ONSEEPKANS BULK WATER SUPPLY UPGRADE

Further upgrades to the bulk water supply system at Onseepkans (Northern Cape Province) to unlock additional agricultural potential.

BIODIVERSITY & BOTANICAL SCAN

A biodiversity scan of affected areas to identify possible significant environmental features and to evaluate the potential impact on such features.

14 January, 2016

PREPARED BY: ***PB Consult***

PREPARED FOR: ***EnviroAfrica CC***

REQUESTED BY: ***Department of Agriculture, Land Reform and Rural Development***

Peet Botes (Pr.Sci.Nat: 400184/05) Registered Professional Environmental and Ecological Scientist
Cell: 082 921 5949; Fax 086 514 8595; Email: pbconsult@vodamail.co.za; 22 Buitekant Street, Bredasdorp, 7280.

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 and 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,

P.J.J. Botes *(Pr.Sci.Nat: 400184/05)*
Registered Professional Environmental and Ecological Scientist

SUMMARY - MAIN CONCLUSIONS

PREPARED BY:	PREPARED FOR:
PB Consult 22 Buitekant Street Bredasdorp 7280	EnviroAfrica CC PO Box 5367 Helderberg 7135
CONTACT PERSON	**CONTACT PERSON**
Peet Botes Cell: +(27)82 – 921 5949 Fax: +(27)86 – 415 8595 Email: pbconsult@vodamail.co.za	Mr. Bernard de Witt Tel: +(27) 21 – 851 1616 Fax: +(27) 86 – 512 0154 Email: bernard@enviroafrica.co.za

SUMMARY OF POSSIBLE SIGNIFICANT BIODIVERSITY FEATURES		
Geology & soils	Geology & soils vary only slightly in the larger study 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. **Possible Impact = low**
Land use and cover	Covered by natural veld in relative good condition. Utilized for grazing.	The area is been utilised for grazing and agriculture. Species diversity is low and represents a drought resistant low shrubland very sparsely vegetated with a high percentage of grasses. The grazing potential is low. **Possible Impact is considered to be low and localised**.
Vegetation types	Eastern Gariep Plains Desert Eastern Gariep Rocky Desert	Both vegetation types are classified as "Least threatened", and in both cases a very high percentage of the vegetation still remains, but very little of this vegetation is currently formally protected and conservation measures will have to put in place to ensure conservation targets are met. In addition the Namakwa District Biodiversity Sector Plan includes most of Onseepkans within CBA 1 or CBA 2 priority conservation areas. Fortunately the proposed sites and associated infrastructure is small scale and are for the most placed in areas already disturbed and with existing access. **Possible impact is considered as low-medium** (very localised).
Conservation priority areas.	In terms of the Namakwa District Biodiversity Sector Plan	According to the Namakwa District Biodiversity Sector Plan most of the Onseepkans has been identified as either CBA 1 or CBA 2 priority conservation areas. Fortunately the proposed sites and associated infrastructure is small scale and are for the most placed in areas already disturbed and with existing access. The aim should be to minimise further disturbances and to locate the sites in or near areas already disturbed. **Possible impact is considered as medium** (but very localised).
Protected plant species	Species observed that are protected nationally or provincially.	No nationally protected species was encountered within the proposed footprint. Two species protected in terms of the NCNCA was observed (both locally abundant). A flora permit will have to be applied for the likely impact on a small number of *Euphorbia* species as well as the possible impact on two *Boscia foetida* individuals. **Possible impact = low** (very 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. The activity is thus not expected to have a significant impact on fauna or avi-fauna. **Possible Impact low**.
Rivers & wetlands	A number of smaller streams and drainage lines were observed on both sites.	Assessed in the wetland expert report.
Invasive alien infestation	*Prosopis* species was observed on both sites.	All invasive alien species must be removed during the construction. **Possible Impact = positive**.

RECOMMENDATION

It is expected that the upgrade will result in improved water conservation and management and will also lead to visual and environmental improvement. In addition, and probably the most significant positive of the proposed canal would be the fact that the proposed upgrade will minimise future maintenance work (and thus negate the current regular disturbance resulting from working with heavy machinery next to the Orange River).

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

Onseepkans is a small settlement on the banks of the Orange River in Northern Cape Province, South Africa, which also acts as a border post with Namibia for traffic between Pofadder in South Africa and Keetmanshoop in Namibia. Onseepkans was established in approximately 1916 by missionary settlers and relies almost exclusively on irrigated lands supplied with water from the Orange River. Water from the Orange River is currently supplied to the agricultural land and smallholdings through a gravity feed earth and concrete canal system designed and build with the establishment of the settlement (no pumping is done). Water is extracted from the Orange River by means of a weir constructed in the river from where it enters the canal. The system is designed to extract a maximum of 1500 l/s. During months with low water demands, flow is regulated with a sluice gate. The canal runs the length of the Onseepkans settlement (a distance of approximately 16.4 km), before it releases its surplus water back into the Orange River. Over the years the canal had been repaired and upgraded on numerous occasions (after flooding incidents), but it is calculated that the canal presently has a water loss of about 30%. Recent floods had again caused extensive damaged and sedimentation within the open canal, resulting in loss of irrigation water too many of the smallholdings and irrigated land and again prompted extensive maintenance and repair works. The location of the canal means that flooding will be a constant issue and together with constant alien infestation problems, this has resulted in on-going maintenance and repair issues leading to constant disturbance within the Orange River riparian zone. The situation has reached such a stage where the canal has to be re-constructed in order to ensure security of irrigation water to producers. In order to alleviate this on-going issue the Northern Cape Department of Agriculture Land Reform and Rural Development had appointed BVi Consulting Engineers to come up with a design upgrade, in order to address flood damage, water loss minimisation and to unlock further agricultural potential at Onseepkans. The objective of the bulk water supply upgrade is to be able to supply water for the:

- re-establishment crops on the existing 118 ha of lands in the flood plain and;
- the 32 ha of existing irrigation land developed by CSIR;
- as well as for the proposed new development of a further 250 ha of irrigation land for the establishment of high value table grapes outside the flood plain.

