrying capacity of the vegetation types (**Catchment mitigation measure not within the control of the Applicant**).

Post Mitigation:

- Future cumulative impacts in the sub-quaternary and quaternary catchment will potentially be **MEDIUM (≥30% - 60% degradation), worse-case scenario**.

RESIDUAL IMPACTS:

As per impact 1 above.

6.3.3. Impact 3: Loss of Ecological Support Area due to clearing

Impact 2: Loss of Ecological Support Area due to clearing

Nature: A relatively small amount of Ecological Support Area (ESA) along the north-eastern/eastern boundary is proposed to be cleared for citrus cultivation. The ESA around the citrus area measures ~4.65 ha in extent (**Figure 6**), with approximately 37.8 ha of ESA to the south of the proposed citrus, totalling 42.4 ha of ESA on the farm. Approximately 1.2 ha / 2.8 % of ESA would be removed on Farm Wolverton within the proposed citrus layout (Alternative 1), which would be classed as a LOW percentage (i.e. < 30 %).

<i>Impact 2: Loss of Ecological Support Area due to clearing</i>		
Ideally no ESA should be removed for citrus cultivation, especially along the steeper and vertical slopes. Although the loss of ESA is considered low in terms of extent of loss, it is still classed as MEDIUM due to the importance of ESA in the landscape. This is especially the case in agricultural landscapes; and the proximity of already impacted river systems. This is even more important since ESA have been removed on the neighbouring land.		
Project phase: Establishment phase (clearing and planting crops), as well as the operational or farming phase (although additional loss should not occur in the latter phase).		
Criteria	Without mitigation	With mitigation
	Alternative 1	Alternative 2
Extent	Site (Score 1)	No Impact
Duration	Permanent on site (Score 5)	No Impact
Magnitude	Moderate (Score 6)	No Impact
Probability	Definite (Score 5)	No Impact
Reversibility	Partially Reversible (Score 0.5).	No Impact
Irreplaceable loss of resources	Partially replaceable (Score 0.5)	No Impact
Significance [Dur+Ext+R+I+Sev] X Probability	Moderate (Score - 65)	No Impact
Status (positive or negative)	Negative	
Degree of Confidence	High	
Can impacts be mitigated/reduced	Yes	
RECOMMENDED MITIGATION MEASURES		
<ul style="list-style-type: none"> Avoid the Ecological Support Area and move the proposed agriculture to the west (see Figure 17 and 18). 		
Cumulative impacts:		
<p><i>With respect to cumulative impacts on the farm Wolverton:</i> MEDIUM pre-mitigation (as per project specific impact above).</p> <p><i>With respect to cumulative impacts of land uses within the N40E catchment:</i> Potential cumulative impacts of citrus cultivation in the N40E catchments provides a background to informing the potential cumulative impact of the project specific impacts combined with current and potential future impacts.</p> <p>Refer Impact 1 regarding land cover status in the catchment. According to the available data, the current and potential loss in extent (ha) of CBA and ESA is probably Low (Section 3.3.1) because these areas have been incorporated into the municipal SDF (although this does not guarantee that losses will not occur in the future). Approximately 1.7 % of the N40E quaternary catchment is designated as Protected Area (PA), largely representing the Addo Elephant National Park to the east (see Table 3, Figure 7). According to the GIS statistics (WGS84 TM25), ~62 % of the N40E catchment is designated as CBA, ESA, and PA. Most of the No Natural Areas Remaining include much of the agricultural land in the Sundays River Valley, to the east, following the Sundays River. The landscape to the far west, represents the mountainous landscape which is, for the most part, not suitable for agriculture, barring river floodplains (which should be avoided from an ecological perspective).</p> <p>However, the potential impact (pre-mitigation) is likely to be a MEDIUM, despite the preamble above. This is a more precautionary conclusion and is possibly more realistic without mitigation measures in place, notwithstanding the planning tools in place.</p> <p><u>The following mitigation measures are not the responsibility of the Applicant, but serve to inform the cumulative impact assessment:</u></p> <ul style="list-style-type: none"> Maintain biodiversity pattern and process targets on individual properties proposed for development in the future and/or comply with the CBA Map (where applicable). This should 		

<i>Impact 2: Loss of Ecological Support Area due to clearing</i>	
include recommended site-verified aquatic buffers, if relevant to a site. (Catchment mitigation measure not within the control of the Applicant).	
<ul style="list-style-type: none"> • Ensure revision of the CBA Map to compensate for losses every 5 years. (Catchment mitigation measure not within the control of the Applicant). • Support expansion of the Protected Area network in terms of the National Environmental Management: Protected Areas Act. (Catchment mitigation measure not within the control of the Applicant). • Ensure sustainable development and comply with the municipal urban edge and rural development policies. (Catchment mitigation measure not within the control of the Applicant). 	
Post Mitigation:	
The potential future cumulative impacts cannot be ascertained with certainty. However, based on the Sundays River Valley CBA Map, which aims to avoid significant cumulative impacts at the landscape and catchment level, and demarcates ~62% of the N40E catchment as Protected Area, Critical Biodiversity Area and Ecological Support Area, future loss in the catchment is potentially LOW , if the above mitigation measures are adopted.	
<i>Note: The cumulative impacts have not been presented in the format as per the project specific format above for brevity purposes (since these are catchment mitigation measures). Importantly, the CBA Map and land cover statistics provide the indicator for level of protection or retention of CBA and ESA. The calculations would result in a LOW rating (pre- and post-mitigation).</i>	
RESIDUAL IMPACTS	
As per impact 1, including fencing that excludes natural movement of larger fauna.	

6.3.4. Impact 4: Loss of Floral Species of Conservation/Special Concern due to clearing

<i>Impact 4: Loss of Floral Species of Conservation/Special Concern due to clearing</i>				
Nature:				
One Endangered and two Declining species were recorded, as well as several Least Concern, but protected species.				
Project phase: Establishment phase (clearing and planting crops), as well as the operational or farming phase (although additional loss should not occur in the latter phase).				
Criteria	Without mitigation		With mitigation	
	Least Concern Species	Endangered Species	Least Concern Species	Endangered Species
Extent	Site (Score 1)	Site (Score 1)	Site (Score 1)	No Impact
Duration	Long-term (Score 4)	Long-term (Score 4)	Long-term (Score 4)	No Impact
Magnitude	Medium (Score 6)	High (Score 8)	Low (Score 2)	No Impact
Probability	Definite (Score 5)	Definite (Score 5)	Definite (Score 5)	No Impact
Reversibility	Partially Reversible (Score 0.5)	Partially Reversible (Score 0.5)	Partially Reversible (Score 0.5)	No Impact
Irreplaceable loss of resources	Partially Replaceable (Score 0.5)	Partially Replaceable (Score 0.5)	Partially Replaceable (Score 0.5)	No Impact
Significance [Dur+Ext+R+I+ Sev] X Probability	Moderate (-60)	Moderate (-72,5)	Moderate (-40)	No Impact
Status (positive or negative)	Negative			
Degree of Confidence	High			

<i>Impact 4: Loss of Floral Species of Conservation/Special Concern due to clearing</i>	
Can impacts be mitigated/reduced	Yes
RECOMMENDED MITIGATION MEASURES	
<ul style="list-style-type: none"> • The Biodiversity No-Go area, which protects the Endangered species, shall be avoided in the recommended layout (Figure 17 & 18). • The Declining <i>Dioscorea elephantipes</i> (Elephants Foot) should be adequately protected from browsing by wildlife. This may require fencing. The use of microchips is also encouraged. Ongoing and regular monitoring must be implemented to ensure the species is not over-browsed. • Translocate as many of the other species as reasonably possible. It should be noted that some of the species are pioneers which establish very easily where disturbance has occurred, especially <i>Drosantherum hispidum</i>, <i>Galenia pubescens</i> and <i>Delosperma ecklonis</i>. Focus should therefore be on the Aloes and other vygies, including the <i>Drimia</i> bulb. • Numerous <i>Sideroxylon inerme</i> (Milkwood trees) occurred on site. Large trees do not transplant well. An attempt to translocate smaller, immature trees is encouraged (if available); or alternatively purchase a percentage (to be determined by the Department of Forestry) of these and plant on the farm and where the pipeline is buried; or other land owned by the Applicant. • License application to the Department of Economic Development, Environmental Affairs and Tourism Department of Forestry for the protected species. • Rehabilitation of disturbed areas with these species, as soon as possible. Other areas of the farm can be used as translocation areas for the Aloes and vygies. However, no major disturbance within 32 m of the river shall be permitted, as per the NEMA regulations. • Audit reporting by the Environmental Control Officer during orchard establishment, rescue, translocation and rehabilitation. 	
CUMULATIVE IMPACTS:	
<i>With respect to cumulative impacts on the farm Wolverton:</i> LOW pre-mitigation (as per project specific impact above).	
<i>With respect to cumulative impacts of land uses within the N40E catchment:</i> As per impact 1 above. With loss of natural vegetation comes a loss of species of conservation/special concern	
<i>The following mitigation measures are not the responsibility of the Applicant, but serve to inform the cumulative impact assessment:</i>	
<ul style="list-style-type: none"> • As per impact 1 above. 	
Post Mitigation:	
<ul style="list-style-type: none"> • As per impact 1 above. 	
RESIDUAL IMPACTS	
As per impact 1, including fencing that excludes natural movement of larger fauna.	

