ASKHAM (KAMEELDUIN)

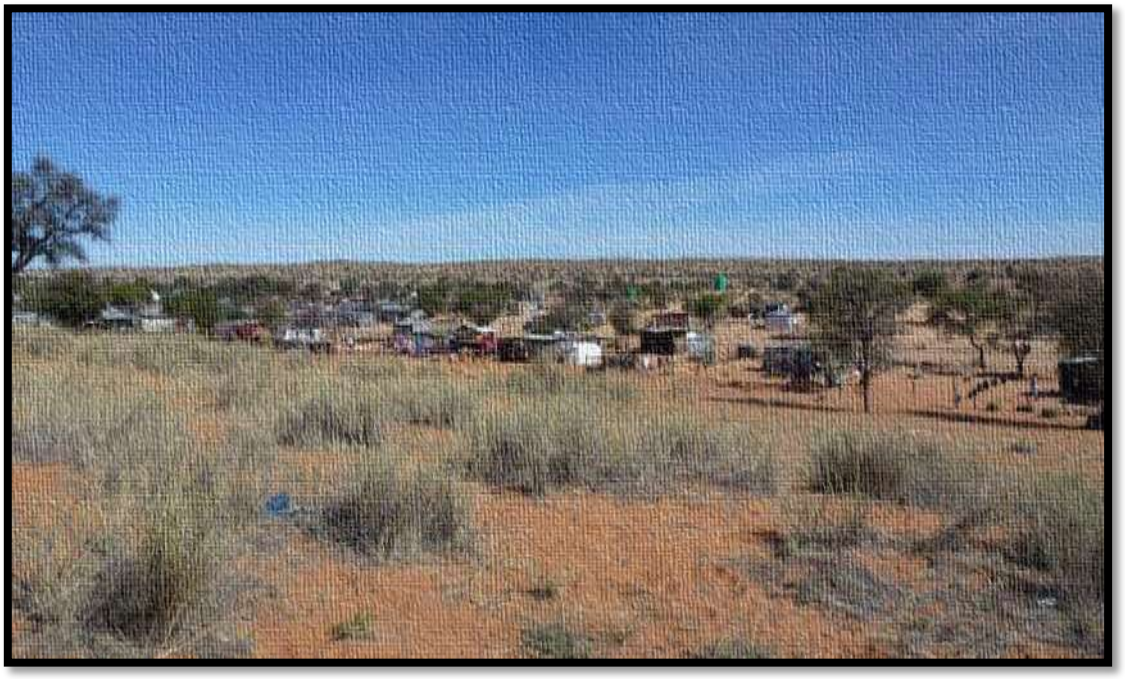
Proposed low cost housing

Mier Municipality Residential Project, Northern Cape

DRAFT BIODIVERSITY & BOTANICAL SCAN

A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required).

November 01, 2012



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INDEPENDENCE & CONDITIONS

PB Consult is an independent consultant to BVi Engineers and has no interest in the activity other than fair remuneration for services rendered. Remunerations for services are not linked to approval by decision making authorities and PB Consult have no interest in secondary or downstream development as a result of the authorization of this proposed project. There are no circumstances that compromise the objectivity of this report. The findings, results, observations and recommendations given in this report are based on the author's best scientific and professional knowledge and available information. PB Consult reserve the right to modify aspects of this report, including the recommendations if new information become available which may have a significant impact on the findings of this report.

RELEVANT QUALITFICATIONS & EXPERIENCE OF THE AUTHOR

Mr. Peet Botes holds a BSc. (Hons.) degree in Plant Ecology from the University of Stellenbosch (Nature Conservation III & IV as extra subjects). Since qualifying with his degree, he had worked for more than 20 years in the environmental management field, first at the Overberg Test Range (a Division of Denel) managing the environmental department of OTB and being responsible for developing and implementing an ISO14001 environmental management system, ensuring environmental compliance, performing environmental risk assessments with regards to missile tests and planning the management of the 26 000 ha of natural veld, working closely with CapeNature (De Hoop Nature Reserve). In 2005 he joined Enviroscientific, an independent environmental consultancy specializing in wastewater management, botanical and biodiversity assessments, developing environmental management plans and strategies, environmental control work as well as doing environmental compliance audits and was also responsible for helping develop the biodiversity part of the Farming for the Future audit system implemented by Woolworths. During his time with Enviroscientific he performed more than 400 biodiversity en environmental legal compliance audits. During 2010 he joined EnviroAfrica in order to move back to the biodiversity aspects of environmental management. Experience with EnviroAfrica includes EIA applications, biodiversity assessment, botanical assessment, environmental compliance audits and environmental control work.

Mr. Botes is also a registered Professional Environmental and Ecological Scientists at SACNASP (South African Council for Natural Scientific Professions) as required in terms of Section 18(1)(a) of the Natural Scientific Professions Act, 2003, since 2005.

Yours sincerely,

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SUMMARY - MAIN CONCLUSIONS

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MAIN VEGETATION TYPES	**Gordonia Duneveld** (Least threatened) is described as occurring on parallel dunes about 3-8 m above the plains. Open grassland with *Acacia haematoxylon* and *Boscia albitrunca* on the dune slopes while *A. erioloba* is common in the interdune straaten and also on the dunes. **Southern Kalahari Mekgacha** (Least threatened) is described as sparse, patchy grass-lands, sedqelands and low herblands dominated by CA grasses (*Panicum, Eragrostis, Enneapogon, Tragus, Chloris and Cenchrus*) on the bottom of (mostly) dry riverbeds.
LAND USE AND COVER	The proposed housing project location is situated within the Duneveld region of the Kalahari. All of these properties are used mainly for livestock grazing and or game farming. No intensive farming has been observed. At present the proposed site and in fact all of the available Municipal land on the remainder of portion 1 of the Farm Kameelduin no. 139 is used for livestock grazing (mostly goats) by the local community living at Kameelduin.
PROTECTED SPECIES	No protected species in terms of NCNCA was observed. Protected Trees: A number of *Acacia erioloba*, A*. haematoxylon* and *Boscia albitrunca* was observed (Refer to Significant or protected plant species, Paragraph 6.9)
IMPACT ASSESSMENT	Development without mitigation: Significance rating = 32.1% Development with mitigation Significance rating = 7.6% Where values of ≤15% indicate an insignificant environmental impact and values >15% constitute ever increasing environmental impact.

RECOMMENDATION

From the information available and the site visit, it is clear that the proposed will not be associated with irreversible species loss, habitat loss, connectivity loss or other associated impacts. However, there is a significant difference between development **without** and development **with** mitigation. As a result it is recommended that all mitigating measures must be implemented in order to further minimise the impact of construction.

With the available information to the author's disposal it is recommended that the project be approved, but that all mitigation measures described in this document is implemented.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOS'

1. INTRODUCTION: ASKHAM

The Mier Municipality is situated adjacent to one of the world's largest conservation areas, the Kgalagadi Transfrontier Park. The municipal area of Mier includes the communities of Rietfontein, Philandersbron, Loubos, Klein Mier, Groot Mier, Welkom, Askham and Noenieput. One of the world's ancient tribes, the !Khomani San, own farms and still reside in the Mier area. The lack of fresh water is a major constraint on development in the Mier area, since water pumped from underground sources is of poor quality, as a result most of the area is used for grazing by livestock or game. More than half of the 6 000 people living in Mier have never left the area. Even so, the biggest asset of Mier is the rich culture and history of its people (www.greenkalahari.co.za).

The municipality has indicated that there is a pressing need for houses, especially low cost houses, as well as serviced plots within all of the communities within the Mier Municipal Area. This is reflected by the housing backlog contained in the 2009/10 version of the Mier IDP (BVi, 2011). The Mier Municipality residential project, are proposing the development of a number of low cost housing at the towns of Rietfontein, Loubos, Groot Mier, Welkom, Askham and Noenieput to alleviate some of the housing problems of the Municipality.

Askham is located approximately 180 km from Upington and 73 km from the Kgalagadi Transfrontier Park, one of the world's largest conservation areas. The Askham community developed around the school that has a boarding house which was built in 1931, and the Dutch Reformed Church of Askham that also serves the whole Kalahari. The Scottish land surveyor, Rodger Jackson, gave Askham its name when he surveyed farms in the Kuruman River in 1919.

The Mier Municipality is proposing a residential expansion of 102 new Ervin on land belonging to the Municipality, next to the existing Askham (Kameelduin build-up), on portion 1 of the Farm Kameelduin no. 139. The specific location has been chosen for the following reasons:

- It is located on Municipal owned land.
- The specific location was chosen by the Municipality and local town planners in order to try and integrate the Kameelduin housing with the rest of Askham.
- It is suitably placed in terms of services.

However, the property and its immediate surrounding areas are still covered by natural veld. As a result a Biodiversity Scan of the proposed location was commissioned in order to evaluate the environmental impact(s) of the proposed project and to establish whether further and more in depth studies would be required. Since the need for additional housing is very apparent this biodiversity study will mainly aim to minimise the environmental impact through correct placement.

From an ecological perspective the specific site location makes immediate sense for the following reasons:

- It will be located on an area already disturbed to some degree as a result of "residential creep". Myriad pedestrian walkways crisscross the property, while it is also used as a playground and grazing for domestic animals belonging to the Kameelduin inhabitants.
- The second main advantage of the proposed location is that it will expand the Kameelduin community away from the Kuruman River corridor, which is located adjacent to the existing Kameelduin community, bordering it to the west and south.

1.1 TERMS OF REFERENCE

EnviroAfrica (Pty) Ltd was appointed by BVi Consulting Engineers (Upington) as the independent Environmental Assessment Practitioner (EAP) to undertake the Basic Assessment (EIA) Process for the proposed development. PB Consult was appointed by EnviroAfrica to conduct a Biodiversity Scan of the proposed site.

PB Consult was appointed within the following terms of reference:

- Complete a Biodiversity Scan of the proposed site in order to determine whether any significant features will be impacted as a result of the proposed development.
- Make recommendations on impact minimisation should it be required
-
- Consider short- to long-term implications of impacts on biodiversity and highlight irreversible impacts or irreplaceable loss of species.

The study includes the following:

- A brief discussion of the local environment in order to give some background on the ecological factors influencing the ecological drivers associated with the specific area.
- A brief discussion of the vegetation types expected and encountered with emphasis on protected species encountered.
- A species list encountered during the site visit.
- Determination of the occurrence, or possible occurrence of threatened or sensitive plant species, and sensitive plant communities, on the basis of the field survey and records obtained from the South African National Biodiversity Institute (SANBI) and available literature.
- Assessment of habitat sensitivity, incorporating faunal distribution on the hand of the field survey and from available literature.
- An evaluation of the potential impact of the proposed project on habitat and species using Van Schoor's method for impact evaluation.
- A discussion of significant impacts focusing on possible mitigation and amendments to the development proposal.

2. APPLICABLE LEGISLATION

Constitution of the Republic of South Africa (1996): of special relevance in terms of environment is section 24

Conservation of Agricultural Resources Act 43 of 1983 (CARA): supports conservation of natural agricultural resources (soil, water, plant biodiversity) by maintaining the production potential of the land and combating/preventing erosion; for example, by controlling or eradicating declared weeds and invader plants.

Hazardous Substances Act 15 of 1973: to control substances that may cause injury, ill-health, or death through their toxic, corrosive, irritant, strongly sensitizing or flammable nature, or by the generation of pressure

National Environmental Management Act 107 of 1998 (as amended): replaces the Environmental Conservation Act (ECA) and establishes principles for decision-making on matters affecting the environment, and for matters connected therewith.

- **Environmental Impact Assessment Regulations** (R543 of 2010): procedures to be followed for application to conduct a listed activity.

National Environmental Management: Air Quality Act 39 of 2004 (NEMAQA): replaces the Atmospheric Pollution Prevention Act (No. 45 of 1965).

National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA): supports conservation of plant and animal biodiversity, including the soil and water upon which it depends.

- **National list of ecosystems that are threatened and in need of protection** (GN 1002 of 9 December 2011).

National Environmental Management: Protected Areas Act 57 of 2003 (as amended Act 31 of 2004) (NEMPAA): To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes.

National Environmental Management: Waste Act 59 of 2008 (NEMWA): To reform the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development.

- **List of Waste Management Activities that have, or are likely to have a detrimental effect on the environment** (GN 718 of 3 July 2009): Identifies activities in respect of which a waste management license is required.

National Forests Act 84 of 1998 (as amended): supports sustainable forest management and the restructuring of the forestry sector.

- **List of protected tree species** (GN 716 of 7 September 2012)

National Heritage Resources Act 25 of 1999: supports an integrated and interactive system for the management of national heritage resources, including supports soil, water and animal and plant biodiversity.