Please note that this is a second round of layout designs. An original application was made for replacing the existing canal with a closed pipeline for which environmental approval was received. However, BVi engineers was tasked by the Department of Agriculture, Land Reform and Rural Development to re-design the Onseepkans bulk water supply system in order to allow for the irrigation of approximately 250 ha of additional land. This will include the construction of a new abstraction point, the establishment of a 75 000 m^3 storage reservoir (± 3.6 ha in size), a small 750 KVA - 1MVA PV solar plant (± 2 ha in size) and distribution cables, for the production of energy to run the system. Water will be pumped from the Orange River to the storage dam (using solar energy). The old open canal system will be replaced by a closed pipe system. Water will be distributed from the storage dam to the pipeline (under pressure) and to the new agricultural areas.

This includes work within the Orange River as well as some of the small tributaries (draining into the Orange River), which had been impacted by the original canal. In addition two new areas will be impacted for the establishment of the reservoir (± 3.6 ha) and the solar site (± 2 ha). Please note that the location of the main distribution pipeline and the borrow pit locations will remain the same as for the original application (Refer to the original biodiversity report by PB Consult dated 30/09/2013).

NB: As a result only the new impact areas are discussed in this report, namely the storage reservoir, solar site, connection pipes and intake area.

1.1 TERMS OF REFERENCE

EnviroAfrica (Pty) Ltd was appointed by the Department of Agriculture, Land Reform and Rural Development as the independent Environmental Assessment Practitioner (EAP) to undertake the Basic Assessment (EIA) Process for the proposed development. PB Consult was appointed by the Department of Agriculture, Land Reform and Rural Development 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 and ecological drivers associated with the specific area.
- A brief discussion of the vegetation types encountered with emphasis on protected species.
- A list of plant species encountered.
- 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 on habitat and species.
- A discussion of significant impacts *vs*. mitigation and possible layout amendments.

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** (2014): 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 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

4. REFERENCES

Acocks, J.P.H. 1953. Veld types of South Africa. *Mem. Bot. Surv. .S. Afr*. No. 28: 1-192.

Alias, D. & Milton S. 2003. A collation and overview of research information on *Boscia albitrunca* (shepherd's tree) and identification of relevant research gaps to inform protection of the species. Research report done for the Department of Water affairs and Forestry. 18th August 2003.

De Villiers C.C., Driver, A., Brownlie, S., Clark, B., Day, E.G., Euston-Brown, D.I.W., Helme, N.A., Holmes, P.M., Job, N. & Rebelo, A.B. 2005. Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape. Fynbos Forum, c/o Botanical Society of South Africa: Conservation Unit, Kirstenbosch, Cape Town.

Forsyth, G.G., FJ Kruger, F.J., & Le Maitre, D.C. 2010: National veldfire risk assessment: analysis of exposure of social, economic and environmental assets to veldfire hazards in South Africa. CSIR Report No: CSIR/NRE/ECO/ER/2010/0023/C. March 2010.

Government Notice No 1002, 9 December 2011. National list of Ecosystems that are threatened and in need of protections. In terms of section 52(1)(a) of the National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004).

Low, A.B. & Rebelo, A.(T.)G. (eds) 1996. *Vegetation of South Africa, Lesotho and Swaziland*. Dept of Environmental Affairs and Tourism, Pretoria.

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

PB Consult. 2013. Onseepkans Canal – Repair and upgrade of Onseepkans Water Supply and flood protection infrastructure, Northern Cape. Biodiversity and Botanical scan. Unpublished report prepared for BVi Engineers, August 2013.

SANBI. 2006. South African National Botanical Institute: Biodiversity GIS Home. http://bgis.sanbi.org (as updated)

SANBI. 2012. Red List of South African Plants version 2012.1. Downloaded from Redlist.sanbi.org.

Seymour, C. & Milton, S. 2003: A collation and overview of research information on *Acacia erioloba* (Camelthorn) and identification of relevant research gaps to inform protection of the species. Research report done for the Department of Water affairs and Forestry. 31st August 2003.