6.4. FINAL RECOMMENDATION AND CONCLUSIONS

6.4.1. Concluding Impact Statement

The proposed development is not considered to be a fatal flaw if it avoids the biodiversity NO-GO areas as depicted in **Figure 17** (Section 4.5). Furthermore, it is important that regular veld condition assessments are undertaken to determine the ecological carrying capacity of the vegetation on site, to avoid long term veld degradation. This is particularly important due to the stocking of extra-limital species (i.e. species indigenous to South Africa but not the region). Droughts and veld type are important factors that affect ecological carrying capacity; thus the need to implement veld condition assessments on an ongoing and regular basis are critical when stocking wildlife within fenced areas.

6.4.2. Summary of Ecological Impacts Assessed

Refer Table 14 below for a summary of the impacts pre- and post-mitigation. The loss of vegetation is considered LOW pre- and post-mitigation; and allows the biodiversity targets for both vegetation units to be safeguarded and substantially exceeded (Impact 1). Veld degradation due to wildlife grazing can be managed via veld condition assessments and ecological carrying capacity determinations. If these are carried out on a regular basis by an experienced professional, the potential impact can be reduced from a High Impact (pre-mitigation) to a Low Impact (post mitigation) (Impact 2).

The loss of Ecological Support Area can be avoided by moving the citrus orchards slightly to the west (i.e. No Impact) (Impact 3).

The loss of species of special/conservation concern can be mitigated (reduced) through the translocation of species, particularly succulents that are easy to transplant, and the significance of the impact reduced to LOW. The threatened and declining species will be avoided in the proposed and recommended layout i.e. No Impact (Impact 4).

The post mitigation impacts are therefore not deemed to be a fatal flaw, especially since this is relatively low-density development type (combined with Addo Big 5), if wildlife grazing is effectively managed, especially extra-limital species. It will be important to compile and implement an Environmental Management /Monitoring Programme that incorporates the mitigation measures recommended to reduce the associated impacts (see summary Section 6.5 below). The most critical management issue is wildlife grazing, which should be addressed through regular veld condition assessments to determine the ecological carrying capacity of the vegetation types on site.

Table 14. Summary of impacts pre- and post-mitigation

ENVIRONMENTAL IMPACT	DEVELOPMENT PHASE	PRE- MITIGATION		POST MITIGATION	
<i>IMPACT 1: Loss of vegetation due to clearing (biodiversity loss)</i>	Establishment & Operational	Low (Score -52.5)		Low (Score -47.5)	
<i>IMPACT 2: Potential degradation of vegetation due to over-grazing and over-browsing by stocked wildlife</i>	Operational	High (Score -80)		Low (Score -44)	
<i>IMPACT 3: Loss of Ecological Support Area due to clearing (biodiversity loss)</i>	Establishment & Operational	Moderate (Score - 65)		No Impact	
<i>IMPACT 4: Loss of floral species of special concern due to clearing (biodiversity loss).</i>	Establishment & Operational	<u>Least Concern</u> Moderate (-60)	<u>Threatened Moderate</u> (-72,5)	<u>Least Concern</u> Low (-40)	<u>Threatened</u> No Impact
Significance Ratings: Low (>26-52.5); Moderate (>52.5 ≤ 78/5); Very High/ Significant (High) (>78.5 - 105)					

Cumulative impacts: Potential cumulative impacts of citrus cultivation in the N40E catchments provides a background to informing the potential cumulative impact of the project specific impacts combined with current and potential future impacts. Some data (even if not accurate) rather than no data is considered more informative in the decision-making process. The mitigation measures are however not within the control of the Applicant and are the responsibility of the relevant Authorities.

6.5. ENVIRONMENTAL MANAGEMENT / MONITORING PROGRAMME RECOMMENDATIONS

A summary of the mitigation measures recommended in Section 6.2 is provided below, which can be incorporated into the Environmental Management Programme.

Compilation of an Environmental Management/ Monitoring Programme that provides the following project specific specifications for the associated impacts:

Impact 1: Loss of vegetation and associated habitat due to clearing

- Retain the No-Go areas along the north-eastern boundary; as well as at the south-western boundary, as per Figure 17 (Section 4.5).
- Maintain remaining land as proposed and remove only the required amount of vegetation for citrus purposes.
- Plant indigenous windbreaks, if feasible. See below regarding indigenous windbreaks.
- Rehabilitation of disturbed areas post establishment with indigenous species, if necessary (as this should be avoided if bullet 2 above is implemented) and where the pipeline is buried. Plants however can be used in the 'rehabilitation' of other disturbed areas on the farm or other land owned by the Applicant. Indigenous trees could potentially be purchased and planted in the disturbed areas, and immature trees translocated from the clearing process.
- Rehabilitation of limestone borrow pit sites, post closure, to be undertaken with indigenous species.
- Control and management alien invasive plants, such as *Opuntia ficus-indica* etc.
- Audit reporting by the Environmental Control Officer during construction / clearing of orchard areas.
- Compliance with regulations pertaining to the Conservation of Agricultural Resources Act (43 of 1983), where applicable.

Indigenous windbreaks:

- Available information on indigenous windbreaks for citrus cultivation (in South Africa and in the region) could not be found (and is potentially not available)⁷. Windbreaks are required to be high, up to 20 m high. Given this height requirement, most of the potential indigenous species tend to grow in moister regions and will likely require the additional irrigation water to establish and reach maximum height. The following examples are provided and should be discussed with the applicant in terms of suitability for citrus cultivation:

Species not indigenous to the vegetation unit, but indigenous to South Africa, which could be considered by the applicant:

- *Ptaeroxylon obliquum*. This species occurs in Sundays Thicket and can reach up to 20 m in height. It has a moderate to fast growth rate. Additional water may enhance its ability to reach 20 m.
- *Celtis africana*. Reaching heights of up to 30 m. This species is usually deciduous away from the coast.
- *Brachylaena glabra*. Reaching heights of up to 18 m.
- *Ekebergia capensis*. Fast growing and reaching heights of up to 20 m to 30 m. Usually evergreen but can be semi-deciduous in drier climates, which would be unfavourable, however, the additional irrigation water may prevent this.
- *Ocotea bullata*. Quite fast growing and reaching heights of up to 30 m. This is a protected tree in terms of the National Forest Act.
- *Vachellia (Acacia) xanthophloea*. Large tree (10 – 25 m). This tree has been planted in the Sundays River Valley as a windbreak. The species is usually associated with water, and could assist with uptake of the additional run-off from irrigation or possibly compete for water. The applicant advised that the leaves are small and growth is not as compact, which reduces its screening ability (i.e. to prevent wind penetration).
- *Cunonia capensis*. A fast-growing tree, up to 30 m. This species enjoys moist conditions and could possibly compete for water.

⁷ Library internet searches of Stellenbosch University, Rhodes University and Nelson Mandela Bay Metropolitan University, and a general internet search.

Compilation of an Environmental Management/ Monitoring Programme that provides the following project specific specifications for the associated impacts:

- *Pittosporum viridifolium*. Fast growing tree from 10 m – 30 m. Additional water may ensure 20 m height. Protected tree in terms of the National Forest Act.
- *Vepris lanceolata*. Moderate to fast growing tree, 5m – 20 m. Additional water may ensure 20 m height.
- If the growth form is not suitable, other smaller species could be planted to ensure protection near the ground e.g. *Plumbago auriculata*, *Tecoma capensis*. Alternatively, consider synthetic mesh materials (although this may be more financially onerous).
- Issues of windbreak species competing for water, acting as a refuge for false codling moth, slow growth rates, growth form and height will need to be considered and should ideally be discussed with the citrus farmer(s) who should have specific knowledge regarding certain requirements. For example, *Cassuarina cunninghamina* (non-indigenous windbreak used in the region) is known to compete with citrus for water, thereby affecting production. An indigenous tree that occurs in Sundays Thicket or at least on the farm, *Olea europaea* subsp. *africana*, is known to be a host, while *Podocarpus latifolius*, which is used in the Western Cape, is a host (Stotter, 2009). *Crassula ovata*, *Podocarpus falcatus* *Schotia afra*, *Ziziphus mucronata* and *Diospyros* species, including the alien invasive, *Ricinus communis*, are also known to be a secondary host (US Department of Agriculture, 2010; Stotter, 2009).

Alternative **indigenous** species as otherwise recommended could be used.