National Veld and Forest Fire Act 101 of 1998 (NVFFA): protects soil, water and plant life through the prevention and combating of veld, forest, and mountain fires

National Water Act 36 of 1998 (NWA): promotes the protection, use, development, conservation, management, and control of water resources in a sustainable and equitable manner.

Northern Cape Nature Conservation Act 9 of 2009 (NCNCA): To provide for the sustainable utilization of wild animals, aquatic biota and plants.

2.1 NORTHERN CAPE NATURE CONSERVATION ACT 9 OF 2009

On the 12th of December 2011, the new Northern Cape Nature Conservation Act 9 of 2009 (NCNCA) came into effect, which also provides for the sustainable utilization of wild animals, aquatic biota and plants. Schedule 1 and 2 of the act give extensive lists of specially protected and protected fauna and flora species in accordance with this act. The NCNCA is a very important Act in that it put a whole new emphasis on a number of species not previously protected in terms of legislation.

It also put a new emphasis on the importance of species, even within vegetation classified as "Least Threatened" (in accordance with GN 1002 of 9 December 20011, promulgated in terms of the National Environmental Management Biodiversity Act 10 of 2004). Thus even though a project may be located within a vegetation type or habitat previously not considered under immediate threat, special care must still be taken to ensure that listed species (fauna & flora) are managed correctly.

3. DEFINITIONS & ABBREVIATIONS

3.1 DEFINITIONS

Construction: means the period of the project during which the actual works are carried out, deemed to include site establishment, site preparation, the works, maintenance period and decommissioning.

Construction site: means the area influenced and affected by the construction activities or under the control of the Contractor often referred to as "the Site".

Contaminated water: means water contaminated by the Contractor's activities, *e.g.* concrete water and runoff from plant/ personnel wash areas.

Environment: means the surroundings within which humans exist and that are made up of:

- the land, water and atmosphere of the earth;
- micro-organisms, plant and animal life;
- any part of the combination of the above two bullets and the interrelationships between them;
- the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being

Environmental Aspect: any element of any construction activity, product or services that can interact with the environment.

Environmental Control Officer: a suitably qualified environmental agent responsible for overseeing the environmental aspects of the Construction phase of the EMP.

Environmental Impact: any change to the environment, whether adverse or beneficial, wholly or partially resulting from any construction activity, product or services.

No-Go Area(s): an area of such (environmental/aesthetical) importance that no person or activity are allowed within a designated boundary surrounding this area.

Owner: the owner, or dedicated person, responsible for the management of the property on which the proposed activity will be performed.

Solid waste: means all solid waste, including construction debris, chemical waste, excess cement/concrete, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Precautionary principle: means the basic principle, that when in doubt or having insufficient or unreliable information on which to base a decision, to then limit activities in order to minimise any possible environmental impact.

Watercourse: in this report the author uses a very simplified classification system to define the difference between rivers, streams or a drainage lines encountered in the Northern Cape.

- River: A river is a natural watercourse with a riverbed wider than 3m, usually freshwater, flowing toward an ocean, a lake, a sea or another river. In a few cases, a river simply flows into the ground or dries up completely before reaching another body of water. The flow could be seasonal or permanent.

- Stream: A small river or natural watercourse with a riverbed of less than 3 m, usually freshwater, flowing toward an ocean, a lake, a sea or another river. In a few cases, a river simply flows into the ground or dries up completely before reaching another body of water. The flow could be seasonal or permanent.
- Drainage line: A very small and poorly defined watercourse, mostly on relatively flat areas, which only flows for a short period after heavy rains, usually feeding into a stream or river or dries up completely before reaching another body of water.

3.2 ABBREVIATIONS

BGIS	Biodiversity Geographical Information System
CARA	Conservation of Agricultural Resources Act 43 of 1983
CBA	Critical Biodiversity Areas (Municipal)
DAFF	Department of Agriculture Forestry and Fisheries
DEA	Department of Environmental Affairs
DENC	Department of Environment and Nature Conservation (Northern Cape Province)
EAP	Environmental assessment practitioner
EIA	Environmental impact assessment
EMF	(Municipal) Environmental Management Framework
EMP	Environmental management plan
NCNCA	Northern Cape Nature Conservation Act 9 of 2009
NEMA	National Environmental Management Act, Act 107 of 1998
NEMAQA	National Environmental Management Air Quality Act 39 of 2004
NEMBA	National Environmental Management Biodiversity Act, Act 10 of 2004
NEMPAA	National Environmental Management Protected Areas Act 57 of 2003
NEMWA	National Environmental Management Waste Act 59 of 2008
NFA	National Forests Act 84 of 1998
NSBA	National Spatial Biodiversity Assessment
NVFFA	National Veld and Forest Fire Act 101 of 1998
NWA	National Water Act 36 of 1998
SABIF	South African Biodiversity Information Facility
SANBI	South African National Biodiversity Institute
SIBIS	SANBI's Integrated Biodiversity Information System
SKEP	Succulent Karoo Ecosystem Project
WWTW	Wastewater Treatment Works

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5. PROJECT DESCRIBTION

The municipality has indicated that there is a pressing need for houses, especially low cost houses, as well as serviced plots within all of the communities within the Mier Municipal Area. This is reflected by the housing backlog contained in the 2009/10 version of the Mier IDP. The backlog within the Mier Municipal area was 1380 (Refer to Table 1). The Mier Municipality does not have the financial- and/or human resources available to initiate this development process on their own. The municipality is supported by COGHSTA (Northern Cape) and BVi Consulting Engineers.

The need in terms of housing of phase 1a, covered in the BVi (2011) business plan, in the Mier area are as follows:

Table 1: Identified need for low cost housing in the Mier Municipality (BVi, 2011)

Description	Project	Houses	Town Planning	Geo-Tech	Land Surveying	EIA (1A)
Fill in Houses	Rietfontein	114		114		
	Loubos	55		55		
	Philandersbron	70		70		
	Klein Mier	55		55		
	Groot Mier	40		40		
	Welkom	70		70		
	Askham	100		100		
New Developments (Greenfields)	Groot Mier	178	178	178	178	178
	Welkom	103	103	103	103	103
	Loubos	138	138	138	138	138
	Rietfontein	107	107	107	107	107
	Askham	100	100	100	100	100
Totals		**1130**	**626**	**1130**	**626**	**626**

The Mier Residential Project aims at providing for the need for additional formal Ervin and housing through "in-fill" development within existing build-up areas and the servicing of new areas for formal Ervin (Greenfields). Since the Mier townships were formally planned and developed, before the current EIA legislation, no EIA are needed for existing formal towns ("in fill" development). However, environmental authorization is needed for the development of the new or "greenfield" developments. This biodiversity scan is only applicable to these latter developments.

Greenfield development will entail the construction and placement of all services (water, electricity and sewerage systems) and road infrastructure to service the new town extensions. In effect it will basically mean the levelling and removal of all natural vegetation (except large trees wherever possible) from the site and the establishment of a new town. Since the need for such housing is very apparent this biodiversity study will mainly aim to minimise the environmental impact through correct placement.

5.1 METHODS

Desktop studies were conducted, coupled by a physical site visit during September 2012. The timing of the site visit was reasonable in that essentially all perennial plants were identifiable and although the possibility remains that a few species may have been missed, the author is confident that a fairly good understanding of the biodiversity status in the area was obtained.

The survey was conducted by walking through the site and examining, marking and photographing any area of interest (Refer to Figure 1 underneath). Confidence in the findings is high. During the site visit the author endeavoured to identify and locate all significant biodiversity features, including rivers, streams or wetlands, special plant species and or specific soil conditions which might indicate special botanical features (e.g. rocky outcrops or silcrete patches).

Figure 1: Google image indicating the route walked during the site visit as well as GPS reference points taken

A number of the protected *Acacia erioloba* (Camel thorn) as well as individuals of *Boscia albitrunca* (Sheppard's tree) were encountered throughout the terrain and were also distributed throughout the immediate vicinity of the location (e.g. the surrounding veld showed exactly the same distribution of these species).

6. DESCRIPTION OF ENVIRONMENT

The aim of this description is to put the study area in perspective with regards to all probable significant biodiversity features which might be encountered within the study area. The study area has been taken as the proposed site and its immediate surroundings. During the desktop study significant biodiversity features associated with the larger surroundings was identified, and were taken into account. The desktop portion of the study also informs as to the biodiversity status as classified in the National Spatial Biodiversity Assessment (2004) as well as in the recent National list of ecosystems that are threatened and in need of protection (GN 1002, December 2011), promulgated in terms of the National Environmental Management Biodiversity Act (NEM: BA), Act 10 of 2004. It also aims to take Municipal Environmental Management Frameworks (EMF's) and Municipal Critical Biodiversity Areas (CBA's) into account where applicable.

6.1 LOCATION & LAYOUT

Askham (Kameelduin) is located in the Northern Cape Province, Mier Local Municipality (Siyanda District Municipality), approximately 180 km north of Upington, where the R360 intersects with the R31 (Figure 2 - 4).

Figure 2: General location of the town within South Africa

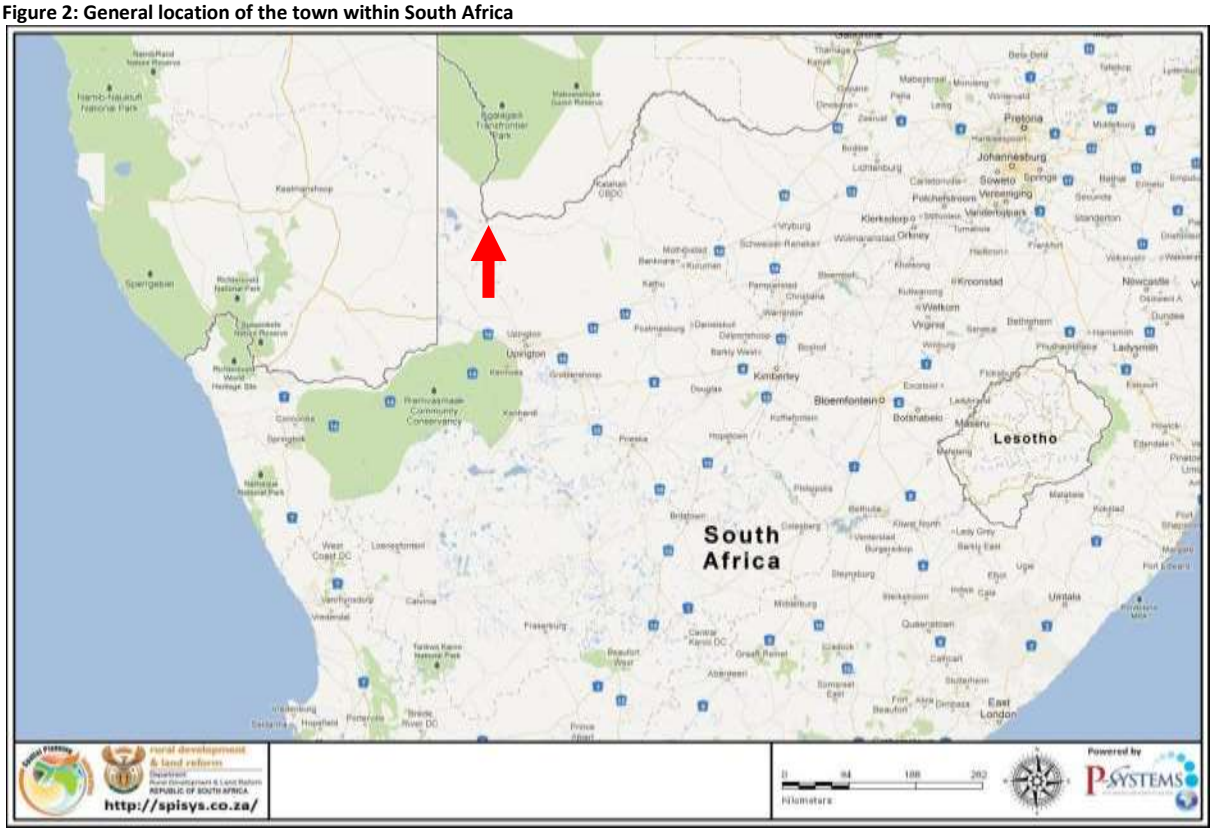
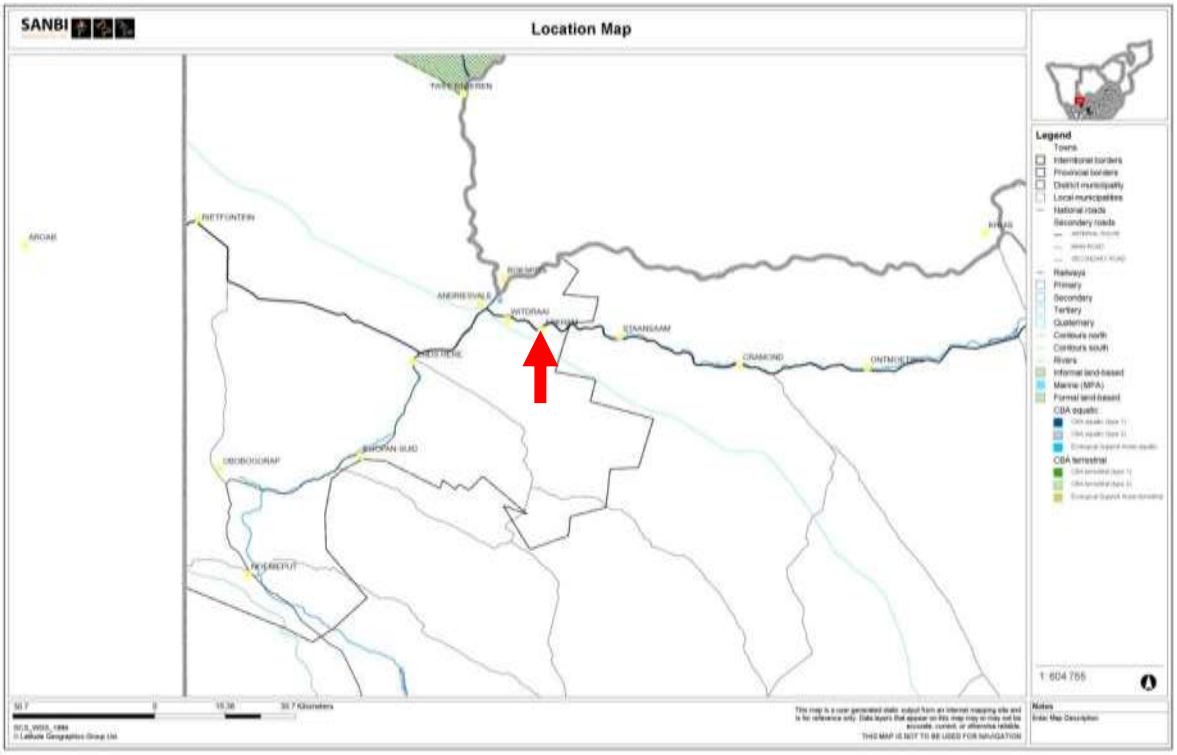