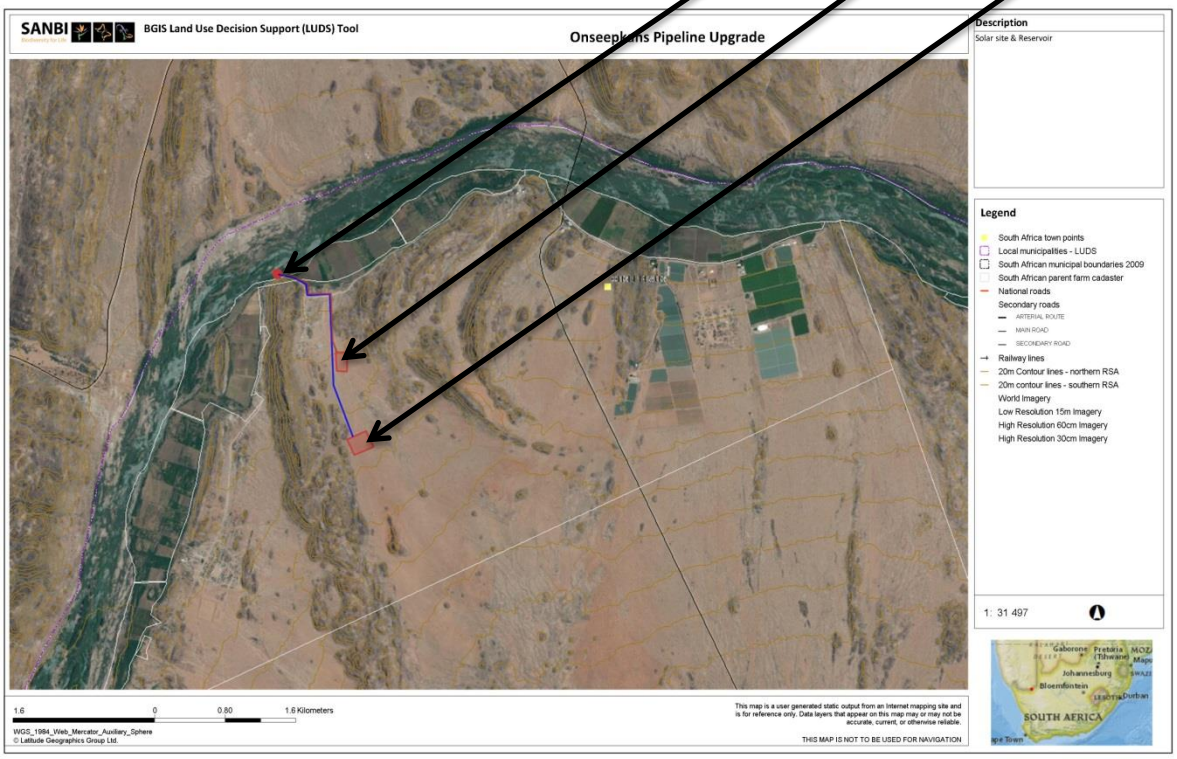
Siyanda Draft EMF Report. 2008. Draft Environmental Framework report for the Siyanda District Municipality. A joined project between Siyanda District Municipality, Department of Tourism, Environment and Conservation, Department of Environmental Affairs and Tourism, Northern Cape. In association with MetroGIS & Mosakong Management. 2008.

Van Rooyen, M.W., Van Rooyen, N.; Bothma, J. du P. & Van Den Berg, H. M. 2008. Landscapes in the Kalahari Gemsbok National Park, South Africa. Koedoe [online]. 2008, vol.50, n.1, pp. 99-112. ISSN 0075-6458.

5. PROJECT DESCRIBTION

The Northern Cape Department of Agriculture, Land Reform and Rural Development indicated that there is a pressing need to upgrade/repair the existing Onseepkans Canal in order to minimise the constant maintenance and repair costs associated with sedimentation, overgrowing and flood damage. BVi Engineers proposed various options for improving the system. The existing canal is an earth canal with a total length of approximately 16.4km. Please note that Environmental Authorization was already obtained for replacing the existing canal system with a closed pipeline (and its associated infrastructure). As a result this report only focus on the additional infrastructure associated with the new design proposal (Refer to Figure 1).

Figure 1: SANBI BGIS map showing the proposed additional infrastructure (new extraction point, solar plant and storage reservoir)



In order to unlock further agricultural opportunities, BVi was tasked to further re-design the Onseepkans bulk water supply system to include storage and supply for an additional 250 ha of irrigation land (Refer Figure 1).

The new design includes the following additional infrastructure:

- The establishment of a new abstraction point;
- The construction of a 75 000 m^3 storage reservoir (± 3.6 ha in size);
- The construction of a small 750 KVA - 1MVA PV solar plant (± 2 ha in size) and distribution cables, for the production of energy to run the system.

Since the main distribution network remains within the footprint of the existing canal (for which environmental authorization was obtained) it was not discussed again in this report (Refer to PB Consult, 2013).

The latest design upgrade proposes that water be pumped from the Orange River to the storage dam (using solar energy). The original open canal system will still be replaced by a closed pipe system (though it will now be smaller in diameter and a will be delivered under pressure – no further pumping needed by land owners as in the old system). Water will be distributed from the storage dam to the pipeline (under pressure) and to the new agricultural areas (Figure 1)

5.1 METHODS

Desktop studies were conducted, coupled by two physical site visits on the 3rd of November 2015). 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 because of previous site visits a fairly good understanding of the biodiversity status in the area was obtained.

The survey was conducted by walking through the site(s) and examining, marking and photographing any area of interest. 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).

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 (as updated) 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

Onseepkans is a small settlement on the banks of the Orange River in Northern Cape Province, South Africa. It is a border post with Namibia for traffic between Pofadder in South Africa and Keetmanshoop in Namibia. The settlement is located within the Khai-Ma Local Municipality (Namakwa District Municipality) of the Northern Cape Province, approximately 50 km due north of Pofadder and 220 Northwest of Upington (Figure 2).