Impact 2 - Potential degradation of vegetation due to over-grazing and over-browsing by stocked wildlife

- A wildlife grazing plan to be developed for the entire area that is being stocked with wildlife i.e. Farm Wolverton and the Addo Big 5 Game Reserve. A veld condition assessment should inform the ecological carrying capacity of the vegetation and stocking rate, to prevent veld degradation.
- The Applicant is encouraged to investigate protected area status for the combined properties, in terms of the National Protected Areas Act, with support from the Eastern Cape Parks and Tourism Agency. Extra-limits species (i.e. species indigenous to South Africa but not the region) are not permitted in the Nature Reserve category; but are allowed within the Protected Environment category, on condition that regular veld condition assessments are undertaken to inform stocking rates and prevent veld degradation.
- Regular veld condition assessments to determine the ecological carrying capacity and associated stocking rate to prevent veld degradation into the future.
- Compliance with regulations pertaining to the Conservation of Agricultural Resources Act (43 of 1983), where applicable.

Impact 3: Loss of Ecological Support Area (ESA) due to the citrus orchards

- Avoid the Ecological Support Area and move the proposed agriculture to the west (see Figure 17 and 18).

Impact 4: Loss of Plant Species of Conservation/Special Concern

- The Biodiversity No-Go area, which protects the Endangered species, shall be avoided in the recommended layout (Figure 17 & 18).
- The Declining *Dioscorea elephantipes* (Elephants Foot) should be adequately protected from browsing by wildlife. This may require fencing. The use of microchips is also encouraged. Ongoing and regular monitoring must be implemented to ensure the species is not over-browsed.
- Translocate as many of the other species as reasonably possible. It should be noted that some of the species are pioneers which establish very easily where disturbance has occurred, especially *Drosanthemum hispidum*, *Galenia pubescens* and *Delosperma ecklonis*. Focus should therefore be on the Aloes and other vygies, including the *Drimia* bulb.
- Numerous *Sideroxylon inerme* (Milkwood trees) occurred on site. Large trees do not transplant well. An attempt to translocate smaller, immature trees is encouraged (if available); or alternatively

Compilation of an Environmental Management/ Monitoring Programme that provides the following project specific specifications for the associated impacts:

purchase a percentage (to be determined by the Department of Forestry) of these and plant on the farm and where the pipeline is buried; or other land owned by the Applicant.

- License application to the Department of Economic Development, Environmental Affairs and Tourism Department of Forestry for the protected species.
- Rehabilitation of disturbed areas with these species, as soon as possible. Other areas of the farm can be used as translocation areas for the Aloes and vygies. However, no major disturbance within 32 m of the river shall be permitted, as per the NEMA regulations.
- Audit reporting by the Environmental Control Officer during orchard establishment, rescue, translocation and rehabilitation.

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8. ADDENDUM 1: PLANT INVENTORY

SPECIES	FAMILY	SPECIES	FAMILY
<i>Abutilon sonneratianum</i>	Malvaceae	<i>Crassula nudicaulis</i>	Crassulaceae
<i>Acalypha glabrata</i>	Euphorbiaceae	<i>Crassula muscosa</i>	Crassulaceae
<i>Aizoon rigidum</i>	Aizoaceae	<i>Crassula intermedia</i>	Crassulaceae
<i>Albuca cooperi</i>	Hyacinthaceae	<i>Crassula pellucida</i>	Crassulaceae
<i>Aloe africana</i>	Asphodelaceae	<i>Crassula perforata</i>	Crassulaceae
<i>Aloe ferox</i>	Asphodelaceae	<i>Crassula rhombifolius</i>	Crassulaceae
<i>Anacampseros arachnoides</i>	Anacampserotaceae	<i>Crassula tetragona</i>	Crassulaceae
<i>Aponogeton distachyos</i>	Aponogetonaceae	<i>Cuspidia cernua</i> (Weed)	Asteraceae
<i>Argemone ochroleuca</i>	Papaveraceae	<i>Cussonia spicata</i>	Araliaceae
<i>Aristida congesta</i>	Poaceae	<i>Cynanchum ellipticum</i>	Apocynaceae
<i>Aristida adscensionis</i>	Poaceae	<i>Cynodon dactylon</i>	Poaceae
<i>Aspalathus setacea</i>	Fabaceae	<i>Cymbopogon validus</i>	Poaceae
<i>Asparagus africanus</i>	Asparagaceae	<i>Cyperus sexangularis</i>	Cyperaceae
<i>Asparagus crassycladus</i>	Asparagaceae	<i>Cyphostemma cymosum</i>	Vitaceae
<i>Asparagus striatus</i>	Asparagaceae	<i>Datura ferox</i> (Alien invasive)	Solanaceae
<i>Asparagus suaveolens</i>	Asparagaceae	<i>Delosperma ecklonis</i>	Aizoaceae
<i>Asparagus virgatus</i>	Asparagaceae	<i>Delosperma sp.</i>	Aizoaceae
<i>Atriplex semibacatta</i>	Amaranthaceae	<i>Digitaria eriantha</i>	Poaceae
<i>Azima tetracantha</i>	Salvadoraceae	<i>Digitaria sanguinalis</i>	Poaceae
<i>Azolla filiculoides</i>	Salviniaceae	<i>Dioscoreae elephantipes</i>	Dioscoreaceae
<i>Berkheya heterophylla</i>	Asteraceae	<i>Diospyros dichrophylla</i>	Ebenaceae
<i>Berula erecta</i>	Apiaceae	<i>Disphyma crassifolium</i>	Aizoaceae
<i>Blepharis capensis</i>	Acanthaceae	<i>Drimia altissima</i>	Hyacinthaceae
<i>Boscia oleoides</i>	Brassicaceae	<i>Drosanthemum hispidum</i>	Aizoaceae
<i>Brachylaena ilicifolia</i>	Asteraceae	<i>Ehretia rigida</i>	Boraginaceae
<i>Bromus catharticus</i>	Poaceae	<i>Eragrostis curvula</i>	Poaceae
<i>Buddleja saligna</i>	Scrophulariaceae	<i>Eragrostis lehmannia</i>	Poaceae
<i>Bulbine narcissifolia</i>	Asphodelaceae	<i>Eragrostis obtusa</i>	Poaceae
<i>Bulbine latifrons</i>	Asphodelaceae	<i>Eucalyptus grandis</i>	Myrtaceae
<i>Bulbine abyssinica</i>	Asphodelaceae	<i>Euclea undulata</i>	Ebenaceae
<i>Capparis sepiara</i>	Capparaceae	<i>Euphorbia fimbriata</i>	Euphorbiaceae
<i>Cadaba aphylla</i>	Brassicaceae	<i>Euphorbia caerulescens</i>	Euphorbiaceae
<i>Carissa bispinosa</i>	Apocynaceae	<i>Euphorbia mauritania</i>	Euphorbiaceae
<i>Cheilanthes viridus</i>	Pteridaceae	<i>Euphorbia gregaria</i>	Euphorbiaceae
<i>Chloris gayana</i>	Poaceae	<i>Euphorbia triangularis</i>	Euphorbiaceae
<i>Chloris virgata</i>	Poaceae	<i>Euryops anethoides</i>	Asteraceae
<i>Cineraria lobata</i>	Asteraceae	<i>Euryops euryopoides</i>	Asteraceae
<i>Cirsium vulgare</i>	Asteraceae	<i>Eustachys paspalloides</i>	Poaceae
<i>Combretum caffrum</i>	Combretaceae	<i>Felicia erigeroides</i>	Asteraceae
<i>Commelina africana</i>	Commelinaceae	<i>Felicia filifolia</i>	Asteraceae
<i>Conyza scabrida</i>	Asteraceae	<i>Galenia pubescens</i>	Aizoaceae
<i>Cotyledon orbiculata</i>	Crassulaceae	<i>Gasteria bicolor</i>	Asphodelaceae
<i>Crassula capitella</i>	Crassulaceae	<i>Gazania rigens</i>	Asteraceae
<i>Crassula cultrata</i>	Crassulaceae	<i>Gleditsia triacanthos</i>	Fabaceae
<i>Crassula dependens</i>	Crassulaceae	<i>Gnidia capitata/Lasiosiphon capitatus</i>	Thymelaceae
<i>Crassula ericoides</i>	Crassulaceae	<i>Grewia occidentalis</i>	Malvaceae