Table 2: GPS coordinates for Askham, Kameelduin settlement and the proposed new development

DESCRIPTION	LATITUDE AND LONGITUDE	ALTITUDE
Askham	S26 58 49.9 E20 46 51.4	856 m
Existing Kameelduin Settlement	S26 58 50.2 E20 46 12.2	856 m
Proposed new development	S26 58 38.1 E20 46 12.5	861 m

Figure 3: Showing the town in relation to the immediate surrounding towns



The Municipality in consultation with local town planners proposes to locate the new Ervin on a portion of portion 1 of the Farm Kameelduin no. 139 (land owned by the Municipality).

Figure 4: Google image giving an indication of the proposed location for the new development (in green)

Please note that the area indicated by the green block above represents a total area of approximately 11 ha. Each Ervin will be approximately 350m², which gives a total area of approximately 3.5 ha needed for the Ervin.

By adding approximately 40% for roads and infrastructure it was estimated by BVi that the total development footprint will be approximately 6 ha. There is thus a 5 ha leeway build into the original 11 ha for finer placement due to environmental concerns.

6.2 TOPOGRAPHY

The town of Askham is located within the parallel dune fields typical of the Kalahari. The proposed new site location will be located within these dunes adjacent and just east of the existing Kameelduin settlement. The landscape can be described as a Duneveld landscape. Elevation data in Table 2, shows that the mean elevation of the elevation varies from 856 – 861 m.

The Kuruman River is located approximately 500 m west and 600 m south of the proposed new housing project. No other natural watercourses or drainage lines have been encountered on the terrain.

6.3 HERTITAGE REMAINS

Although an archaeological or heritage study is not part of this biodiversity study, it is thought prudent to note that 6 grave sites were observed on the site marked by GPS waypoint 75 (the status or these graves will have to be address through a heritage assessment).

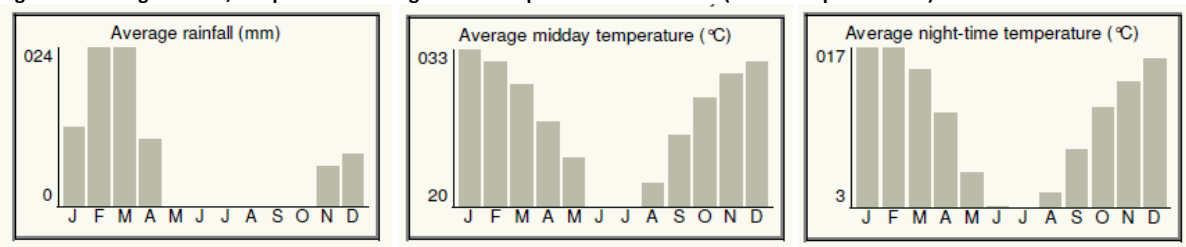
Figure 5: Google image showing the location of the six graves that were observed near waypoint 075 (Orange dot)

Photo 1: Depicting the graves encountered mentioned in Figure 5

6.4 CLIMATE

All regions with a rainfall of less than 400 mm per year are regarded as arid. Askham normally receives about 84 mm of rain per year, with most rainfall occurring mainly during summer. The chart below (lower left) shows the average rainfall values for Askham per month. It receives the lowest rainfall (0 mm) in May and the highest (24 mm) in February. The temperatures at Askham is typical of a desert climate in summer reaching between approximately 30°- 40°C during the day and the middle twenties in the evening. Winter goes to the other end of the scale with daylight temperatures measuring around 20°C and the evenings between 0°- 5°C. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Askham range from 20°C in June to 33°C in January. The region is the coldest during July when the mercury drops to 2.9°C on average during the night. Consult the chart below (lower right) for an indication of the monthly variation of average minimum daily temperatures (www.saexplorer.co.za).

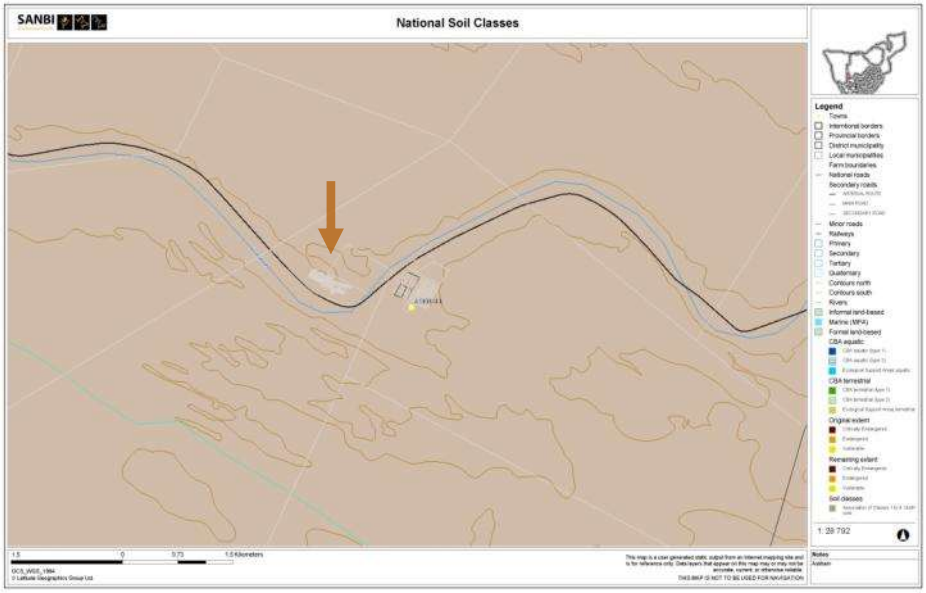
Figure 6: Average rainfall, temperature and night-time temperatures for Askham (www.saexplorer.co.za)



6.5 GEOLOGY & SOILS

According to Mucina and Rutherford (2006) and the SANBI Biodiversity Geographical Information System, the geology and soils for this area is described as aeolian sand underlain by superficial silcretes and calcretes of the Cenozoic Kalahari Group. Mostly fixed parallel sand dunes with Af land type almost exclusively (Mucina & Rutherford, 2006).

Figure 7: General soil map for the area (SANBI BGIS)



No special soils or geology features (e.g. quartz patches or broken veld), which could support special botanical features, were observed during the site visit (or are expected).

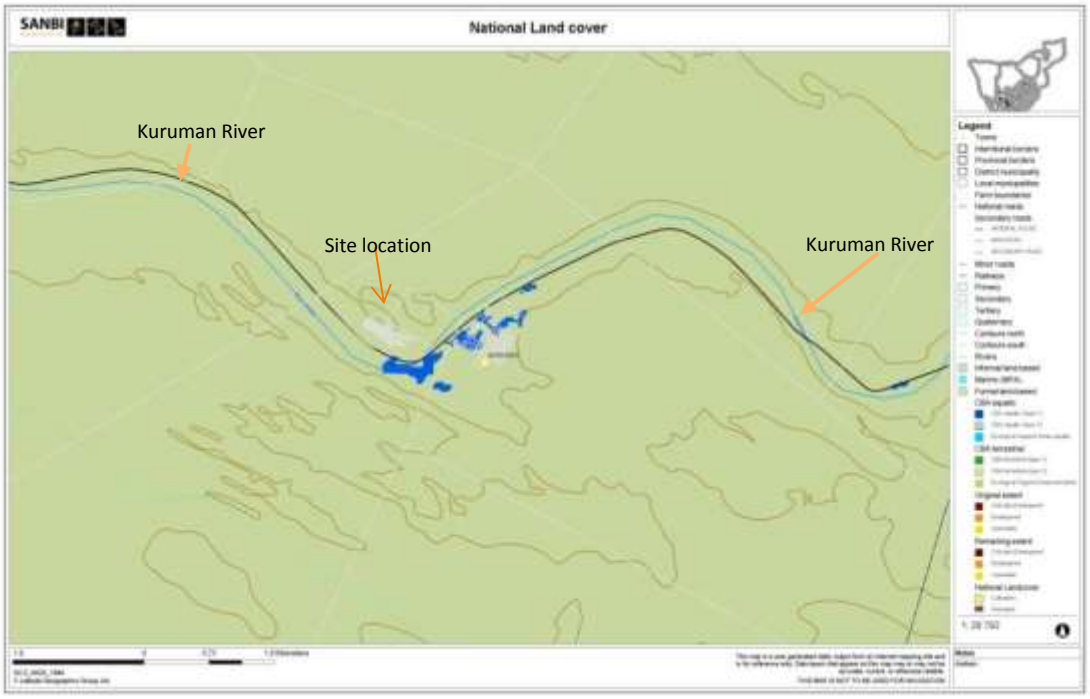
6.6 LANDUSE AND COVER

The proposed housing project location is situated within the Duneveld region of the Kalahari. All of these properties are used mainly for livestock grazing and or game farming (Refer to Figure 8). No intensive farming has been observed (lack of irrigation water). At present the proposed site and in fact all of the available Municipal land on the remainder of portion 1 of the Farm Kameelduin no. 139 is used for livestock grazing (mostly goats) by the local community living at Kameelduin. Although natural fauna and avi-fauna may still be present, it is expected that it would be limited to avi-fauna, insects and maybe some reptile's species. Because of the proximity to the town of Askham and the current land-use game is not expected to be encountered in the vicinity of the site (none has been observed). Also note that a number of graves were observed within the proposed site as well as an old dumping site.

Natural vegetation forms a uniform grassy cover over most of the area with larger trees scattered throughout. The main biodiversity features of this area are:

- the remaining natural veld (light to medium impacted as a result of grazing pressure and "urban creep");
- the Kuruman River to the south and west; and
- the number of protected trees was observed (e.g. *Acacia erioloba* and *Boscia albitrunca*).
- Please note that no species listed in the Northern Cape Nature Conservation Act (NCNCA) was observed.