Figure 2: General location of Onseepkans within South Africa

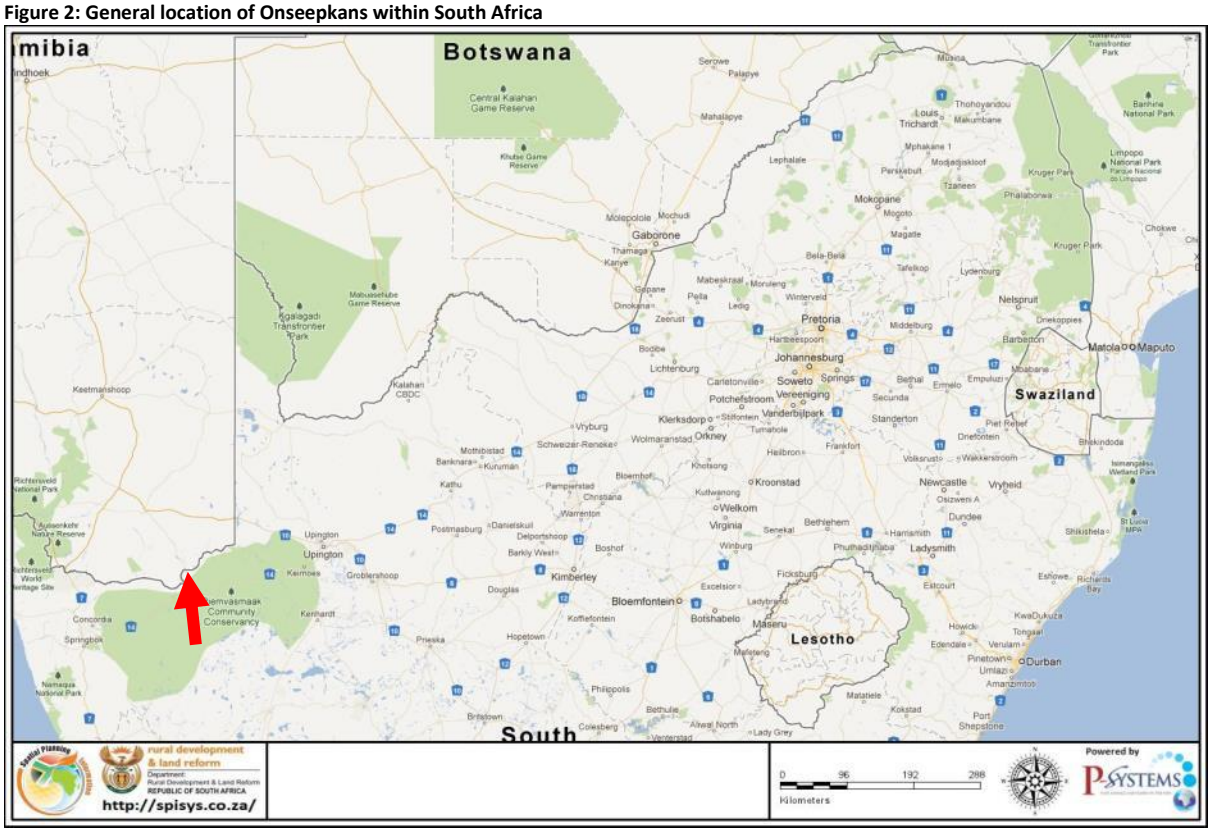


Table 1: GPS coordinates for Onseepkans Canal, and proposed borrow pit locations

DESCRIPTION	Farm Name	LATITUDE AND LONGITUDE	ALTITUDE
Abstraction point	Rem. Farm 88, Onseepkans	S28 44 44.3 E19 16 30.0	369 m
Storage reservoir	Rem. Farm 88, Onseepkans	S28 45 38.2 E19 16 59.5	431 m
Solar plant	Rem. Farm 88, Onseepkans	S28 45 12.3 E19 16 52.6	400 m
Electrical services	Rem. Farm 88, Onseepkans	S28 45 12.0 E19 16 49.1	397 m
Borrow pit 1	Rem. Farm 88, Onseepkans	S28 44 49.3 E19 18 12.7	392 m
Borrow pit 2	Rem. Farm 421, Onseepkans	S28 45 05.9 E19 21 13.3	386 m
Borrow pit 3	Rem. Farm 88, Onseepkans	S28 45 24.6 E19 19 57.3	464 m
Borrow pit 4	Rem. Farm 88, Onseepkans	S28 44 25.4 E19 17 51.9	382 m
Borrow pit 5	Rem. Farm 88, Onseepkans	S28 45 16.5 E19 16 39.6	405 m
Borrow pit 6	Rem. Farm 88, Onseepkans	S28 45 46.1 E19 16 29.3	385 m
Borrow pit 7	Rem. Farm 88, Onseepkans	S28 46 22.7 E19 16 24.2	402 m

Figure 1 shows the proposed locations for the new extraction point, storage dam, connecting pipelines, solar site and overhead cables.

6.2 TOPOGRAPHY

The original Onseepkans Canal was located along the southern banks of the Orange River, contained within the narrow valley between the mountains and the river which also encloses the Onseepkans Settlement. The alluvial floodplains next to the river have been developed into productive agricultural land and small holdings. The valley bottom ranges in width from less than 500 m to just over 2 km wide in places. The Orange River

forming the northern boundary of the settlement area, enclosed to the south by the rather steep kopjes enclosing the Orange River valley in this part of the Northern Cape.

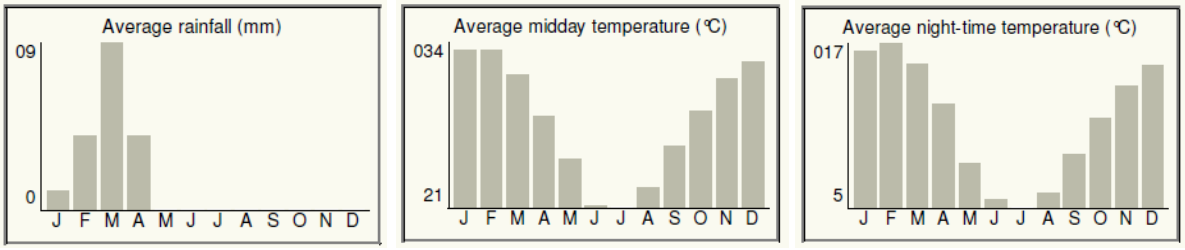
In places, the area is very rocky and possesses a "broken" topography with *Aloe dichotoma* and *Euphorbia* species associated with the steep slopes of the hills of the area. On the pediments, Black Thorn (*Acacia mellifera)*, *Rhigozum trichotomum*, Shepherd's Tree (*Boscia albitrunca)* and Stink Shepherd's Tree (*B. foetida)* are common trees and shrubs, while Silky Bushman Grass (*Stipagrostis uniplumis)* can dominate the plains, especially after good summer rains. There are abundant thickets along the banks of the Orange River itself. However, the riparian vegetation (the zone of vegetation along the river banks) has been notably disturbed and replaced by invasive alien species, most commonly Mesquite *(Prosopis glandulosa)*, with *Nicotiana glauca* (Wild tobacco) and *Ricinus communis* (Castor-oil plant) also in evidence.