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SPECIES	FAMILY	SPECIES	FAMILY
<i>Crassula expansa</i>	Crassulaceae	<i>Grewia robusta</i>	Malvaceae
<i>Gymnosporia buxifolia</i>	Celastraceae	<i>Phragmites australis</i>	Poaceae
<i>Gymnosporia polycantha</i>	Celastraceae	<i>Polygala virgata</i>	Polygaceae
<i>Helichrysum roseum</i>	Asteraceae	<i>Polypogon monspeliensis</i>	Poaceae
<i>Helichrysum terretifolium</i>	Asteraceae	<i>Physalis peruviana (Weed)</i>	Solanaceae
<i>Hermannia coccocarpa</i>	Malvaceae	<i>Plectranthus verticillatus</i>	Lamiaceae
<i>Hypocharis radicus (Weed)</i>	Asteraceae	<i>Plumbago auriculata</i>	Plumbaginaceae
<i>Hypoestes aristata</i>	Acanthaceae	<i>Portulacaria afra</i>	Portulacaceae
<i>Ifloga procumbens</i>	Asteraceae	<i>Potamogeton pectinatus</i>	Potamogetonaceae
<i>Indigofera denudata</i>	Fabaceae	<i>Pseudonafalium luteo-album</i>	Asteraceae
<i>Jasminum angulare</i>	Oleaceae	<i>Psilocaulon articulatum</i>	Aizoaceae
<i>Jatropha capensis</i>	Lamiaceae	<i>Ptaeroxylon obliquum</i>	Rutaceae
<i>Jamesbrittenia microphylla</i>	Scrophulariaceae	<i>Putterlickia pyracantha</i>	Celastraceae
<i>Juncus acutus</i>	Juncaceae	<i>Ranunculus mulfidus</i>	Ranunculaceae
<i>Justicia protracta</i>	Acanthaceae	<i>Raphionacme zeyheri</i>	Apocynaceae
<i>Kalanchoe rotundifolia</i>	Crassulaceae	<i>Rhigozum obovatum</i>	Bignoniaceae
<i>Kedrostis nana var zeyheri</i>	Cucurbitaceae	<i>Rhoicissus digitata</i>	Viscaceae
<i>Lampranthus lavisii</i>	Mesembryanthemaceae	<i>Rhoicissus tridentata</i>	Viscaceae
<i>Ledebouria revoluta</i>	Hyacinthaceae	<i>Rhyncosia leucoscias</i>	Fabaceae
<i>Lemna gibba (aquatic)</i>	Lemnaceae	<i>Ruschia tenelle</i>	Aizoaceae
<i>Leucas capensis</i>	Lamiaceae	<i>Ruschia unicata</i>	Aizoaceae
<i>Lycium afrum</i>	Solanaceae	<i>Salvia triangularis</i>	Lamiaceae
<i>Melilotus albus (Weed)</i>	Fabaceae	<i>Sansevieria hyacinthoides</i>	Dracaenaceae
<i>Melolobium candicans</i>	Fabaceae	<i>Samolus valerandi</i>	Theophrastaceae
<i>Mentha longifolia</i>	Lamiaceae	<i>Sarcocornia perennis</i>	Amaranthaceae
<i>Mesembryanthemum aitonis</i>	Aizoaceae	<i>Sarcostemma viminale</i>	Apocynaceae
<i>Mestoklema tuberosum</i>	Aizoaceae	<i>Schoenoplectus scirpiodes</i>	Cyperaceae
<i>Maerua stricta</i>	Iridaceae	<i>Schotia afra</i>	Fabaceae
<i>Monsonia emarginata</i>	Geranaceae	<i>Searsia longispina</i>	Anacardiaceae
<i>Nicotinia glauca (alien invasive)</i>	Solanaceae	<i>Searsia pyroides</i>	Anacardiaceae
<i>Olea europaea subsp. africana</i>	Oleaceae	<i>Selago cinerea</i>	Selaginaceae
<i>Opuntia aurantiaca</i>	Cactaceae	<i>Senecio deltioides</i>	Asteraceae
<i>Opuntia ficus-indica</i>	Cactaceae	<i>Senecio pterophyta</i>	Asteraceae
<i>Ornithogalum longibracteatum</i>	Hyacinthaceae	<i>Senecio euryopoides</i>	Asteraceae
<i>Osyris lanceolata</i>	Santalaceae	<i>Setaria sphacelata</i>	Poaceae
<i>Pachypodium bispinosum</i>	Apocynaceae	<i>Solanum elaeagnifolium</i>	Solanaceae
<i>Panicum maximum</i>	Poaceae	<i>Sporobolus africanus</i>	Poaceae
<i>Pappea capensis</i>	Sapindaceae	<i>Sporobolus pectinatus</i>	Poaceae
<i>Paspallum distichum</i>	Poaceae	<i>Sutera campanulata</i>	Scrophulariaceae
<i>Paspallum urvillei</i>	Poaceae	<i>Themedia triandra</i>	Poaceae
<i>Pelargonium auritum</i>	Geranaceae	<i>Thesium junceum</i>	Santalaceae
<i>Pelargonium auritum</i>	Geranaceae	<i>Tithonia diversifolia (Weed)</i>	Asteraceae
<i>Pelargonium odoritissimum</i>	Geranaceae	<i>Trachyandra ciliata</i>	Asphodelaceae
<i>Pelargonium acetosum</i>	Geranaceae	<i>Tradescantia fluminensis</i>	Commelinaceae
<i>Persicaria lapathifolia</i>	Polygonaceae	<i>Typha capensis</i>	Typhaceae
<i>Pentzia incana</i>	Asteraceae	<i>Vachelia (Acacia) karroo</i>	Fabaceae
<i>Pennisetum clandestinum</i>	Poaceae	<i>Zygophyllum/Roepera morgsana</i>	Zygophyllaceae

9. ADDENDUM 2: CURRICULUM VITAE

CURRICULUM VITAE: MS DEBORAH CLAIRE VROMANS

ENVIRONMENTAL SCIENTIST : BIODIVERSITY SERVICES PROFESSIONAL

BOTANICAL, RIPARIAN, ESTUARINE (BOTANICAL) AND WETLAND SURVEYS, ECOLOGICAL ASSESSMENTS, GIS MAPPING

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Services and Skills Offered

- Botanical: Vegetation and Floristics
- Terrestrial and estuarine botanical surveys and assessments
- Wetland surveys and assessments
- Riparian delineation and assessments
- Basic ecological assessments
- Basic GIS mapping and digitizing

Ms Deborah Vromans holds an MSc degree in Botany (Estuaries) (NMMU), a BA degree in Environmental and Geographical Sciences (UCT), and a National Diploma in Horticulture (Botany) (Cape Technikon). Her MSc permitted publication and poster presentation in the international and national domain (Journal: Aquatic Botany, Conference Poster).

Deborah has 19 years of experience in the environment and biodiversity sector. Her current focus is botanical (terrestrial and aquatic), wetland, basic ecological assessments, and riparian delineation & assessments, coupled with basic GIS mapping and digitizing. The relevant reports are compiled for Environmental Impact Assessment (EIA) consultants in order to guide the layout of proposed developments in order to safeguard biodiversity features. She therefore has a good understanding of environmental and planning legislation.

Deborah has assisted, and is assisting, Eastern Cape Parks and Tourism Agency with several biodiversity assessments and protected area management plans for several sites declared or to be declared as protected areas in terms of the National Protected Areas Act (2016 – 2020).

She has conducted Environmental Impact Assessments, Environmental Management Plans, Basic Assessments, although currently her focus is specialist vegetation, wetland and riparian surveys and assessments (. She has river and estuary research experience; and has processed water use applications. Deborah has also performed several environmental risk assessments for abalone, as well as freshwater and marine fish species, in association with Enviro-Fish Africa (Department of Ichthyology and Fisheries Science, Rhodes University). She similarly assisted with the development of one of the first Municipal Coastal Management Programmes, required in terms of the Integrated Coastal Management Act (Eden District Municipality).

She was employed by South African National Parks on two Global Environmental Facility (GEF) funded projects, aimed at mainstreaming biodiversity data and policy guidelines into land use planning and decision-making at the local, provincial and national level (2007 – 2012). Activities encompassed stakeholder consultation, the development of municipal biodiversity sector plan handbooks (main author) and compiling a legislative guide, as well as leading local and provincial capacity building workshops. She provided biodiversity input into the development of draft rural land use management guidelines for the Department of Environmental Affairs and Development Planning (Western Cape) (2008).

She undertook a review of 30 key municipal planning documents in the Olifants Catchment (Limpopo, Mpumalanga and Gauteng Provinces), as part of the Resilim-O Project supported by the United States Agency for International Development (USAID), and has acted as a biodiversity advisor where she has assisted with mainstreaming biodiversity into local and district municipal planning (2015 – 2019). This included GIS refinement of the Local Ba-Phalaborwa and Maruleng Municipal portions of the Mopani District Critical Biodiversity Areas Map, and the production of the Ba-Phalaborwa and Maruleng Municipal Biodiversity Sector Plan Handbooks (November 2018). Deborah was co-author in the compilation of the Waterberg District Municipality Bioregional Plan (Limpopo Province) for the Department of Economic Development, Environmental and Tourism; as well as the Biodiversity Sector Plan for the North West Province for the Rural, Environmental and Agricultural Development, in association with Ecosol GIS, Dr Philip Desmet and Dr Stephen Holness (the leading conservation planners in South Africa).

QUALIFICATIONS

Tertiary Education

Nelson Mandela Metropolitan University (2011)

- MSc Botany (Estuaries): The Phenology of Macrophytes in a Temporarily Open/Closed Estuary compared with a Permanently Open Estuary, South Africa (71%).