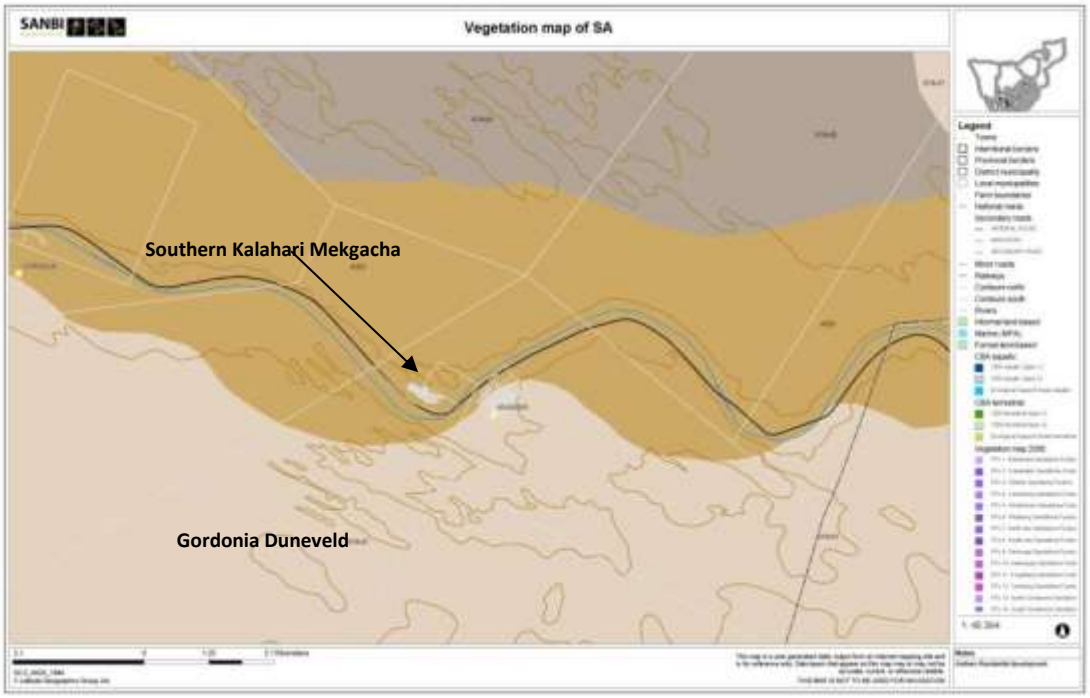
Figure 8: National land cover map indicating the Landcover expected



6.7 BROAD SCALE VEGETATION TYPES EXPECTED

In accordance with the 2006 Vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006) two broad vegetation type is expected in the vicinity and its immediate surroundings, namely *Southern Kalahari Mekgacha* in the bottom along the dry Kuruman River (note that only *Southern Kalahari Mekgacha* is expected on the proposed location) and Gordonia *Duneveld* and (Figure 9).

Figure 9: Vegetation map of SA, Lesotho and Swaziland (2006)



According to the *National list of ecosystems that are threatened and in need of protection* (GN 1002, December 2011), both Gordonia Duneveld and Southern Kalahari Mekgacha were classified as "Least Threatened".

Table 3: Vegetation status according to the 2004 National Spatial Biodiversity Assessment

VEGETATION TYPE	NATIONAL STATUS 2011	REMAINING	CONSERVATION TARGET	FORMALLY CONSERVED
Gordonia Duneveld	Least Threatened	99.8 %	16 %	14.2 %
Southern Kalahari Mekgacha	Least Threatened	98.3 %	24%	17.5 %

According to Mucina & Rutherford (2006), Southern Kalahari Mekgacha is found in both the Northern Cape and the North-West Provinces in valleys (including beds and adjacent slopes) of the intermittent rivers draining the dry savannah south of the Bakalahari Schwelle in the South African part of the Kalahari Region at altitudes ranging from 850 m to 1 100 m, with a few occurrences as high as 1 500 m. Gordonia Duneveld is found in the Northern Cape Province along the larger part of the South African side of the Kgalagadi Transfrontier Park south of the Molopo River (west of Van Zylsrus), interleaving with Kalahari Karroid Shrubland in the west and south at altitudes varying from 1 100 -1 500 m.

6.7.1 Southern Kalahari Mekgacha

Southern Kalahari Mekgacha is described as sparse, patchy grass-lands, sedqelands and low herblands dominated by CA grasses (*Panicum, Eragrostis, Enneapogon, Tragus, Chloris and Cenchrus*) on the bottom of (mostly) dry riverbeds. Low shrublands are found in places with patches of taller shrubland (with *Schotia afra*) on the banks of the rivers. Relatively tall *Acacia erioloba* trees can form a dominant belt along some of the rivers, for example the middle and lower reaches of the Kuruman River In some other rivers the taller trees are scattered. The term 'mekgacha' (singular 'mokgacha') is of Setswana origin and means 'dry (river) valley'. Mekgacha are considered to be remnants of an ancient extensive riverine system of the 'Kalahari River', which drained the Kalahari Basin and used the current lower Orange River channel from Kakamas downstream.

Important taxa in the Dry river bottoms include the following: Tall Shrubs: *Lebeckia linearifolia*, *Sisyndite spartea* and *Deverra denudata* subsp. *aphylla;* Herbs: *Amaranthus dinteri* subsp. *dinteri*, A*. praeter-missus*, *A. schinzianus*, *Boerhavia repens*, *Chamaesyce inaequi- atera*, *Cucumis africanus*, *Geigeria ornativa*, *G. pectidea*, *Heliotropium lineare*, *Indigofera alternans*, *I. argyroides*, *Kohautia cynanchica*, *Lotononis platycarpa*, *Osteospermum muricatum*, *Platycarpha carlinoides*, *Radyera urens*, *Stachys spathulata*, *Tribulus terrestris*; Succulent Herb: *Zygophyllum simplex*.; Graminoids: *Cenchrus ciliaris*, *Chloris virgata*, *Enneapogon desvauxii*, *Eragrostis annulata*, *E. bicolor*, *Odyssea paucinervis*, *Panicum coloratum*, *Eragrostis porosa*, *Panicum impeditum*, *Sporobolus nervosus*;

Rocky slopes of river canals Tall Tree: *Acacia erioloba*; Low Shrubs: *Aptosimum lineare*, *Pechuel-Loeschea leubnitziae*; Graminoids: *Setaria verticillata*, *Enneapogon scaber*, *Oropetium capense*, *Stipagrostis uniplumis*, *Tragus racemosus*; Herb: *Dicoma capensis*.

The mekgacha are under strong utilisation pressure, both from wildlife (to graze and for salt licks) and domestic animals (grazing, browsing and animal penning). Alien woody *Prosopis* species occur as invasive plants in places.

6.7.2 Gordonia Duneveld

Gordonia Duneveld is described as occurring on parallel dunes about dunes about 3-8 m above the plains. Open shrubland with ridges of grassland dominated by *Stipagrostis amabilis* on the dune crests and *Acacia haematoxylon* on the dune slopes, also with *A. mellifera* on lower slopes and *Rhigozum trichotomum* in the interdune straaten.

According Mucina & Rutherford (2006), important taxa include the following: Small Tree: *Acacia mellifera* subsp. *detinens;* Tall Shrubs: *Grewia flava* and *Rhigozum trichotomum*; Low Shrubs: *Aptosimum albomarginatum*, *Monechma incanum* and *Requienia sphaerosperma*; Succulent Shrubs: *Lycium bosciifolium*, *L. pumilum* and *Talinum caffrum;* Graminoids: *Schmidtia kalahariensis*, *Brachiaria glomerata*, *Bulbostylis hispidula*, *Centropodia glauca* (Kalahari-Gha Grass), *Eragrostis lehmanniana*, *Stipagrostis ciliata*, *S. obtusa* and *S. uniplumis*; Herbs: *Hermbstaedtia fleckii*, *Acanthosicyos naudinianus*, *Hermannia tomentosa*, *Limeum arenicolum*, *L argute-carinatum*, *Oxygonum dregeanum* subsp. *canescens* var. *canescens*, *Sericorema remotiflora*, *Sesamum triphyllum* and *Tribulus zeyheri*.

Biogeographically important taxa (Kalahari endemics) include: Tall Shrub: *Acacia haematoxylon*; Graminoids: *Stipagrostis amabilis*, *Anthephora argentea* and *Megaloprotachne albescens*; Herbs: *Helichrysum arenicola*, *Kohautia ramosissima* and *Neuradopsis austro-africana*.

6.8 VEGETATION ENCOUNTERED

The following is a discussion of the vegetation and other significant environmental features encountered on site. The author did not attempt to identify all species but rather concentrated on identifying and marking protected plant species or any other biodiversity feature of significance. Although according to the vegetation map of South Africa (Figure 9), the vegetation expected should be Southern Kalahari Mekgacha, the vegetation encountered did not conform to this vegetation type but rather showed the typical species composition and physical character expected of Gordonia Duneveld. It is clear that because of the scale on which the vegetation map was done it does not accurately depict the boundaries in all cases. The Author is of the opinion that the site is situated within the vegetation type described as Gordonia Duneveld (Refer to Photo 2 & 3, as well as Figure 10).

Photo 2: Kameelduin settlement (right), proposed site (left)

Photo 3: A view over the proposed site

Figure 10 clearly shows the current demarcation between the Southern Kalahari Mekgacha (next to the Kuruman River) and the Gordonia Duneveld (rest of the overview).

Figure 10: A Google image showing the landscape on which the proposed site is to be located

The proposed larger site is located within a parallel dune landscape and overlaps two dunes as well as the interdune straaten (with most of the proposed site located within the interdune straaten). The vegetation encountered can be described as open sparse woodland (larger trees scattered throughout) dominated by a grassy bottom layer. The vegetation typically has two stratums with a third shrub layer sometimes present.

Photo 4: A view of the site from south to north

Very low species diversity was encountered on site. The grassy bottom layer was dominated by *Stipagrostis ciliata* and *Eragrostis Iehmanniana* but with *Stipagrostis uniplumis* also sometimes present (vegetation cover approximately 35%). The lack of bulb, succulent and herbaceous species was consistent throughout the site. Only single individuals of *Aptosimum procumbens* was observed as well as the weed *Argemone ochroleuca* (Mexican poppy). Larger shrubs were also uncommon with only single individuals of the shrub *Lycium bosciifolium* observed. The only small tree species observed (mostly along the dune ridges) was *Acacia mellifera,* and *A. haematoxylon*. However, a large number of full grown *Acacia erioloba* (Camelthorn) and *Boscia albitrunca* (Sheppard's tree) trees were observed. *Boscia albitrunca* was mostly located on the dune ridges while *Acacia erioloba* was distributed throughout the site. Single individuals of the invader *Prosopis grandulosa* were also observed.

Table 4: List of species encountered on site (excluding grass species)

SPECIES NAME	COMMON NAME	FAMILY	STATUS
Acacia erioloba	Camelthorn	FABACEAE	Protected in terms of the NFA
Acacia haematoxylon	Grey Camelthorn	FABACEAE	Protected in terms of the NFA
Acacia mellifera	Blackthorn	FABACEAE	
Aptosimum procumbens	Karoo violet	SCROPHULARIACEAE	
Argemone ochroleuca	Mexican poppy	PAPAVERACEAE	Alien weed
Boscia albitrunca	Sheppard's tree	CAPPARCEAE	Protected in term of the NFA
Lycium bosciifolium	Slapkriedoring	SOLANACEAE	
Prosopis grandulosa	Honey mesquite	FABACEAE	Category 2 invader

6.9 SIGNIFICANT AND/OR PROTECTED PLANT SPECIES

Please note that this study never intended to be full botanical assessment. However, a scan of significant species was done during the site visit, and even though the author does not claim that all species encountered were identified, all efforts were made to do just that. According to Mucina & Rutherford (2006), the following

biogeographically important taxa (Kalahari endemics) may be encountered namely: Tall Shrub: *Acacia haematoxylon*; Graminoids: *Stipagrostis amabilis*, *Anthephora argentea* and *Megaloprotachne albescens*; Herbs: *Helichrysum arenicola* and *Kohautia ramosissima*.

The National Forests Act of 1998 (Act 84 of 1998) provides for the protection of forests as well as specific tree species (GN 716 of 7 September 2012). Three listed protected species were encountered within the study area (Table 5). Refer to Table 6 for location data on the individual trees encountered.

Table 5: Protected tree species with a geographical distribution that may overlap the broader study area

SPECIES NAME	COMMON NAME	TREE NO.	DISTRIBUTION
Acacia erioloba	Camel Thorn Kameeldoring	168	In dry woodlands next to water courses, in arid areas with underground water and on deep Kalahari sand
Boscia albitrunca	Shepherds-tree Witgat/Matopie	130	Occurs in semi-desert and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils.
Acacia haematoxylon	Grey Camel Thorn Vaalkameeldoring	169	In bushveld, usually on deep Kalahari sand between dunes or along dry watercourses.