Various small seasonal streams and drainage lines drains the kopjes into the Orange River (during times of heavy rains). Elevation varies from approximately 370 m in the valley bottom to just over 500 m at the top of the immediate kopjes.

6.3 CLIMATE

All regions with a rainfall of less than 400 mm per year are regarded as arid. The Onseepkans area falls within the desert biome or **hyper arid region** of fringing the western South African shoreline, Southern Angola and Namibia. The desert biome is characterised by ecological extremes and of all the biomes in SA it has the lowest amount of and the variability in rainfall. Onseepkans normally receives about 18mm of rain per year, with most rainfall occurring mainly during autumn. The chart below (lower left) shows the average rainfall values for Onseepkans per month. It receives the lowest rainfall (0mm) in May and the highest (9mm) in March. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Onseepkans range from 20.7°C in July to 33.4°C in January. The region is the coldest during July when the mercury drops to 4.7°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 3: Average rainfall, temperature and night-time temperatures for Onseepkans Canal (www.saexplorer.co.za)



6.4 GEOLOGY & SOILS

According to Mucina and Rutherford (2006) and the SANBI Biodiversity Geographical Information System, the geology and soils of the alluvial soils next to the river are mostly recent alluvial deposits of the Orange River

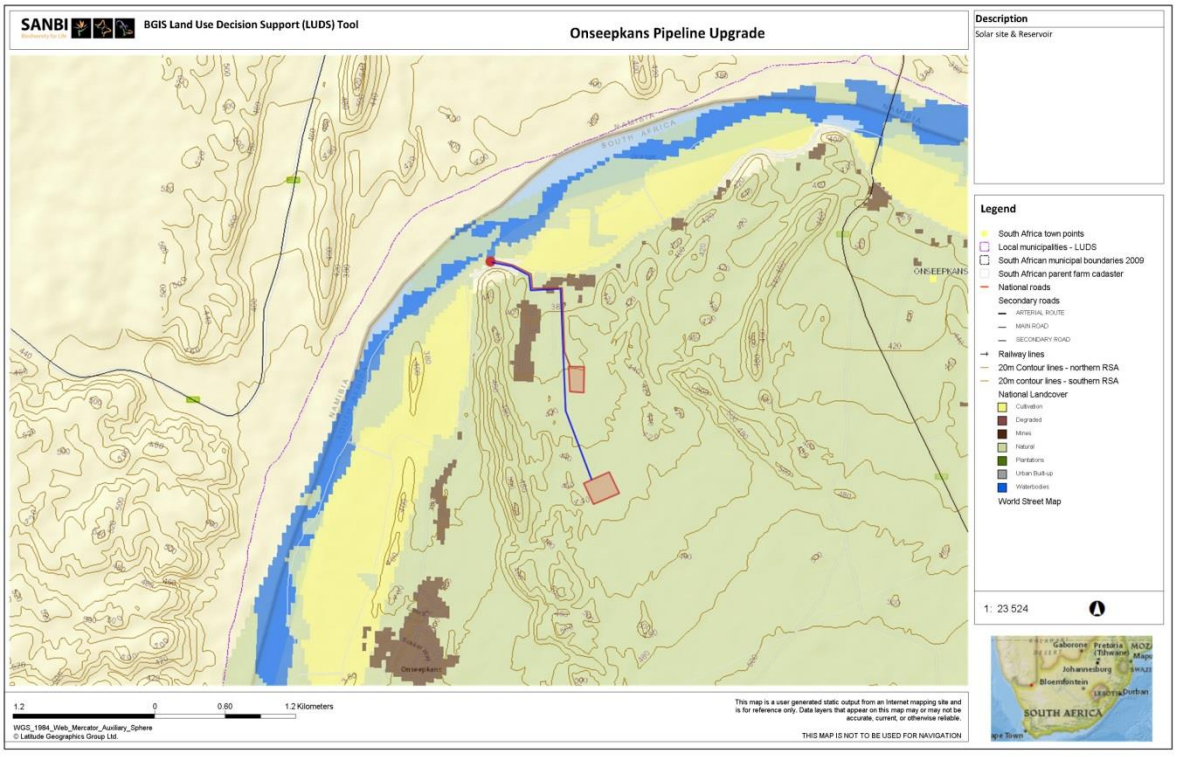
supporting soil forms such as Dundee and Oakleaf. The river cuts through a great variety of Precambrian metamorphic rocks (la land type). As it name suggests the flood plains are subject to floods, especially in summer, caused by high precipitation on the Highveld.

Along the upper slopes the geology and soils are described by Mucina and Rutherford (2006) as follows: towards the east mainly leucocratic biotite gneiss and quartz-feldspar gneiss of the Stalhoek Complex and lesser amounts of leucocratic biotite gneiss are, with intercalations of calc-silicate rocks, mafic gneiss, and a quartzite-schist association of the Hom Subgroup, Bushmanland Group. In the west the area consists of granodiorite, adamellite, leucogranite, tonalite and diorite of the Vioolsdrif Suite and intermediate and acid volcanics of the Haib Subgroup of the Orange River Group (all of the above of Mokolian age). Very rocky substrate, with little or no soils. Land type lc. Soils are described as soils with minimal development, usually shallow on hard and weathered rock, with or without intermitted diverse soils. Lime generally present in part or most of the area. 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).

6.5 LANDUSE AND COVER

In general desert environments are not very attractive to human settlement; nevertheless, even low level of human activity can have a high impact due to the sensitivity of the desert environs.

Figure 4: SANBI BGIS map showing the 2009 land use update for Onseepkans



The proposed pipeline will be located within footprint of the existing canal, but will also impact on virgin soils (approximately 6 ha for the construction of the Reservoir and Solar Plant and its associated infrastructure)

(Figure 4). Even so, it is not expected to have any significant additional impact on land use or cover because of the relative small footprint of the proposed development in relation to its surroundings. In fact it is expected to lessen maintenance, which will have significant long term benefits.