University of Cape Town – Bachelor of Arts Degree (1997)

- Major Subject - Environmental & Geographical Sciences

- Relevant Subjects - Integrated Environmental Management (IEM), Environmental Impact Assessment (EIA), Conflict Management, Ecological Issues in Africa, Geo-Science, Statistics, Research Methodologies and Report Writing.
- Deans Merit list (1995 & 1996), Class Medals (Geo-Science, 1995; African Religious Traditions, 1996).

Cape Technikon – National Horticultural Diploma (1994)

- Relevant Subjects - IEM, EIA, Environmental Studies, Soil Science, Botany, Plant Identification and Landscape Design, Soil Science, Horticultural Science, Propagation and Re-vegetation Practices.
- 10 out of 20 distinctions.

Additional Courses

- Estuary Management Course (2009) - Nelson Mandela Metropolitan University
- Landscape Function Analysis (2005) – Potchefstroom University.
- Rehabilitation Course (2004) – Rhodes University (Prof R Lubke).
- Environmental Impact Assessment (2003) – Coastal & Environmental Services, Rhodes University.
- Class 4 Commercial Diver (2002).

Other

- I have not received a SACNASP registration due to a BA degree, not a BSc undergraduate degree (a key requirement). I was requested an interview in Johannesburg, but declined as there is no guarantee of success, despite almost 20 years of experience, an MSc degree and the host of projects below demonstrating my capabilities.

PROFESSIONAL EXPERIENCE

Independent Biodiversity Services Professional: Integrating Biodiversity and Planning (2011 -2020)

Botanical, Wetland, Riparian and Estuarine (Botanical) Surveys, Basic Ecological Assessments, Basic GIS Mapping Projects -

- Vissers Vale Vegetation and Aquatic Assessment. Proposed Chalet and Agricultural Development. Sunland/ Kirkwood. Sundays River Valley Municipality. (Contracted by: Habitat Link Consulting) (Current).
- Sunriver Citrus Vegetation and Aquatic Assessment. Proposed Agricultural Development. Colchester, Sundays River Valley Municipality. (Contracted by: Sunriver Citrus cc) (2019).
- Biodiversity Advisor to the Association for Water and Rural Development (AWARD) - Integrating Biodiversity into Municipal Planning Documents in the Limpopo Catchment of South Africa and Mozambique. (Contracted by: RESILIM/AWARD – USAID Funded Project) (2017 - 2019t) – developing Biodiversity Sector Plan handbooks, A3 mapbooks and pamphlet for Ba-Phalaborwa and Maruleng Municipalities, Limpopo Province.
- Wolwerton Farm. Revised Project Description. Citrus Cultivation. Vegetation and Aquatic Survey and Assessment. Sundays River Valley Municipality. (Contracted by: Habitat Link Consulting) (Current).
- Hillsnek and Kwandwe Game Reserve Biodiversity Assessment and incorporation into the Indalo Protected Environment and associated Protected Area Management Plan. Protected Environment Application to the Eastern Cape Parks and Tourism Agency. Eastern Cape. (Contracted by: Mr B. Cook and Kwandwe Game Reserve) (Current, 2019).
- African Flame Biodiversity Assessment for a Protected Area Application to the Eastern Cape Parks and Tourism Agency. Eastern Cape. Portion 89, Port Elizabeth, Nelson Mandela Bay Municipality, Eastern Cape (Contracted by: Mr Toto van der Merwe) (Current, 2019).
- Coleridge Biodiversity Assessment and incorporation into the Buffalo Kloof Protected Environment and associated Protected Area Management Plan. Protected Environment Application to the Eastern Cape Parks and Tourism Agency. Eastern Cape. (Contracted by: Mr Cole) (Current, 2019).
- Sibuya Game Reserve Environmental Management Plan, as part of the Indalo Protected Environment (Contracted by: Mr Nick Fox) (Current).
- Ikamva Lethu Citrus Water Use License Application: Sundays River Valley Municipality. (Contracted by: Ikamva Lethu Farms Pty Ltd) (2017 - 2019).
- Falcon Ridge Cultivation Water Use License Application: Sundays River Valley Municipality. (Contracted by: Mr Johannes Joubert) (2017 - 2019).
- Ecological Assessment, with Riparian Assessment. Cycads Retirement Development. East London. Buffalo City Metropolitan Municipality Eastern Cape. (Contracted by: Controlab) (Current – await EIA modifications).
- Scheepersvlakte. Vegetation and Aquatic Assessment. Addo. Eastern Cape. (Contracted by: Public Process Consultants) (2018).
- Ecological Assessment, with wetland and riparian assessment. Megamore Park Light Industrial Development. East London. Buffalo City Metropolitan Municipality Eastern Cape. (Contracted by: Environmental Impact Management Services Pty Ltd) (2018).
- Ecological Assessment. Port Alfred, Erf 4669, Residential Development. Ndlambe Municipality Eastern Cape. (Contracted by: Sandy van der Wahl, Independent Consultant) (March – May 2018).
- Vegetation and Floristics Assessment. Riverleigh Mixed Use Development. East London. Buffalo City Metropolitan Municipality Eastern Cape. (Contracted by: Terreco Environmental cc) (2018).
- 5 Biodiversity Assessments and Protected Area Management Plans (Golden Fleece, Balloch, Sompondo Communal Area, Elansberg /Glenara, Mimoso Park). Protected Area Applications to the Eastern Cape Parks and Tourism Agency. Eastern Cape. (Contracted by: Eastern Cape Parks and Tourism Agency) (2018).

- Biodiversity Assessment and Protected Area Management Plan. Intsomi Protected Environment. Protected Environment Application to the Eastern Cape Parks and Tourism Agency. Eastern Cape. (Contracted by: San Miguel South Africa Pty Ltd) (2017 - 2019).
- Protected Area Management Plan. Buffalo Kloof Game Reserve. Protected Environment Application to the Eastern Cape Parks and Tourism Agency. Eastern Cape. (Contracted by: Mr W Rippon) (August 2017 – 2019 final).
- Protected Area Management Plan. Indalo Game Reserves. Protected Environment Application to the Eastern Cape Parks and Tourism Agency. Eastern Cape. (Contracted by: Indalo Game Reserves) (Draft format 2018).
- Chelsea. Vegetation and Floristics Assessment. Port Elizabeth (Contracted by: Habitat Link Consultants) (August 2017 – February 2018).
- San Miguel Sylvania Citrus. Expansion of Citrus. Vegetation and Aquatic Survey and Assessment. Kirkwood, Sundays River Valley Municipality. (Contracted by: Public Process Consultants) (2018).
- Ikamva Lethu. Falcon Ridge Farm Vegetation and Aquatic Assessment: Phase ii Impact Assessment. Sundays River Valley Municipality. (Contracted by: Public Process Consultants) (2018).
- Lake de la Vie. Vegetation and Aquatic Assessment. Port Elizabeth (Contracted by: Habitat Link Consultants) (Current – await EIA modifications).
- Botanical Survey. Bushmans, Mixed Use Development. Ndlambe Municipality Eastern Cape. (Contracted by: Sandy van der Wahl, Independent Consultant) (August 2017).
- Dunbrody. Water Use License Application to the Department of Water and Sanitation. (Contracted by: Unifrutti Pty Ltd) (July 2017 – March 2018).
- Falcon Ridge. Water Use Application to the Department of Water and Sanitation. (Contracted by: Habata Boerdery Pty Ltd) (November 2017 – May 2018, submitted await authorisation).
- Lebombo Msikaba Wetland Assessment. Eastern Cape. (Contracted by: ETC Environmental Consultants) (August – September 2018).
- Dunbrody Estates. Expansion of Citrus. Vegetation and Aquatic Survey and Assessment. Kirkwood, Sundays River Valley Municipality. (Contracted by: Public Process Consultants) (January - June 2017).
- Falcon Ridge Farm. Vegetation and Aquatic Survey and Assessment. Nelson Mandela Bay Municipality. (Contracted by: Public Process Consultants) (December 2015 –February 2015/Phase 2 2017).
- Falcon Ridge Farm. Vegetation and Aquatic Survey and Assessment. Nelson Mandela Bay Municipality. (Contracted by: Public Process Consultants) (December 2015 –February 2015/Phase 2 current).
- Ikamva Lethu. Vegetation and Aquatic Assessment: Phase ii Impact Assessment. Sundays River Valley Municipality. (Contracted by: Public Process Consultants) (Current – await EIA modifications).
- Langbos Citrus. Section 21c and 21i water use application. Addo. Sundays River Valley Municipality. (Contracted by: Francois Joubert) (April – August 2017).
- Freshgro Kariega Citrus Development. Section 21c and 21i Supplementary Form Completion, Kirkwood, Sundays River Valley Municipality. (Contracted by: Applicant) (2016).
- Biodiversity Assessment. Buffalo Kloof Game Reserve. Protected Environment Application to the Eastern Cape Parks and Tourism Agency. Eastern Cape. (Contracted by: Mr W Rippon) (December 2016 – February 2017).
- Protected Area Management Plan. Indalo Game Reserves. Protected Environment Application to the Eastern Cape Parks and Tourism Agency. Eastern Cape. (Contracted by: Indalo Game Reserves) (2016-2017).
- Riparian Desktop Assessment. Proposed Low Level Bridge Crossings at Ngqandulo (Kujadu River) and Suncity (Mzenge River). Ingquza Hill Local Municipality, Eastern Cape. (Contracted by: Izwile Africa Development Consultants) (September 2016).
- Zoetgenoegd Farm – Citrus Agriculture: Ecological Assessment. Addo. Nelson Mandela Bay Municipality. (Contracted by: IWR Terblanche and Associates – Environmental Consulting) (August 2016).
- Wetland Assessment. Chatty Bulk Stormwater Development, Nelson Mandela Bay Municipality, Port Elizabeth. (Contracted by: SRK Consulting) (August 2016).
- Wetland and Riparian Assessment. Bengal Heights Proposed Housing Development, Buffalo City Municipality, East London. (Contracted by: Terreco Environmental cc) (June – July 2016).
- Biodiversity Assessment. Indalo Game Reserves. Protected Environment Application to the Eastern Cape Parks and Tourism Agency. Eastern Cape. (Contracted by: Indalo Game Reserves) (May – August 2016).
- Langbos Farm. Expansion of Citrus. Vegetation and Aquatic Survey and Assessment. Addo, Sundays River Valley Municipality. (Contracted by: Public Process Consultants) (Current, Draft submitted).
- Proposed Mncwasa Bridge Crossing. Present Ecological State Assessment. Mbashe Local Municipality (Contracted by: Ikamva Consulting) (March – April 2016).
- Proposed Quarry along the N2 between Grahamstown and Peddie. Vegetation Survey and Assessment Makana Local Municipality. (Contracted by: Terreco Environmental cc) (March 2016).
- Seven Fountains Mixed Use Development. Aquatic Survey and Assessment. Makana Local Municipality. (Contracted by: Public Process Consultants) (February 2016).
- Misty Mount Aquatic Study. Mthatha, Nyandeni Local Municipality, Eastern Cape (Contracted by: Ikamva Consulting) (January – February 2016).
- Wolweton Farm. Citrus Cultivation. Vegetation and Aquatic Survey and Assessment. Sundays River Valley Municipality. (Contracted by: Public Process Consultants) (December 2015 – January 2015).
- Habata Portion 15 of 203. Vegetation and Wetland Survey and Assessment. Sundays River Valley Municipality. (Contracted by: Public Process Consultants) (November 2015).