In addition to the above the Northern Cape Nature Conservation Act 9 of 2009 (NCNCA) came into effect on the 12th of December 2011, which also provides for the sustainable utilization of wild animals, aquatic biota and plants. Schedule 1 and 2 of the act give extensive lists of specially protected and protected fauna and flora species in accordance with this act. However, none of the species listed in terms of NCNCA were encountered during the site visit.

Table 6 gives the GPS co-ordinates of the protected trees encountered within the site.

Table 6: A list of protected species encountered during the site visit, referenced by GPS waypoints (WG84 format)

Waypoint no.	SPECIES NAME	COMMON NAME	NUMBER OF TREES	LOCATION
037	*Acacia erioloba*	Camelthorn	single	S26 58 39.4 E20 46 03.2
038	*Acacia erioloba*	Camelthorn	single	S26 58 40.4 E20 46 03.6
039	*Boscia albitrunca*	Sheppard's tree	single	S26 58 41.1 E20 46 04.3
040	*Acacia erioloba*	Camelthorn	single	S26 58 40.4 E20 46 05.2
041	*Acacia erioloba*	Camelthorn	single	S26 58 40.4 E20 46 06.0
042	*Acacia erioloba*	Camelthorn	single	S26 58 39.6 E20 46 06.7
043	*Acacia erioloba*	Camelthorn	single	S26 58 40.7 E20 46 07.1
044	*Acacia erioloba*	Camelthorn	single	S26 58 40.7 E20 46 06.8
045	*Acacia erioloba*	Camelthorn	single	S26 58 41.0 E20 46 06.5
046	*Acacia erioloba*	Camelthorn	single	S26 58 41.9 E20 46 05.9
047	*Acacia erioloba*	Camelthorn	single	S26 58 42.3 E20 46 07.0
048	*Acacia erioloba*	Camelthorn	single	S26 58 41.7 E20 46 08.3
049	*Boscia albitrunca*	Sheppard's tree	single	S26 58 42.0 E20 46 09.0
050	*Boscia albitrunca*	Sheppard's tree	single	S26 58 44.4 E20 46 11.2
051	*Boscia albitrunca*	Sheppard's tree	single	S26 58 44.4 E20 46 11.4
052	*Acacia erioloba*	Camelthorn	single	S26 58 43.9 E20 46 12.4
053	*Acacia erioloba*	Camelthorn	single	S26 58 43.5 E20 46 13.9
054	*Acacia erioloba*	Camelthorn	single	S26 58 42.8 E20 46 13.4
055	*Acacia erioloba*	Camelthorn	single	S26 58 41.9 E20 46 13.4
057	*Acacia erioloba*	Camelthorn	single	S26 58 41.2 E20 46 15.0
058	*Boscia albitrunca*	Sheppard's tree	single	S26 58 40.7 E20 46 16.2
059	*Acacia erioloba*	Camelthorn	single	S26 58 40.3 E20 46 15.7
060	*Acacia erioloba*	Camelthorn	single	S26 58 40.1 E20 46 16.3
061	*Acacia erioloba*	Camelthorn	single	S26 58 37.5 E20 46 17.5
062	*Boscia albitrunca*	Sheppard's tree	single	S26 58 36.5 E20 46 15.3

063	*Boscia albitrunca*	Sheppard's tree	single	S26 58 34.8 E20 46 14.4
064	*Acacia haematoxylon*	Grey Camelthorn	single	S26 58 34.5 E20 46 11.5
065	*Acacia haematoxylon*	Grey Camelthorn	single	S26 58 34.0 E20 46 11.6
066	*Boscia albitrunca*	Sheppard's tree	single	S26 58 34.1 E20 46 10.8
067	*Acacia erioloba*	Camelthorn	single	S26 58 35.5 E20 46 10.6
068	*Acacia erioloba*	Camelthorn	single	S26 58 36.9 E20 46 10.1
069	*Acacia erioloba*	Camelthorn	single	S26 58 36.7 E20 46 10.8
070	*Acacia erioloba*	Camelthorn	single	S26 58 37.1 E20 46 11.0
071	*Acacia erioloba*	Camelthorn	single	S26 58 38.1 E20 46 10.5
072	*Acacia erioloba*	Camelthorn	single	S26 58 38.6 E20 46 10.7
073	*Acacia erioloba*	Camelthorn	single	S26 58 39.2 E20 46 10.3
074	*Acacia erioloba*	Camelthorn	single	S26 58 39.9 E20 46 10.6
076	*Acacia erioloba*	Camelthorn	single	S26 58 40.7 E20 46 12.5
077	*Acacia erioloba*	Camelthorn	single	S26 58 41.7 E20 46 13.5

6.9.1 Camelthorn

Photo 5 shows a mature *Acacia erioloba* (Camelthorn) tree found on site. The slow-growing Camelthorn grows well in poor soils and in harsh environmental conditions. However, they will take up to 10 years before starting to flower, and only by age 20, will produce regular large pod crops (Seymour & Milton, 2003). It is this of great important that especially mature seed producing individuals are protected. Most benefits brought by *A. erioloba* are not immediately apparent, and it is only when they are large, years after establishment, that they begin to appreciably affect soil quality, produce large patches of shade, and produce pods, gum, and fuel wood.

Photo 5: One of the numerous Camelthorn trees encountered on the site

Large trees also diminish nutrient leaching, increase nutrient levels beneath their canopies (owing to nutrient cycling and concentration of livestock dung), mitigate soil degradation, prevent soil erosion on steep slopes, sequester carbon and replenish organic matter. Pod production is linearly related to tree size, so as trees become older, they become more valuable as a source of seed and forage, as livestock relish eating the pods (Seymour and Milton, 2003). In addition, it is often the only available dense shade tree in the hot arid environment of the south-western regions of its distribution.

The Camelthorn tree exhibits distinctive high quality red heartwood and is a used as a firewood as well as fodder (especially the pods). It holds economic significance in the southern Kalahari region. Camelthorn wood is regarded as the best source of firewood in the region where fuel wood is scarce. As a result this tree has been utilised extensively in the past and are now protected species tree species in South Africa in terms of National Forests Act (GN 716 of 7 September 2012).

6.9.2 Sheppard's tree

Photo 6 show a beautiful full grown Sheppard's tree encountered on site. According to Alias & Milton (2003) *Boscia albitrunca* is a keystone species in arid southern Africa, where it primarily provides browse to livestock and game, shade and food and shelter to other animals including invertebrates and birds. The laws of numerous African traditions strictly prohibit destruction of this tree. The wood is not favoured as a fuel wood and has no commercial value, although it is sometimes used in rural areas for making household items such as tables, chairs, spoons and dishes.

This species is under threat, however, owing to intense use of its branches to supplement livestock feed, particularly in times of drought. Its nutritious foliage suggests that this species obtains nutrients from ground water and perhaps also from the concentration of nutrients beneath its canopy because of animal activities. It therefore contributes to nutrient cycling in mainly oligotrophic sands, as well as performing other ecological services such as reducing nutrient leaching, mitigating soil degradation, preventing soil erosion, sequestering carbon and replenishing organic matter.

Photo 6: A magnificent Sheppard's tree encountered at the foot of one of the dunes on site

This species is observed to establish beneath other large trees within its environment, primarily *A. erioloba*, which serve as resting and perch sites for animals and birds, making the species dependent on large tree species in arid savannah. Therefore, threats to species that provide these micro-sites also constitute a threat to *B. albitrunca*. Within the arid Kalahari, indiscriminate removal of Camelthorn (*Acacia erioloba*) trees could reduce the availability of suitable germination sites (Alias & Milton, 2003).

6.10 FINE-SCALE MAPPING (CBA'S)

Although a draft version of the Siyanda District Municipal, Environmental Management Framework (EMF) is available it has not been approved or published. No fine-scale mapping is as yet available for this area and as a result no critical biodiversity areas or biodiversity support areas has been promulgated for this area.

However, the proposed priorities for conservation in the Siyanda District is depicted on Maps 12a (Refer Figure 15) and 12b within this document, based on local occurrence, the national conservation target, the national ecosystem status and the national protection level of the vegetation types. A proposal is made for the prioritisation of vegetation types in the Siyanda District.

The landcover of the Siyanda district reflects the results of the 2000 national landcover determination and is depicted on Map 13 from which it is evident that most of the area is in a natural state and the most significant spatial impact on the environment has come from mining which occupies an area of almost 7% of the total area.

A sensitivity index is shown on Map 14 of the Draft EMP. The main factors that were used to compile the index include the following:

- The erosion potential of soil where soils with a high erosion potential were awarded a sensitivity of 1;
- The conservation priority of veld types for veld types with a medium conservation priority were awarded a sensitivity count of 1 those with a high conservation priority were awarded a count of 2 and those with a very high conservation priority were awarded a count of 3;
- Topographical areas with a high variance in shape and form were awarded a sensitivity count of 1;
- All watercourses, drainage lines and pans (including a 32m buffer on either side) were awarded a sensitivity count of 2; and
- All transformed areas were awarded a sensitivity count of -1.

Environmental control zones are depicted on Map 15 of the EMF. The purpose of environmental control zones is to indicate areas that require a specific type or regime of control due to unique environmental elements that occur in these areas. It may or may not be linked to the application of EIA legislation and should be dealt with at a more strategic level where it should serve as a guide for decision-making and planning.

6.10.1 Summary of findings according to the EMF

According to the Siyanda Environmental Management Framework the proposed site falls within the following categories according to the various maps.

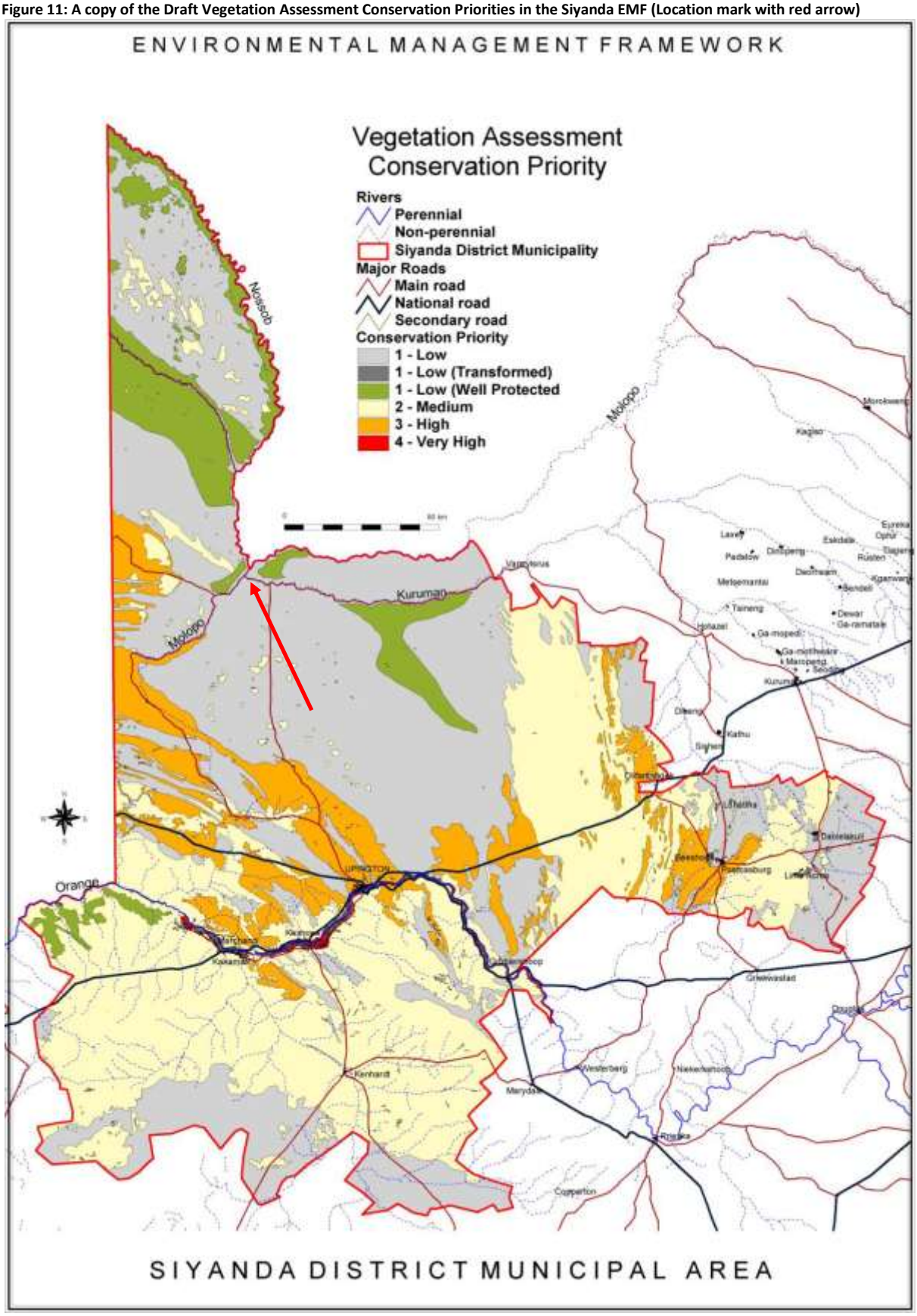
Conservation priority areas: According to Map 12a the site falls within an area regarded as having a Low (1) conservation priority. According to Map 12b, the site also does not fall within a proposed conservation area.