The proposed location for the solar site and reservoir will not impact on any significant watercourse or wetland.

6.6 BROAD SCALE VEGETATION TYPES EXPECTED

In accordance with the 2006 Vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006) three (3) broad vegetation types are expected in the vicinity of the proposed extraction point, solar site and reservoir, namely ***Lower Gariep Alluvial Vegetation*** (at the extraction point) along the Orange river alluvial plain (Blue in Figure 5), while ***Eastern Gariep Rocky Desert*** is expected along the River and just back of the river and ***Eastern Gariep Plains Desert*** (at the reservoir and solar site) (Figure 5).

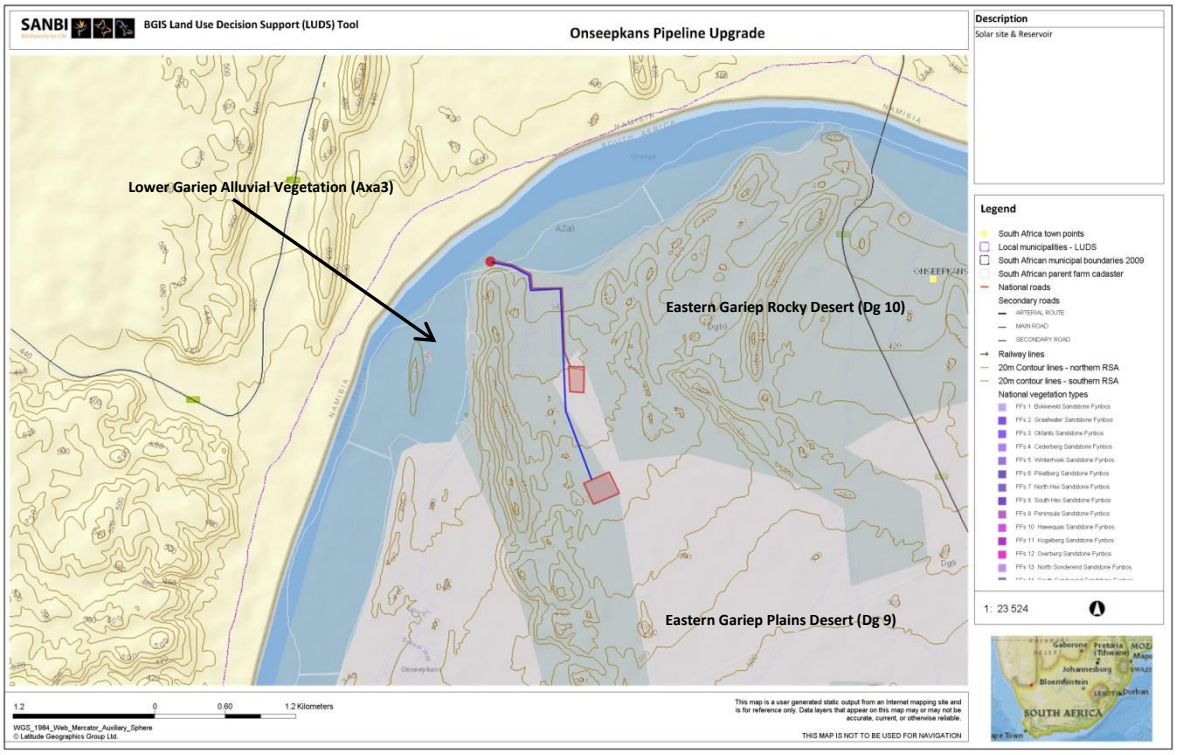
According to the *National list of ecosystems that are threatened and in need of protection* (GN 1002, December 2011) these vegetation types are currently classified as follows

Table 2: Vegetation status according to the 2004 & 2011 National Spatial Biodiversity Assessment

VEGETATION TYPE	NATIONAL STATUS 2011	REMAINING (2004)	CONSERVATION TARGET	FORMALLY CONSERVED
Lower Gariep Alluvial Vegetation	Endangered	50.3%	31%	5.8%
Eastern Gariep Plains Desert	Least Threatened	Very little intact examples remains	34%	-
Eastern Gariep Rocky Desert	Least Threatened	99.7%	34%	-

However, it is important to note that even though both Eastern Gariep Plains Desert and Eastern Gariep Rocky Desert, has been classified as least threatened, they also both falls within the South African Desert Biome, in this case fringing on the Namibian desert. The Desert Biome is a hyperarid region of great age and one with extraordinary high diversity of organisms (including many endemics), adaptions and includes both winter- and summer rainfall areas, making it one of the most interesting hyperarid regions of the world. Compared with other desert regions, plant species richness is very high (especially the Richtersveld) and does not differ much from that of the Succulent Karoo (Mucina & Rutherford, 2006). However, not all parts of this biome are equally rich in species diversity. Plant species richness of the western Gariep Lowland Desert vegetation unit, is thought to be less rich than that of for example the Richtersveld and is described by Mucina & Rutherford (2006) as moderate.

Figure 5: SANBI BGIS Vegetation map of SA, Lesotho and Swaziland (2006)



6.6.1 Eastern Gariep Plains Desert

The vegetation type is described as occurring on sloping plains, sharply contrasting with the surrounding rocky hills and mountains. Typical wash vegetation in the breaks between the mountains to the Orange River. Grassland dominated by 'white grasses', some spinescent (*Stipagrostis* species), on much of the flats with additional shrubs and herbs in the drainage lines or on more gravelly or loamy soil next to the mountains.