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- Amajingqi Macadamia Cultivation. Shixini Area, former Transkei. Mbashe Municipality. Aquatic Survey and Assessment. Present Ecological State, Riparian Vegetation Delineation and Impact Assessment. (Contracted by: Laughing Waters) (October – November 2015).
- Wetland Survey and Assessment. Eskom Ankerlig-Sterrekus Powerline 20km, Cape Town, Western Cape (Contracted by: Environmental Impact Management Services Pty Ltd) (Current).
- North West Province Biodiversity Sector Plan (BSP). BSP handbook for the Department of Rural, Environment and Agricultural Development (Contracted by: ECOSOL GIS) (Current).
- Waterberg District Bioregional Plan. Limpopo Province. Department of Economic Development and Environmental Affairs (Contracted by: ECOSOL GIS) (Current).
- Umgcabo Farm Vegetation and Aquatic Assessment. Rapid Environmental Risk Assessment. Sundays River Valley Municipality. (Contracted by: Public Process Consultants) (June – July 2015).
- Gafney Farm Vegetation and Aquatic Assessment: Sensitive Areas Mapping. Rapid Environmental Risk Assessment. Sundays River Valley Municipality. (Contracted by: Public Process Consultants) (June – July 2015).
- Aquatic Assessment. Citrus Cultivation of Farm Hitgeist. Sundays River Valley Municipality. Instomi Citrus Cultivation. (Contracted by: Engineering Advise and Services) (Current).
- Aquatic Assessment and Water Use License Application. Sundays River Valley Municipality. Instomi Citrus Cultivation. (Contracted by: Public Process Consultants) (Current/Ongoing).
- Botanical Survey to Mark Threatened and Protected Species. R72 Road Upgrade: Port Alfred to Fish River Estuary – 25 km. (Contracted by: Gibb) (July 2015).
- Freshgro Aquatic Sensitivity Mapping. Sundays River Valley Municipality. Freshgro Citrus Cultivation. (Contracted by: Public Process Consultants) (May 2015).
- Ecological Assessment: Ablution facility at Mtamvuna Estuary, Port Edward. Eastern Cape Province. (Contracted by: Ikamva Consulting Pty Ltd) (March / April 2015).
- Botanical Survey to Identify Protected Plant Species. Eskom Albany-Mimosa Powerline 1.1km, Alicedale, Eastern Cape (Contracted by: Environmental Impact Management Services Pty Ltd) (April 2015).
- Municipal review of the socio-ecological content of spatial and non-spatial planning documents in the Limpopo Catchment. (Contracted by: RESILIM/AWARD – USAID Funded Project) (Current).
- Ecological Assessment: Citrus Cultivation Scheepers Vlake Farm. Sundays River Valley Municipality. (Contracted by: I.W. Terblanche and Associates) (September/October 2014).
- Buffelspruit Nature Reserve Ecological Assessment: Lodge Development, Maletswai Local Municipality, Eastern Cape (Contracted by: NS Environmental Consulting) (Current).
- Ecological Assessment: Loerie Heights Mixed Use Development, Buffalo City Metropolitan Municipality, Eastern Cape (Contracted by USK Consulting Engineers) (Current).
- Wetland Aquatic Assessment. Rosedale Water Works. Mthatha. (Contracted by: Scherman Colloty and Associates) (October 2014).
- Aquatic Assessment. Sabelele Road Upgrade, Cofimvaba, Eastern Cape. (Contracted by: SRK Consultants) (August – September 2014).
- Specialist Review: Construction activities within buffers recommended in the Sunny South Housing Development, Buffalo City Metropolitan Municipality, Eastern Cape. (Contracted by: Environmental Impact Management Services Pty Ltd) (August 2014).
- Wetland Survey and Assessment. Gonubie. Buffalo City Metropolitan Municipality (Contracted by: Tshani Consulting) (December 2014).
- Ecological Assessment: Citrus Cultivation Scheepers Vlake Farm. Sundays River Valley Municipality. (Contracted by: I.W. Terblanche and Associates) (August - September 2014).
- Ecological Assessment: Thina Lodge Development, Thina Falls, Mhontlo Municipality, Eastern Cape (Contracted by: Ikamva Consulting) (September – October 2014).
- Aquatic Assessment. Summerstrand Stormwater Upgrade. Nelson Mandela Bay Metropolitan Municipality (Contracted by: Public Process Consultants) (August 2014).
- Hintsabe Ecological Assessment: Mixed Use Development, Nqgushwa Local Municipality, Eastern Cape (Contracted by: Indwe Environmental Consulting) (August 2014).
- Gonubie Ecological Assessment: Residential Development, Buffalo City Metropolitan Municipality, Eastern Cape (Contracted by: NS Environmental Consulting) (Current).
- Mkuze Wetland Survey and Water Use License Application (Contracted by: Scherman Colloty and Associates) (April - September 2014).
- Specialist Botanical Assessment: Vegetation and Floristics. Thornhill Bulk Water Supply Scheme, Greater Mthatha Area, Eastern Cape (Contracted by: Gibb Africa) (Current).
- Ecological Assessment: Cofimvaba Mixed Use Human Settlement. Cofimvaba, Intsika Yethu Local Municipality, Eastern Cape. (Contracted by USK Consulting) (February 2014).
- R72 Main Road Biodiversity Assessment. Ndlambe and Ngqushwa local municipalities, Eastern Cape (Contracted by: Scherman Colloty and Associates) (January – March 2014).
- Specialist Botanical Assessment: Vegetation and Floristics. Rosedale Water Treatment Works and Associated Pipeline, Mthatha, Eastern Cape (Contracted by: Gibb Africa) (Current).