Landcover: According to Map 13 of the Draft EMF, it would seem as if the proposed site falls within the area marked as grassland or woodland.

Sensitivity Index: According to Map 14 of the Draft EMF, the proposed site falls within an area identified as of very low environmental sensitivity (1) in an index which starts at Transformed and then are given values of 0-8 (8 being of high environmental sensitivity).

Control Zones: According to Map 15, the proposed site location falls within a control zone 2 area, which is a potential wind erosion area.

Figure 11: A copy of the Draft Vegetation Assessment Conservation Priorities in the Siyanda EMF (Location mark with red arrow)



6.10.2 Key Environmental issues identified in the EMF

The following are considered to be the main environmental issues that may cause negative impacts and have to be addressed in the EMF:

- The conservation of the remaining Lower Gariep Alluvial Vegetation along the Orange River;
- the protection of vegetative groundcover across the area against overgrazing and other activities such as 4x4 and quad bike driving;
- the effect that inappropriate irrigation may have on the salination of soil in places;
- the provision of services, especially water to small populations in remote areas that may be unsustainable over the long term;
- the extensive use of firewood for cooking and heating that may be a threat to especially the protected Camel Thorn trees in places; and
- the rehabilitation of mining areas, especially along scenic routes that may have potential for further tourism development.

According to the EMF maps and the summary underneath the main environmental issues identified for the broad scale area would be the erosion factor. Please note that although the EMF does not indicate any CBA or ecological support area next to the Kuruman River, almost all fine scale Municipal CBA maps adopt the principle of establishing ecological support areas next to river systems. If this holds true it is expected that over time an ecological corridor will be established next to the Kuruman River (although not yet applicable).

6.11 FAUNA AND AVI-FAUNA

Although natural fauna and avi-fauna may still be present, it is expected that it would be limited to avi-fauna, insects and maybe some reptile's species. Because of the proximity to the town of Askham and the current land-use it is not expected that game will be encountered in the vicinity of the site (none has been observed). However, it is a known fact that many animal and bird species associate with large *Acacia erioloba* as well as *Boscia albitrunca* trees and the removal of mature trees of these species will have an impact on such wildlife (even though very localised).

Mammals: The site falls within the distribution range of approximately 50 mammal species indicating moderate diversity. Human activity in the area is medium-high and it is highly unlikely that a fair representation of these mammals will be found on the property. Even though the impact will be permanent, it is highly unlikely that it will pose a significant impact on mammal species and as a result the impact is deemed negligible.

Reptiles: The site falls within the distribution range of approximately 30 reptile species, indicating low diversity. As a result of the open planes on site the reptile composition is likely to be dominated by species which inhabit open areas, such as snakes, lizards and geckos. Human activity in the area is medium-high and it

is highly unlikely that large numbers of these species will be present on site. As such, the impact on reptiles should be negligible.

Amphibians: The site falls within the distribution range of approximately 10 amphibian species. However, no suitable breeding places were observed on the proposed site and it is highly unlikely that the proposed development will have any significant impact on amphibian species. In addition, most amphibians require perennial water and will thus not be affected at all.

Avi-fauna: The site falls within the distribution range of approximately 200 bird species known from the broad area. But because of the medium-high human activity it is not expected that a fair representation of these species will be encountered on site or its immediate vicinity. Apart from the possible impact on mature trees (mentioned above) the proposed activity is not expected to have a significant impact on avi-fauna. However, it remains important that all larger indigenous trees must be protected wherever possible in order to minimise the possible impact (although localised) on bird species.

6.12 RIVERS AND WETLANDS

Rivers maintain unique biotic resources and provide critical water supplies to people. South Africa's limited supplies of fresh water and irreplaceable biodiversity are very vulnerable to human mismanagement. Multiple environmental stressors, such as agricultural runoff, pollution and invasive species, threaten rivers that serve the world's population. River corridors are important channels for plant and animal species movement, because they link different valleys and mountain ranges. They are also important as a source of water for human use. Vegetation on riverbanks needs to be maintained in order for rivers themselves to remain healthy, thus the focus is not just on rivers themselves but on riverine corridors.

With the exception of the Orange River all the rivers in the Siyanda District Municipal area are non-perennial rivers and the last recordings of flows in the lower reaches of the Molopo and Kuruman Rivers were in 1933 and again in the 1974/5 and 1975/6 season. The proposed site is located approximately 500 m away from the Kuruman River corridor (which has already been disturbed in the Askham area due to the establishment of the town). No additional impact is expected on the Kuruman River. It is highly unlikely that the proposed project will have any significant additional impacts on the river system or its ecology.

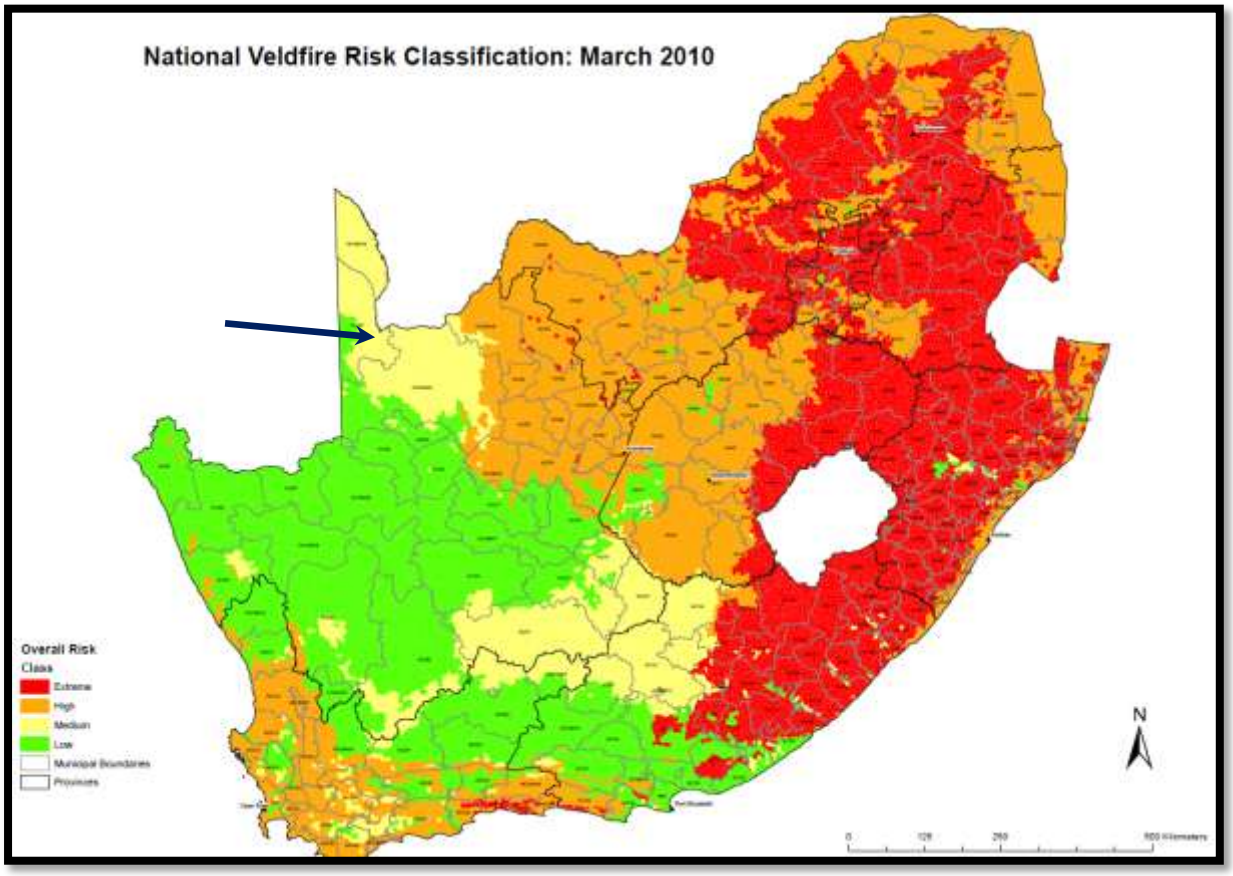
6.13 INVASIVE ALIEN INFESTATION

The only invasive alien vegetation encountered on site was single species of *Prosopis grandulosa* (a category 2 invader). According to regulation 15 and 16 of CARA all category 2 plants has the proven potential of becoming invasive, but may have certain beneficial properties. The regulations makes provisions for category 2 plants to be retained in special areas demarcated for that purpose, but those occurring outside demarcated areas must be controlled.

7. VELD FIRE RISK

Gordonia Duneveld is part of the Savanna Biome (Mucina & Rutherford, 2006) which is prone to veldfires. According to Forsyth (2010), the main fire issue relates to its effects on the number and size of woody plants in the savanna mixture, which in turn determines the productivity and quality of the grasses. Frequent, high-intensity fires suppress trees and thus promote grasses, while protection from fire, and lower intensity fires (often associated with high levels of grazing, and correspondingly lower grass fuel loads) allows woody plants to increase, the widespread "bush encroachment" phenomenon. According the revised veldfire risk classification of March 2010 (Forsyth, 2010) in terms of the National Veld and Forest Fire Act 101 of 1998, the site is located in an area classified as a "Medium Fire Risk" area.

Figure 12: South African National Veldfire Risk Classification (March 2010)



The purpose of the revised fire risk classification is to serve as a national framework for implementing the National Veld and Forest Fire Act, and to provide a basis for setting priorities for veldfire management interventions such as the promotion of and support to Fire Protection Associations. In the fire-ecology types and municipalities with High to Extreme fire risk, comprehensive risk management strategies are needed.

The Askham is situated in the Mier local Municipal area and have a medium fire risk classification. Although, the fire risk is not considered high or extreme it is still important that during construction and operation the site must adhere to all the requirements of the local Fire Protection Association (FPA) if applicable, or must adhere to responsible fire prevention and control measures.

7.1 SIGNIFICANT BIODIVERSITY FEATURES ENCOUNTERED

The table underneath gives a summary of biodiversity features encountered during the site visit and a short discussion of their possible significance in terms of regional biodiversity targets.

Table 7: Summary of biodiversity features encountered on Erf 1654, Askham (Kameelduin) and their possible significance

BIODIVERSITY ASPECT	SHORT DESCRIPTION	SIGNIFICANCE RATING
Geology & soils	Geology & soils vary only slightly in the larger study area, with deeper sandy soils found over most of the area.	No special features have been encountered (e.g. true quartz patches or broken veld) and the impact on geology and soils is expected to be very localised and low. Impact = low
Land use and cover	Natural veld utilised for stock grazing.	The property is used for livestock grazing by the local inhabitants. According to the draft Siyanda EMF the property falls within an area of grassland with the possibility of woodland. As long as the protected species is incorporated within the layout design the impact is expected to be low and localised.
Vegetation types	Gordonia Duneveld. Southern Kalahari Mekgacha	Both are considered "Least threatened", but the remaining natural veld shows good connectivity with the surrounding areas. According to the draft Siyanda EMF, the site does not fall within a proposed conservation area or a CBA area. Impact low.
Conservation priority areas.	In terms of the draft Siyanda EMF	According to the EMF the site also does not fall within a proposed conservation area. Impact low/localised.
Sensitivity index	In terms of the draft Siyanda EMF	According to the EMF, the proposed site falls within an area identified as of very low environmental sensitivity (1). Impact low and localised.
Protected plant species	A number of protected tree species was observed (Refer to Table 6), but no protected species in terms of NCNCA was observed	Protected tree species was observed throughout the site and unless they are incorporated within the layout design they will be impacted. However, these trees are also the only shade trees in the landscape and it would make perfect sense ensure through micro-layout placement they are incorporated within the housing layout plans. If they are protected the impact is expected to be much reduced (only single individuals) and may be regarded as local and relative low. However, if the protected trees are to be removed the impact will be a much more significant medium (although still localised).
Fauna & Avi-fauna	The site is used for live-stock grazing and is in close proximity to constant human activity.	Although natural fauna and avi-fauna may still be present, it is expected that it would be limited to avi-fauna, insects and maybe some reptile's species (proximity to the town of Askham and the current land-use). Apart from the possible impact on mature trees and the associated impact on wildlife the activity is not expected to have a significant impact on fauna or avi-fauna. Impact low.
Rivers & wetlands	The Kuruman river is situated approximately 500 m away from the proposed site	The Kuruman River is already disturbed in the Askham area due to the establishment of the town. No additional impact is expected on the Kuruman River. Additional impact none.
Invasive alien infestation	Only single Prosopis species was observed	All invasive alien species must be removed during the construction. Impact positive.
Erosion	The Siyanda EMF recognised the larger area as falling within an area subject to erosion.	During the rehabilitation special emphasis will have to be placed on the prevention of erosion (especially wind erosion) as it will most likely be one of the most important long term challenges of the project.