According to Rutherford and Mucina (2004), important taxa include the following: Small tree: *Parkinsonia africana*. Stem- & Leaf-succulent Shrubs: *Brownanthus pseudoschlichtianus*, *Psilocaulon subnodosum*. Stem-succulent Shrub: *Euphorbia gregaria*. Leaf-succulent Shrub: *Zygophyllum microcarpum*. Other Shrubs: *Sisyndite spartea*, *Calicorema capitata*, *Galllonia crocyllis*, *Hermbstaedtia glauca*, *Monechma spartioides*, *Petalidium setosum*. Graminoids: *Stipagrostis brevifolia*, *S. ciliata*, *Schmidtia kalahariensis*, *Stipagrostis obtusa*. Perennial Herbs: *Codon royenii*, *Rogeria longiflora*. Succulent Herb: *Mesembryanthemum guerichianum*.

6.6.2 Eastern Gariep Rocky Desert

The vegetation type is described as occurring on hills and mountains (up to 650 m of relative altitude from their base), mostly with bare rock outcrops and covered with very sparse shrubby vegetation in crevices, usually separated by broad sheet-wash plains (Eastern Gariep Plains Desert).

Important Taxa (""Mainly western part, 'Mainly eastern part) Succulent Tree: Aloe dichotoma. Small Trees: *Acacia mellifera, Boscia albitrunca, B. foetida, Ehretia rigida, Euclea pseudebenus*, *Maerua gilgii*, *Pappea capensis*. Stem-& Leaf-succulent Shrubs: *Brownanthus pseudoschlichtianus*, *Ceraria fruticulosa, Psilocaulon subnodosum, Ruschia barnardii*. Stem- succulent Shrubs: *Ceraria namaquensis, Commiphora capensis, C cervifolia, C. gracilifrondosa, C namaensis, Euphorbia avasmontana, E. friedrichiae, E. gariepina, E. gregaria, E. guerichiana, E. virosa.* Leaf- succulent Shrubs: *Aloe dabenorisana, A. gariepensis, Mesembryanthemum inachabense, Prenia tetragona, Trianthema parvifolia, Tylecodon rubrovenosus, Zygophyllum decumbens, Z microcarpurn, Z. rigidum.* Other Shrubs: *Adenolobus gariepensis, Antherothamnus pearsonii, Aptosimum tragacanthoides, Barleria lancifolia', B. rigida, Cadaba aphylla, Calicorema capitata, Diospyros acocksii, Dyerophytum africanum, Eriocephalus scariosus, Hermannia stricta, Justicia orchioides, Monechma mollissimum, Petalidium setosum, Rhigozum obovatum, Rhus populifolia, Sisyndite spartea.* Graminoids: *Enneapogon scaber, Schmidtia kalahariensis, Stipagrostis anomala, S. ciliata, S. obtusa*. Perennial Herbs: *Abutilon pycnodon, Chascanum garipense, Codon royenii, Rogeria longiflora, Tribulus cristatus.* Geophytic Herb: *Bowiea gariepensis*. Succulent Herb: *Mesembryanthemum guerichianum*. Annual Herbs: *Cleome angustifolia* subsp. *diamdra*, C. *foliosa* var. lutea.

Endemic Taxa Small Tree: *Ozoroa namaquensis*. Leaf-succulent Dwarf Shrub: *Tylecodon sulphureus*.

6.7 VEGETATION ENCOUNTERED

6.7.1 Vegetation at extraction point

A wetland expert has been appointed to evaluate the impact of the proposed extraction point on the river ecosystem. As a result this report only refers to the vegetation encountered and does not evaluate the impact on the riparian zone or river itself. Most of the riparian zone along the Orange River neighbouring Onseepkans can be described as degraded and even transformed in places. Thickets are still found, but large portions of the riparian zone is dominated by dense stands of the common reed *Phragmites australis*, which often forms almost single species stands. *Phragmites australis* is the dominant semi-aquatic macrophyte along the whole of the Orange River.

Photo 1: Phragmites dominated vegetation at extraction point

At the point where the extraction point will be locate the riparian zone is very narrow and the vegetation dominated by *Phragmites*. Alien invader species like the *Prosopis glandulosa* (Mesquite tree), *Nicotiana glauca* (Wild tobacco), *Datura stramonium* (Thorn apple) and *Ricinus communis* (Castor-oil plant) were also observed. No protected tree species was observed in the vicinity of the proposed new extraction point.

6.7.2 Vegetation at solar site

According the vegetation map of South Africa (Mucina & Rutherford, 2006) the proposed solar site should be located within Eastern Gariep Plains Desert vegetation type (Refer to Figure 5). The proposed solar plant will cover approximately 2 ha, which will include service roads and associated infrastructure. It is located just to the south east of the Viljoensdraai Settlement (and near to the new extraction point). The site is located within one of the sheet washed plains found in between rocky outcrops associated with Eastern Gariep Plains Desert vegetation type (Photo 2).

Photo 2: Looking over the proposed solar plant site, with typical sheet washed plains vegetation

The vegetation was dominated by a low grassy bottom stratum (reaching approximately 0.5 m) including, *Stipagrostis*-, *Enneapogon*- species and *Schmidtia kalahariensis*. The middle stratum (0.5-1m) consists of a very sparse short to medium shrubby layer, dominated by the hardy shrub *Petalidium setosum* and *Euphorbia gregaria. Other shrub species encountered included Sisyndite spartea*, *Aptosimum spinescens* and *Zygophyllum microcarpum*.

No other features of significance or protected tree species were encountered on the site and its immediate surroundings.