- Specialist Ecologist and Wetland Assessment. Coega Tankatara Road Upgrade. Coega Industrial development Zone. Nelson Mandela Bay Municipality. Eastern Cape. (Contracted by: Environmental Impact Management Services Pty Ltd) (2014).
- Msenge Emoyeni Wind Farm Water Use Licensing Application, Bedford (Phase II) – Report Compilation in collaboration with Dr Patsy Scherman (Contracted by: Scherman Colloty and Associates) (Current & Ongoing).
- Mvoti – Mzimkulu Water Management Area (WMA 12) – Assistance with Water Quality component of Classification Study (Contracted by: Scherman Colloty and Associates) (Current & Ongoing).
- Inkomati Water Management Area– Assistance with Water Quality component of Classification Study (Contracted by: Scherman Colloty and Associates) (Current & Ongoing).
- R72 Main Road Biodiversity Assessment. Ndlambe and Ngqushwa local municipalities, Eastern Cape (Contracted by: Scherman Colloty and Associates) (October 2013).
- Swaziland Scoping Study. Biodiversity Data and Mapping Report (Contracted by: Scherman Colloty and Associates) (October 2013).
- Ingquza Wetland Study. Eastern Cape (Contracted by: Scherman Colloty and Associates for AURECON) (September 2013).
- Specialist Ecologist and Wetland Assessment. Proposed Residential Development within 100 m of the High-Water Mark, Kariega Estuary, Kenton-On-Sea. Ndlambe Municipality (Contracted by Conservation Support Services). (July – September 2013).
- Proposed Dedisa – Grassridge 132 kV Powerline. Protected Species Permit Application - Specialist Botanical Survey. (Contracted by: Scherman Colloty and Associates). (Feb – July 2013).
- Proposed Dedisa – Grassridge 132 kV Powerline Environmental Management Programme and Specialist Botanical Survey. (Contracted by: Scherman Colloty and Associates). (Feb – July 2013).
- Specialist Botanical and Vegetation Assessment. Proposed Upgrade of Storm water Infrastructure. Addo, Sundays River Valley Municipality, Eastern Cape. (Contracted by: Scherman Colloty and Associates). (June – July 2013).
- Specialist Wetland Study. Proposed Port Alfred Central Well Fields. Ndlambe Municipality, Eastern Cape (Contracted by Coastal and Environmental Services) (June 2013).
- Specialist Ecologist Assessment. Proposed Residential Development within 100 m of the High-Water Mark, Bushmans Estuary, Bushmans Mouth, Kenton-On-Sea. Ndlambe Municipality (Contracted by Conservation Support Services). (March – May 2013).
- Specialist Ecologist and Wetland Assessment. Proposed Access Road and Culvert Crossing over the Salt Vlei Wetland, Port Alfred. Ndlambe Municipality (Contracted by Conservation Support Services). (January – April 2013)
- Specialist Ecologist and Wetland Assessment. Proposed Slipway on the Mthatha River, Mthatha. King Sabata Dalinyendebo Municipality (Contracted by Conservation Support Services) (February – April 2013).
- Specialist Ecological and Wetland Study for the proposed Sunny South Housing Development, Buffalo City Metropolitan Municipality, Eastern Cape. (Contracted by: Environmental Impact Management Services Pty Ltd) (May 2013).
- Specialist Botanical Report for the Kwanobuhle Housing Development, Port Elizabeth, Nelson Mandela Bay Municipality (Contracted by: Scherman Colloty and Associates) (May 2013).
- Swanepoel Kraals Wetland Study. (Contracted by: Scherman Colloty and Associates) (April 2013).
- Watercourse Delineation Study for the formalization of the Mdantsane Townships. East London. Buffalo City Metropolitan Municipality, Eastern Cape. (Contracted by: Scherman Colloty and Associates) (March 2013).
- Letaba Catchment Reserve – Assistance with Water Quality component of Classification Study (Contracted by: Scherman Colloty and Associates) (October 2012 – June 2013).
- Aquaculture Scoping Study for South Africa Environmental Risk Analysis of current species farmed and associated farming methods in South Africa (Contracted by: Enviro-Fish Africa, Department of Ichthyology and Fisheries Science, Rhodes University) (2012).
- Addo Elephant National Park Mainstreaming Biodiversity Project: Ndlambe, Sundays River Valley, Blue Crane Route and Ikwezi Municipalities, Eastern Cape (Contracted by: South African National Park Parks, French GEF funded project) – Biodiversity and Planning Advisor, capacity building at the local and provincial level on the uptake of biodiversity information, production of user friendly products (four handbooks, four posters, a mapbook and DVD), managing the design component of user friendly products. The production of four Biodiversity Sector Plans (main author) (July 2011 – December 2012).
- Eden District Municipality Coastal Management Programme – Assistance with report compilation: Sensitive environments, legislative review, and management action plans (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Ndlambe Wetland Delineation Study – Present Ecological State Assessment and GIS Mapping (Contracted by: Coastal and Environmental Services) (2012).
- Amakhala Emoyeni Wind Farm Water Use Licensing Application (Phase I), Bedford – Assistance with report compilation (Contracted by: Scherman Colloty and Associates) (2012).
- Tsitsikamma Wind Farm Water Use Licensing Application, Kouga Local Municipality – Assistance with report compilation, including an Integrated Water and Waste Management Plan. Technical assistance with wetlands and wetland GIS mapping, including Wetland Delineation and Sensitivity Assessment Report (Contracted by: Scherman Colloty and Associates). (2012).
- Tombo Access Roads: Water Use Licensing Application, Port St Johns Local Municipality – Assistance with report compilation (Contracted by: Scherman Colloty and Associates) (2012).

- Mthatha Corana Bridge Crossings: Water Use Licensing Application, King Sabata Municipality, Eastern Cape - Assistance with report compilation (Contracted by: Scherman Colloty and Associates). (2012).
- Environmental Assessment and Abalone Marine Ranching Proposal Report. Proposed Abalone Marine Ranching Pilot Project EC1: Schoemakerskop (Sardinia Bay) Marine Protected Area to Cape Recife, Eastern Cape, Nelson Mandela Bay Municipality. Including Environmental Management Plan. Report Compilation in collaboration with Aquaculture Specialist Prof P Britz (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Environmental Assessment and Abalone Marine Ranching Proposal Report. Proposed Abalone Marine Ranching Pilot Project EC2: Hamburg to East London Harbour, Eastern Cape. Including Environmental Management Plan. Report Compilation in collaboration with Fisheries (Abalone) Specialist Prof P Britz (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Environmental Assessment and Abalone Marine Ranching Proposal Report. Proposed Abalone Marine Ranching Pilot Project Concession Area EC3: Chintsa to Mazeppa Bay, Eastern Cape Great Kei Municipality. Including Environmental Management Plan. Report Compilation in collaboration with Fisheries (Abalone) Specialist Prof P Britz (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Environmental Assessment and Abalone Marine Ranching Proposal Report. Proposed Abalone Marine Ranching Pilot Project Concession Area EC3: Chintsa to Mazeppa Bay, Eastern Cape Great Kei Municipality. Including Environmental Management Plan. Report Compilation in collaboration with Fisheries (Abalone) Specialist Prof P Britz (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Environmental Assessment and Abalone Marine Ranching Proposal Report. Proposed Abalone Marine Ranching Pilot Project Concession Area NC1: Boegoeberg Noord to Beach North of North Point, Richtersveld Local Municipality, Northern Cape. Including Environmental Management Plan. Report Compilation in collaboration with Fisheries (Abalone) Specialist Prof P Britz (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Environmental Assessment and Abalone Marine Ranching Proposal Report. Proposed Abalone Marine Ranching Pilot Project Concession Area NC4: Skulpfontein to Two Small Rocks 200m From Shore, Kamiesberg Local Municipality, Northern Cape Including Environmental Management Plan. Report Compilation in collaboration with Fisheries (Abalone) Specialist Prof P Britz (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Ecological Risk Assessment. Proposed Aquaculture Development: The Development of a Pilot Land-Based Dusky Kob (*Argyrosomus japonicus*) Mariculture Facility at Hamburg, Ngqushwa Municipality, Eastern Cape. Including Environmental Management Plan. Report Compilation in collaboration with Aquaculture Specialist Dr T Shipton (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).
- Basic Assessment Report. Proposed Trout Aquaculture Facility, Reedsdell Farm, north of Barkley East, Senqu Local Municipality, Eastern Cape. Including Environmental Management Plan (Contracted by: Enviro-Fish Africa, Rhodes University) (2012).

Biodiversity Consultant for South African National Parks (SANParks) - Addo Elephant National Park Biodiversity Mainstreaming Project (SANParks) - Global Environmental Facility Funded Project (2011-2012)

- Duties: Main author of four biodiversity sector plan handbooks for 4 local municipalities (Ndlambe, Ikwezi, Sundays River Valley, Blue Crane Route), Production of user-friendly products and input into the design process, Leading local municipal capacity building workshops, Assisting with incorporating biodiversity into IDP and SDF documents.

Biodiversity Liaison Officer for South African National Parks (SANParks), Global Environmental Facility Funded project (2007 – 2010) – Garden Route Initiative

- Duties – Mainstreaming biodiversity into land use planning and decision making through government stakeholder workshops, main author of two biodiversity sector plan handbooks for 5 local municipalities, capacity building at the local and provincial level on the uptake of biodiversity information, the review of municipal Integrated Development Plans and Spatial
- Development Frameworks, the review of biodiversity policy documents e.g. biodiversity offset guidelines and rural land use guidelines developed by the Department of Environmental Affairs and Development Planning.
 - Vromans, D.C., Maree, K.S., Holness, S., Job, N. and Brown, A.E. 2010. The Garden Route Biodiversity Sector Plan for the George, Knysna and Bitou Municipalities. Supporting land-use planning and decision-making in Critical Biodiversity Areas and Ecological Support Areas for sustainable development. Garden Route Initiative. South African National Parks. Knysna. ISBN 978-0-9869776-1-9.
 - Vromans, D.C., Maree, K.S., Holness, S., Job, N. and Brown, A.E. 2010. The Garden Route Biodiversity Sector Plan for the Southern Regions of the Kouga and Koukamma Municipalities. Supporting land-use planning and decision-making in Critical Biodiversity Areas and Ecological Support Areas for sustainable development. Garden Route Initiative. South African National Parks. Knysna. ISBN 978-0-9869776-2-6.