In summary, the proposed site is located in remaining natural vegetation (even though impacted through grazing and urban creep), with very good connectivity with the surrounding natural veld. However, the proposed impact will be localised. The impact on individual species is regarded as medium to low (protected species), the impact on sensitive habitats is regarded as low to very low, the impact on ecosystem function is regarded as very low (but erosion prevention measures must be assured), cumulative impact on ecology is regarded as very low and finally the impact on economic use of the vegetation is regarded as very low.

8. BIODIVERSITY ASSESSMENT

Biological diversity, or biodiversity, refers to the variety of life on Earth. As defined by the United Nations Convention on Biological Diversity, it includes diversity of ecosystems, species and genes, and the ecological processes that support them. Natural diversity in ecosystems provides essential economic benefits and services to human society—such as food, clothing, shelter, fuel and medicines—as well as ecological, recreational, cultural and aesthetic values, and thus plays an important role in sustainable development. Biodiversity is under threat in many areas of the world. Concern about global biodiversity loss has emerged as a prominent and widespread public issue.

The objective of this study was to evaluate the biological diversity associated with the study area in order to identify significant environmental features which should be avoided during development activities and or to evaluate short and long term impact and possible mitigation actions in context of the proposed development.

As such the report aim to evaluate the biological diversity of the area using the Ecosystem Guidelines for Environmental Assessment (De Villiers *et. al*., 2005), with emphasis on:

- Significant ecosystems
    - Threatened or protected ecosystems
    - Special habitats
    - Corridors and or conservancy networks
- Significant species
    - Threatened or endangered species
    - Protected species

8.1 METHOD USED

During May 2001, Van Schoor published a formula for prioritizing and quantifying potential environmental impacts. This formula has been successfully used in various applications for determining the significance of environmental aspects and their possible impacts, especially in environmental management systems (e.g. ISO 14001 EMS's). By adapting this formula slightly it can also be used successfully to compare/evaluate various environmental scenario's/options with each other using a scoring system of 0-100%, where any value of 15% or less indicate an insignificant environmental impact while any value above 15% constitute ever increasing environmental impact.

Using Van Schoor's formula (adapted for construction with specific regards to environmental constraints and sensitivity) and the information gathered during the site evaluation the possible negative environmental impact of the activity was evaluated.

Underneath follows a short description of Van Schoor's formula. In the formula the following entities and values are used in order to quantify environmental impact.

***S* = [(*fd* + *int* + *sev* + *ext* + *loc*) x (*leg* + *gcp* + *pol* +*ia* + *str*) x *P*]** (as adapted for construction activities)

Where

S = Significance value

fd = frequency and duration of the impact

int = intensity of the impact

sev = severity of the impact

ext = extent of the impact

loc = sensitivity of locality

leg = compliance with legal requirements

gcp = conformance to good environmental practices

pol = covered by company policy/method statement

ia = impact on interested and affected parties

str = strategy to solve issue

P = probability of occurrence of impact

8.1.1 Criteria

The following numerical criteria for the above-mentioned parameters are used in the formula.

fd = frequency and duration of the impact					
low frequency ; low duration	1	medium frequency; low duration	1.5	high frequency ; low duration	2
low frequency; medium duration	1.5	medium frequency ; medium duration	2	high frequency ; medium duration	2.5
low frequency ; high duration	2	medium frequency ; high duration	2.5	high frequency ; high duration	3

int = intensity of the impact					
low probability of species loss; low physical disturbance	1	medium probability of species loss; low physical disturbance	1.5	high probability of species loss; low physical disturbance	2
low probability of species loss; medium physical disturbance	1.5	medium probability of species loss; medium physical disturbance	2	high probability of species loss; medium physical disturbance	2.5
low probability of species loss; high physical disturbance	2	medium probability of species loss; high physical disturbance	2.5	high probability of species loss; high physical disturbance	3

sev = severity of the impact	
changes immediately reversible	1
changes medium/long-term reversible	2
changes not reversible	3

ext = extent of the impact	
locally (on-site)	1
regionally (or natural/critical habitat affected)	2
globally (e.g. critical habitat or species loss)	3

loc = sensitivity of location	
not sensitive	1
moderate (e.g. natural habitat)	2
sensitive (e.g. critical habitat or species)	3

leg = compliance with legal requirements	
compliance	0
non-compliance	1

gcp = good conservation practices	
conformance	0
non-conformance	1

pol = covered by company policy	
covered in policy	0
not covered/no policy	1

ia = impact on interested and affected parties	
not affected	1
partially affected	2
totally affected	3

str = strategy to solve issue	
strategy in place	0
strategy to address issue partially	0.5
no strategy present	1

P = probability of occurrence of impact	
not possible (0% chance))	0
not likely, but possible (1 - 25% chance)	0.25
likely (26 - 50% chance)	0.50
very likely (51 - 75% chance)	0.75
certain (75 - 100% chance)	0.95

8.2 NATURE OF THE IMPACT

The construction of the proposed low cost housing entails:

- the layout planning and location of the proposed housing within the larger site;
- clearing of the footprint (including topsoil);
- installation of Municipal works (water, sewerage and electricity) and associated infrastructure (e.g. roads);
- construction of housing; and
- rehabilitation of the construction footprint (outside the designated housing area) on completion of the project.

Other impacts associated with the construction phase include:

- the possible establishment of a construction camp and labourers facilities (including cooking and toilet facilities);
- the establishment of temporary storage areas for construction equipment and material;
- the disposal of general and construction waste associated with the construction phase;
- the disposal of any remaining clean subsoil (spoil).

8.2.1 Parameters of the impact

Extent of the impact:	Local.
Duration of the impact:	Permanent
Probability or likelihood:	The probability or likelihood that the impact will occur if the project is approved is very likely.
Severity of the impact:	The severity of the impact is considered to be medium to low depending on the impact minimisation actions implemented.

8.2.2 Possible issues / impacts associated with construction

The following possible environmental impacts were identified while doing the site visit and discussing the project with the engineers and land-owners:

- The possible impact on protected plant species as described in the "List of protected tree species" (GN 716 of 2012) and the "Protected Species" list (Schedule 1 & 2 of the NC Nature Conservation Act 9 of 2009).
- Erosion (notably wind erosion) – The sandy dunes are very susceptible to disturbance and it would be imperative that the dunes are stabilised immediately after construction.
- Establishment of a construction camp and site offices as well as the possibility of labourer's facilities during construction.
- Temporary storage areas.
- Waste management and control.

8.3 Evaluation of Significant Impacts

The main drivers in this vegetation type would be fire and grazing pressure (herbivore), and could largely determine plant community composition and occurrence of rare species. Grazing may be an important factor in regulating competitive interaction between plants (*Acacia mellifera* encroachment is often a sign of overgrazing or bad veld management). Certain species can act as important "nursery" plants for smaller species and are also important for successional development after disturbance. Tortoises and mammals can be important seed dispersal agents. Watercourses, wetlands, upland- down land gradients or vegetation boundaries are all significant ecological features.

8.3.1 Threatened or protected ecosystems

The site visit confirmed that the vegetation conforms to Gordonia Duneveld and Southern Kalahari Mekgacha, both of which are classified as "Least Threatened". Recently the *National list of ecosystems that are threatened and in need of protection* (GN 1002, December 2011), was promulgated in terms of the National

Environmental Management Biodiversity Act (NEM: BA), Act 10 of 2004. According to this National list, both **Gordonia Duneveld and Southern Kalahari Mekgacha remains classified as Least Threatened**.

According to the Draft Siyanda Environmental Management Framework the proposed site falls within the following categories according to the various maps.

Conservation priority areas: According to Map 12a the site falls within an area regarded as having a Low (1) conservation priority. According to Map 12b, the site also does not fall within a proposed conservation area.

Landcover: According to Map 13 of the Draft EMF, it would seem as if the proposed site falls within the area marked as grassland or woodland.

Sensitivity Index: According to Map 14 of the Draft EMF, the proposed site falls within an area identified as of very low environmental sensitivity (1) in an index which starts at Transformed and then are given values of 0-8 (8 being of high environmental sensitivity).

Control Zones: According to Map 15, the proposed site location falls within a control zone 2 area, which is a potential wind erosion area.

The proposed housing development will have a permanent, but localised impact on wildlife and avi-fauna. The impact will be much more severe if all the mature indigenous trees on the site are also to be removed. It is a known fact that many animal and bird species associate with large *Acacia erioloba* as well as *Boscia albitrunca* trees and the removal of mature trees of these species will have an impact on such wildlife (even though very localised).

Taking the above into account it is clear that the proposed project will have a permanent, but very localised impact on the natural vegetation as well as wildlife, but it will likely impact on protected trees. On the other hand the vegetation type in which the project will be located is not considered threatened or in need of special conservation at this point in time. **The impact on threatened or protected ecosystems is thus rated as low**.

Mitigation:

- The proposed housing layout should be placed within the inter-dune straaten alone, avoiding the dunes to the east and west of the straaten. In doing this the impact on *Boscia albitrunca* is almost totally negated and the possible impact of wind erosion will be reduced.
- The natural vegetation on the dunes must be protected during the construction activities (erosion control).
- All efforts must be made to protect all the protected trees within the proposed final footprint (and any other protected species that might be encountered on site). On-site micro- adjustment of the final Ervin must be done in order to minimise the impact on as many of the protected tree species as possible.
- Permits must be obtained for the removal of any protected species which cannot be avoided.

8.3.2 Special habitats

The vegetation itself is not considered to belong to a threatened or protected ecosystem. No special habitats, were encountered on site (e.g. quartz patches or broken veld), which could sustain significant smaller ecosystems. The Kuruman River is located just west and south of the proposed site location, but it is highly unlikely that the proposed project will have any additional impact on the river system or its ecology.

It is considered highly unlikely that the proposed project will have any impact on special habitats. **The impact is thus rated as very low**.

8.3.3 Corridors and or conservancy networks

Looking at the larger site and its surroundings it shows excellent connectivity with remaining natural veld in almost all directions. Corridors and natural veld networks are still relative unscathed (apart from road networks).

The localised impact of the housing project makes it highly unlikely that it will have a significant effect on corridors or conservancy networks. **The impact is thus rated as low**.

8.3.4 Threatened or endangered species

No threatened or endangered species were recorded during the site visit, however, this does not rule out their presence as they may be subject to seasonable rainfall and may not have been observable during the time of the site visit, since the composition of the vegetation layers will fluctuates with seasonal rainfall (Van Rooyen *et. all*, 1984, *vide* Mucina & Rutherford, 2006). However, it must be noted that the vegetation type is considered "Least Threatened" and that this classification is based on plant species diversity and turnover as well as habitat transformation. The number of species per broad geographical levels for the savannah biome is relative low (Van Rooyen, 1988, *vide* Mucina & Rutherford, 2006). It is therefore very unlikely that any red data species will be confined to the proposed site alone.

Taking the above into account it is highly unlikely that the proposed project will have a significant or long term effect on threatened or endangered species. **The impact is thus rated as low**.

8.3.5 Protected species

Three protected tree species in terms of the National Forests Act of 1998 (Act 84 of 1998) have been observed and are likely to be impacted during the construction namely: *Acacia erioloba* (Camel thorn) *Boscia albitrunca* (Sheppard's tree) and *Acacia haematoxylon* (Grey Camelthorn), refer to Table 6 for location data on the

individual trees encountered. By placing the proposed housing development within the inter-dune straaten not only will wind erosion be curtailed, but the impact on both *Acacia haematoxylon* and *Boscia albitrunca* will be almost negated (as both of these species was only observed on the dunes in this specific site. However, it remains very likely that at least some of the *Acacia erioloba* within the straaten might be impacted by the project.

In addition to the above the Northern Cape Nature Conservation Act 9 of 2009 (NCNCA) came into effect on the 12th of December 2011, which also provides for the sustainable utilization of wild animals, aquatic biota and plants. Schedule 1 and 2 of the act give extensive lists of specially protected and protected fauna and flora species in accordance with this act. Even though this study never intended to be full botanical assessment, a scan of significant species was done during the site visit, and though the author does not claim that all species were recorded, no listed protected species in terms of NCNCA was encountered during the site visit. However, as a pre-cautionary measure all viable herb-, bulbs- and succulent plant species encountered within the footprint should be removed and replanted through a dedicated search and rescue operation.

Taking the above into account it is very likely that the proposed project will have an impact protected species (especially *Acacia erioloba*). **The impact is thus rated as medium** (which can be reduced with mitigation).

Mitigation:

- The proposed housing layout should be placed within the inter-dune straaten alone, avoiding the dunes to the east and west of the straaten. In doing this the impact on *Boscia albitrunca* is almost totally negated and possible impact of wind erosion will be reduced.
- The natural vegetation on the dunes must be protected during the construction activities (erosion control).
- All efforts must be made to protect all the protected trees within the proposed final footprint (and any other protected species that might be encountered on site). On-site micro- adjustment of the final Ervin must be done in order to minimise the impact on as many of the protected tree species as possible.
- As a pre-cautionary measure all viable herb-, bulbs- and succulent plant species encountered within the footprint should be removed and replanted through a dedicated search and rescue operation.
- Permits must be obtained for the removal of any protected species which cannot be avoided.

8.3.6 Direct impacts

As the name suggest, direct impacts refers to those impacts with a direct impact on biodiversity features and in this case were considered for the potentially most significant associated impacts (some of which have already been discussed above).

- Direct loss of vegetation type and associated habitat due to construction and operational activities.
- Loss of ecological processes (e.g. migration patterns, pollinators, river function etc.) due to construction and operational activities. (Refer to page 33).
- Loss of local biodiversity and threatened plant species (Refer to page 34)
- Loss of ecosystem connectivity (Refer to page 36)

The vegetation itself is not considered to belong to a threatened or protected ecosystem. No special habitats were encountered on site. Thus the proposed housing development will have a permanent, but localised impact on vegetation, wildlife and avi-fauna.

Taking the above into account the direct impact on the environment is **rated as medium-low, which can be reduced to low** with mitigation.

Mitigation: The following is some mitigation which will minimise the impact of the solar plant location and operation.

- The proposed housing development should be placed within the inter-dune straaten alone, avoiding the dunes to the east and west of the straaten. In doing this the impact on *Boscia albitrunca* is almost totally negated and possible impact of wind erosion will be reduced.
- The natural vegetation on the dunes must be protected during the construction activities (erosion control).
- All efforts must be made to protect all the mature protected trees within the proposed final footprint (and any other protected species that might be encountered on site). On-site micro- adjustment of the final Ervin must be done in order to minimise the impact on as many of the protected tree species as possible.
- Permits must be obtained for the removal of any protected species which cannot be avoided.
- As a pre-cautionary measure all viable herb-, bulbs- and succulent plant species encountered within the footprint should be removed and replanted through a dedicated search and rescue operation.
- Only existing access roads should be used for access to the terrain.
- Access roads must be clearly demarcated and access must be tightly controlled (deviations may not be allowed).
- Indiscriminate clearing of areas must be avoided (all remaining areas to remain as natural as possible).
- All topsoil (at all excavation sites) must be removed and stored separately for re-use for rehabilitation purposes. The topsoil and vegetation should be replaced over the disturbed soil to provide a source of seed and a seed bed to encourage re-growth of the species removed during construction.
- Once the construction is completed all further movement must be confined to the access tracks to allow the vegetation to re-establish over the excavated areas.

- Rehabilitation must include sand stabilisation methods to protect the open sandy areas against wind erosion.

8.3.7 Indirect impacts

Indirect impacts are impacts that are not a direct result of the main activity, but are impacts still associated or resulting from the main activity. The following possible indirect impacts were associated with the proposed project:

- Erosion (notably wind erosion) – The sandy dunes are very susceptible to disturbance and it would be imperative that the dunes are stabilised immediately after construction.
- The possible impact on protected plant species as described in the "List of protected tree species" (GN 716 of 2012) and the "Protected Species" list (Schedule 2 of the NC Nature Conservation Act 9 of 2009).
- Establishment of a construction camp and site offices as well as labourers facilities.
- Temporary storage areas (e.g. pipe's and fittings and concrete mixing material).
- Waste management

It is very likely that the proposed project will have indirect impacts. It is considered that indirect impacts will have a similar impact as direct impacts, which will lead to a cumulative effect on the environment. However, indirect impacts can be much reduced through good environmental control during construction. **On its own the impact is considered to be medium**.

Mitigation:

- Appoint a suitably experience ECO during the construction phase of the project.

8.3.8 Cumulative impacts

In order to comprehend the cumulative impact, one has to understand to what extent the proposed activity will contribute to the cumulative loss of ecological function and other biodiversity features on a regional basis. Both vegetation types was classified as "Least Threatened", No special habitats were encountered on site (e.g. quartz patches or broken veld), which could sustain significant smaller ecosystems. No wetland or river systems were encountered on the site, although the Kuruman River is located to the south and west of the proposed site. But it is highly unlikely that the proposed project will have any additional significant impacts on the river system or its ecology. The direct impacts will be permanent but localised, while indirect impacts can be much reduced through good environmental control.

The proposed project will thus have a permanent, but very localised impact. **On the whole the cumulative impact is considered to be medium**. With the implementation of impact minimisation actions the impact could even be reduced to low.

8.4 THE NO-GO OPTION

The "No-Go alternative" does not signify significant biodiversity gain or loss especially on a regional basis. However, it will ensure that none of the potential impacts above occur. The current status quo will remain and there will be no impact (even temporarily) on the vegetation, protected species or river corridors.

On the other hand the local municipality and governments have a socio-economic responsibility to provide basic living. Over the long term the proposed project is likely to be one of the viable solutions with acceptable environmental impact.

8.5 QUANTIFICATION OF ENVIRONMENTAL IMPACTS

Taking all of the above discussions into account and using Van Schoor's formula for impact quantification, impacts of the following can be quantified as follows:

8.5.1 No development

The "No-Go alternative" does not signify significant biodiversity gain or loss especially on a regional basis. However, it will ensure that none of the potential impacts occur. The current status quo will remain and there will be no impact (even temporarily) on the vegetation, protected species or river corridors.

On the other hand the local municipality and governments have a socio-economic responsibility to provide basic living. Over the long term the proposed project is likely to be one of the viable solutions with acceptable environmental impact.

8.5.2 Development without mitigation

The purpose of this scenario is to illustrate, using Van Schoor's formula, the biodiversity impact should development be allowed without any mitigation measures. It is assumed that no mitigation actions will be implemented balanced against the regional context of the biodiversity associated with the area.

$$S = [(fd + int + sev + ext + loc) \times (leg + gcp + pol + ia + str) \times P]$$ (as adapted)

$$S = [(1 + 1.5 + 2 + 2 + 2) \times (1 + 1 + 1 + 2 + 1) \times 0.95] = 32.1\ \%$$

In the above any value of 15% or less indicates an insignificant environmental impact, while any value above 15% constitutes ever increasing environmental impact.

8.5.3 Development with mitigation

The purpose of this scenario is to illustrate, using Van Schoor's formula, the environmental gain should development be allowed with all proposed mitigation measures implemented.

***S* = [(*fd* + *int* + *sev* + *ext* + *loc*) x (*leg* + *gcp* + *pol* +*ia* + *str*) x *P*]** (as adapted)

S = [(1 + 1.5 + 1 + 1 + 2) x (0 + 0 +0 + 2 +0) x 0.95] = 7.6 %

In the above any value of 15% or less indicates an insignificant environmental impact, while any value above 15% constitutes ever increasing environmental impact.

9. RECOMMENDATIONS & IMPACT MINIMIZATION

Because of the identified need for low cost housing developments in the Mier Municipal area and the socio-economical responsibility of all Governments it is highly unlikely that the "No-Go" option will be an option. Other locations may be looked at, but ultimately the need for housing will remain (and most probably increase). It is also clear that the Municipality and Town Planners considered various options carefully before approaching the EAP with the most viable options. Even though the impact will be permanent, it will also be very localised and is situated within a vegetation type not considered by either National Spatial Biodiversity Indicators or by local environmental planning initiatives (Siyanda Draft EMF, 2008) as a sensitive area. However, various protected tree species (NFA) was encountered within the larger site and its immediate surroundings (no protected species in terms of NCNCA was encountered), meaning that any housing development in the immediate surroundings of Askham will impact on these species to a certain degree. Various impact minimisation recommendations are given in this report, which will reduce the cumulative impact of the proposed development to a very large degree. The major impact minimisation recommendation is associated with placement and micro-placement of the final lay-out plan.

Having evaluated and discussed the various biodiversity aspects associated with the project it is clear that the most significant impacts associated with the project will be:

- The localised loss of natural vegetation.
- The possible impact on protected tree species.
- The possibility of wind erosion if rehabilitation is not done correctly.

Even if all mitigating options proposed in this report are implemented there will be an impact on:

- Protected species (although it might be limited through micro-layout adjustment); and

It is, however, considered highly unlikely that the proposed project will contribute significantly to any of the following:

- Significant loss of vegetation type and associated habitat.
- Loss of ecological processes (e.g. migration patterns, pollinators, river function etc.) due to construction and operational activities.
- Loss of local biodiversity and threatened plant species.
- Loss of ecosystem connectivity

Finally, when quantifying the development options, the Van Schoor's formula for impact quantification still shows a significant difference between development **without** and development **with** mitigation. As a result it is recommended that all mitigating measures must be implemented in order to further minimise the impact of the construction and operation of the facility.

With the available information to the author's disposal it is recommended that project be approved since it is not associated with irreversible environmental impact, provided that mitigation is adequately addresses.

9.1 IMPACT MINIMIZATION

9.1.1 General

- All construction must be done in accordance with an approved construction and operational phase Environmental Management Plan (EMP), which must be developed by a suitably experienced Environmental Assessment Practitioner.
- A suitably qualified Environmental Control Officer must be appointed to monitor the construction phase in terms of the EMP and the Biodiversity study recommendations as well as any other conditions which might be required by the Department of Environmental Affairs.
- An integrated waste management system must be implemented during the construction phase.
- All rubble and rubbish (if applicable) must be collected and removed from the site to a suitable registered waste disposal site.
- All alien vegetation should be removed from the larger property.

9.1.2 Site placement

- The proposed housing development should be placed within the inter-dune straaten alone, avoiding the dunes to the east and west of the straaten (Refer to Figure 13 underneath). In doing this the impact on *Boscia albitrunca* is almost totally negated and possible impact of wind erosion will be reduced.
- All efforts must be made to protect all the mature protected trees within the proposed final footprint (and any other protected species that might be encountered on site). On-site micro- adjustment of the final Ervin must be done in order to minimise the impact on as many of the protected tree species as possible.
- Access to the property should preferably be from the south-west or south, with emphasis on minimising the impact on the dunes (protection against wind erosion).

9.1.3 Other site specific mitigation recommendations

- A suitably qualified ECO or botanist must inspect the final site with the aim of identifying any protected plant species listed in the NCNCA. Should any protected or specially protected plant be located within the final footprint, an application for approval must be obtained from the DAFF, before any work is done on the site.
- Permits must be obtained for the removal of any protected species which cannot be avoided.
- As a pre-cautionary measure all viable herb-, bulbs- and succulent plant species encountered within the footprint should be removed and replanted through a dedicated search and rescue operation.
- The natural vegetation on the dunes must be protected during the construction activities (erosion control).
- Only existing access roads should be used for access to the terrain. Access roads must be clearly demarcated and access must be tightly controlled (deviations may not be allowed).

- Indiscriminate clearing of areas must be avoided (all remaining areas to remain as natural as possible).
- All topsoil (the top 15-20 cm at all excavation sites), must be removed and stored separately for re-use for rehabilitation purposes. The topsoil and vegetation should be replaced over the disturbed soil to provide a source of seed and a seed bed to encourage re-growth of the species removed during construction.
- Once the construction is completed all further movement must be confined to the access roads to allow the vegetation to re-establish over the excavated areas.
- Rehabilitation must include sand stabilisation methods to protect the open sandy areas against wind erosion.
- Adequate measures must be implemented to ensure against erosion.

Figure 13: Inter-dune straaten area proposed for development (orange area underneath).