Environmental Consultant for 'Coastal and Environmental Services' (May 2003 – December 2006)

- Duties – Quotation and Proposal Compilation, Report Writing, Environmental Impact Assessment and Scoping Studies/Reports, Basic Assessments, Botanical Sampling, Vegetation Surveys and Assessments & Herbarium Work (Plant Identification), Sensitivity Assessments, Rehabilitation Specifications, Environmental Management Plans. Environmental Control Officer. Project Management.

Projects –

- Environmental Control Officer – Environmental Auditing Reports for the proposed “Upgrade of Kenton-on-Sea/Bushmansrivermouth - Bulk Water Supply”. Prepared for the Albany Coast Water Board, Eastern Cape (2005).
- The proposed establishment of an 'Eco-Residential' Development at Seafield (Kleinemonde) in the Eastern Cape: Environmental Scoping Report (2006).

- The proposed Rosehill Mixed Use Development at Port Alfred: Environmental Impact Assessment (2006).
 - The proposed Trailees Wetland Access Road at Port Alfred: Environmental Scoping Report (2006).
 - Vegetation Survey, River Sands, Ndlambe Local Municipality (2006)
 - Cola Beach Guide Plan Amendment: Vegetation Survey, Knysna Local Municipality (2006)
 - Upgrade and extension of the Mpekweni Resort, Ndlambe Local Municipality (2006)
 - KZN Vegetation Mapping, Durban, Kwazulu Natal (2006)
 - ACSA EL Airport Upgrade: Basic Assessment Report, Buffalo City Municipality, Eastern Cape (2006)
 - CSL Vegetation Monitoring, Proposed Mining Project, Mozambique (2006)
 - Vegetation Survey and Environmental Scoping Report: Proposed Eco-Lodge Development and Nature Reserve, as an Extension to Lalibela Game Reserve, Eastern Cape (2006)
 - Vegetation Survey and Sensitivity Assessment, Proposed Mixed Use Development, Gonubie, Buffalo City Municipality (2006).
 - Environmental Scoping study: Proposed Shopping Development, Beacon Bay, Buffalo City Municipality (2006).
 - Lima Massacre Heritage Site, Environmental Scoping Study and Vegetation Survey, Queenstown (2006).
 - Review and editing of several Scoping Studies, EIAs and Vegetation Surveys (2005 – 2006).
 - The proposed upgrading and construction of two tented campsites with jetties along the Kariega River and the reparation of the watercourse bank, Kenton-On-Sea, Eastern Cape. Environmental Scoping Report. Prepared for Foxlaw investments - Private Developer (2004 – 2005).
 - Preparation of a Construction and Operational Environmental Management Plan for the proposed “Upgrade of Kenton-on-Sea/Bushmansrivermouth - Bulk Water Supply”. Prepared for the Albany Coast Water Board, Eastern Cape (2005).
 - Upgrade of Main Road 435, Coega Industrial Development Zone, Nelson Mandela Metropolitan Municipality, Eastern Cape. Includes Vegetation Survey (2005).
 - Environmental Control Officer – Coega Port Rehabilitation (2005).
 - The proposed construction of an ‘eco-lodge camp’ on a ridge located on Salem farm # 498 above the Bushmans River, Eastern Cape – Environmental Scoping Report. Prepared for Mr J Kritzing (2003 – 2004).
 - The proposed construction of a lodge resort within the Ntlangano Community Reserve adjacent to the Tsitsa Falls and Chipoka Mineral Sands, Salima Bay, Malawi: Volume 1: Scoping and Terms of Reference. Compiled this report. Allied Procurement Agency, Lilongwe, Malawi (2003).
 - Establishment of a Community Nature Reserve on the south bank of the Umtamvuna River, Eastern Cape - Environmental Scoping Report. Preparing for PondoCrop, Port Edward. (2003 – 2004).
 - The proposed establishment of a Marine and Wildlife Rehabilitation Centre, St Francis Bay, Eastern Cape: Environmental Scoping Report. Prepared for Ajubatis Marine and Wildlife Rescue. (2004 – 2005).
 - Construction of a 66kv Power Line, 22Kv Feeder Bays and Substation St Francis Bay, Eastern Cape: Environmental Scoping Report. Prepared for Eskom, Southern Region, East London (2004 – 2005).
 - Long term Rehabilitation Plan for the Port of Ngqura. Prepared for the National Ports Authority (NPA), Coega. Port Elizabeth (2004 – 2005).
 - Construction of the proposed refurbishment and rebuilding requirements for the Melkhout/Gamtoos 22kvFeeder Powerline and Gamtoos/Melkhout 22kv Feeder Powerline, Eastern Cape. Environmental Scoping Report. Prepared for Eskom, Southern Region, East London (2004 - 2005).
 - The assessment of an Existing Environmental Scoping Study with additional adaptation to the previously proposed layout design for: The proposed establishment of an ‘Eco-Residential’ development adjacent to the coast and including pristine sand dunes at Aston Bay, Portion 2, Eastern Cape. Prepared for Glenny Buchner Trust (Private Developer) (2004 – 2005)
 - The proposed establishment of an ‘Eco-Residential’ Development at Aston Bay on Farm Swanlake in the Eastern Cape Environmental Scoping Report. Prepared for Glenny Buchner Trust - Private Developer (2004 – 2005).
 - Letaba Water Quality Reserve: Specialist Trainee – Water Quality Assessment of the Letaba River Catchment - Water quality sampling, statistics and report writing (Dr Scherman & Ms Vromans). Preparing for Department of Water Affairs and Forestry (2003 – 2005).
 - Luanda Dredging Pre-feasibility Study: Assistance in writing part of the dredging report for this study. Prepared for PRDW, Cape Town (2003).
 - Construction of a 66kv Power Line Linking Fort Beaufort and Adelaide, Eastern Cape: Scoping Report. Prepared for Eskom, Southern Region, East London (2003).
 - Corridor Sands Chongoene Export Facility EIA, Volume 2: Specialist Reports: Vegetation & Floristics. Assisted in writing and compiling this specialist report. Prepared for ‘Corridor Sands Limitada’. (Prof Lubke & Vromans) (2003).
 - N2 Toll Road Bridges EMP: Vegetation & Sensitivity Analysis. Assisted in writing and compiling the specialist report. (Prof Lubke and Vromans) (2003).
- * Note that all scoping studies include a vegetation assessment and project management.**

Environmental Scientist: Projects Assistant at Enviro-fish Africa PTY (LTD) (Professor Peter Britz, Professor Warwick Sauer, Dr Tim Andrews, Dr Tom Shipton) (Jan – April 2003)

- Duties – Preparation of Tender Proposals, Information Sourcing and Gathering, Data Capture (Excel); Report Writing: Assisted with the compilation of the ‘Nelson Mandela Municipal Metro: Coastal Management Plan’. General Administration and Co-ordination (New Company established).

Environmental Scientist: Projects Management and Assistant at 'Anchor Environmental' PTY (LTD) (Director: Barry Clark) (2000-2002)

- Duties – Preparation of Tender Proposals, Project Management of Tuna Longline, Hake Longline and West Coast Rock Lobster Observer Programmes, Information Sourcing and Presentation (Powerpoint), Data Capture (Excel & Access); Report Writing (MSWord); Financial Administration (Pastel 5.2), General Administration, Project Co-ordination & Logistics, Scientific Sampling (SASS), Estuarine Sampling (Vertebrate & Invertebrate), Coastal Zone (Off-Shore & On-Shore) Sampling (Vertebrate & Invertebrate), Class 4 Scientific Diver.

REFERENCES

- Dr Brian Colloty. EnviroSci Pty Ltd. Cell: 083 498 3299. Email: bcolloty@gmail.com.
- Dr Stephen Holness. Independent Conservation Planner. Cell: 082 887-3735, sholness@mandela.ac.za.
- Dr Philip Desmet. Ecosol GIS. Conservation Planner. Cell: 082 850 8751. Email: drphil@ecosolgis.com.
- Prof Roy Lubke or Dr Alan Carter. EOH Coastal and Environmental Services, Grahamstown and East London (Dr Alan Carter, Prof Roy Lubke). Dr Alan Carter - Tel: 043 742 3302; Email: a.carter@cesnet.co.za. Prof Roy Lubke – Cell: 082 576 2626; Email: R.Lubke@ru.ac.za.