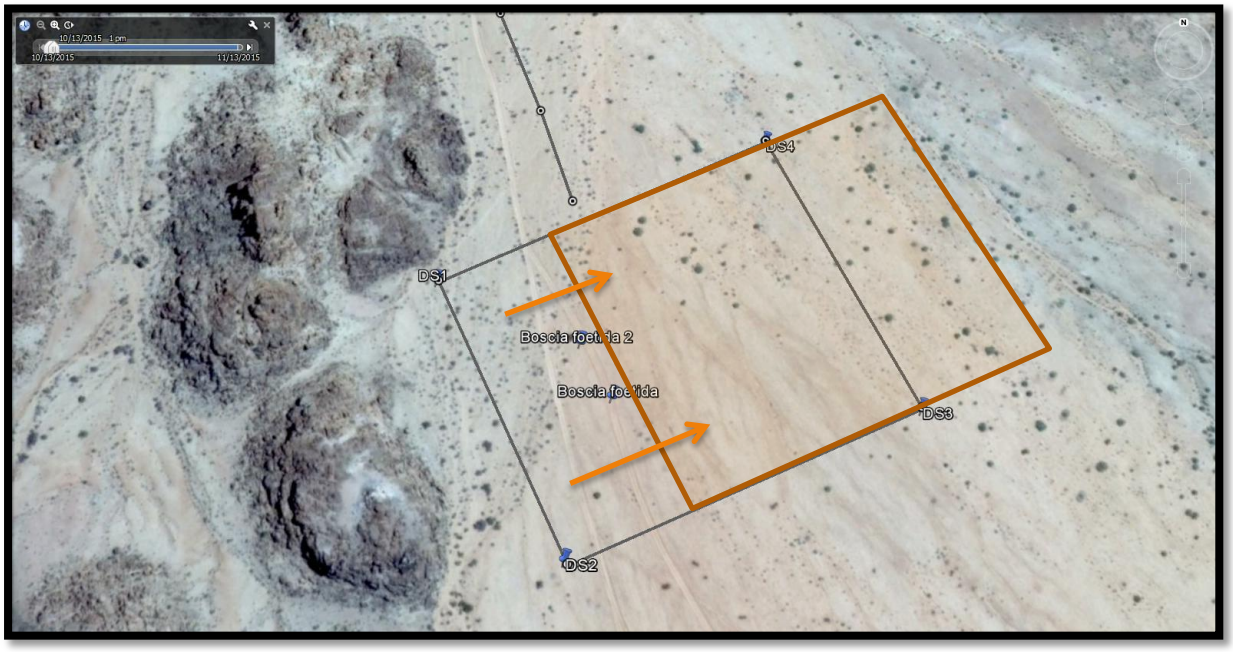
6.7.3 Vegetation at the reservoir site

The proposed storage reservoir will cover approximately 3.6 ha, and is located approximately 650 m further south within the same sheet washed plain as the solar site. Although the Vegetation map of South Africa (Figure 5) indicates that the site is likely to be covered by Eastern Gariep Rocky Desert vegetation type, the vegetation is in fact a continuation of the sheet washed vegetation associated with Eastern Gariep Plains

Desert. The species composition is almost identical to that described for the solar site, although *Euphorbia gregaria* might be slightly more prominent on this site.

Photo 3: Looking over the proposed reservoir site, from west to east

Figure 6: Google image showing the location of the two *Boscia foetida* individuals and the proposed mitigation



The only additional feature of interest was the presence of two low individuals of *Boscia foetida* (protected in terms of the NCNCA), that was encountered to the west of the proposed site. However, it should be fairly simple to avoid these features by moving the site slightly to the east.

6.7.4 Vegetation encountered along pipeline route (also Overhead cable route)

The proposed pipeline and overhead cables route follow existing roads as can be seen in Figure 7. The vegetation from the river to almost at the solar site can be described as disturbed and impacted as a result of grazing practices and urban associated activities (being located right next to a small settlement).

Figure 7: Google image showing the location of the pipeline and overhead cables route in relation to the reservoir- and solar sites

Photo 4: Showing the vegetation near the Orange River looking towards the solar site (note Prosopis individuals)

Photo 4 – 6 shows images of the vegetation encountered from the river towards the solar site. The whole site shows signs of disturbance (including agriculture along the river banks), grazing and urban creep which has left the vegetation in poor condition (alien infested near the river) sometimes even transformed (portions of the riparian zone). Species encountered included: *Aptosimum spinescens, Blepharis mitrata, Calicorema capitata, Chascanum garipense, Cotula* cf. *leptalea, Dyerophytum africanum*, *Euphorbia gregaria, Hirpicium* cf.

alienatum, Kohautia caespitose, Lycium bosciifolium, *Petalidium setosum*, *Prosopis grandulosa*, *Sisyndite spartea* and *Zygophyllum microcarpum.*

Photo 5: Showing the vegetation encountered just south of the river towards the settlement (looking towards the Orange River)

Photo 6: Showing the vegetation adjacent to the small settlement coming towards the solar site (looking towards the river)

The vegetation encountered between the solar- and reservoir site is the same low grassy bottom stratum (reaching approximately 0.5 m) with a sparse short to medium shrubby over layer as encountered at both the solar and reservoir sites.

6.8 FLORA ENCOUNTERED

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.

Table 3: List of species encountered on the sites (excluding grass species)

SPECIES NAME	COMMON NAME	FAMILY	STATUS
Aptosimum spinescens	Doringviooltjie	SCROPHULARIACEAE	
Blepharis mitrata	Klapperbossie	ACANTHACEAE	
Boscia foetida	Stinkbos	CAPPARACEAE	Protected in terms of NCNCA
Calicorema capitata	Klein swartstorm	AMARANTHACEAE	
Chascanum garipense		VERBENACEAE	
Cotula cf. *leptalea*		ASTERACEAE	
Dyerophytum africanum		PLUMBAGINACEAE	
Euphorbia gregaria	Aggenysmelkbos	EUPHORBIACEAE	Protected in terms of the NCNCA
Hirpicium cf. alienatum		ASTERACEAE	
Kohautia caespitosa		RUBIACEAE	
Lycium bosciifolium	Slap Kriedoring	SOLANACEAE	
Monsonia species		GERANIACEAE	
Petalidium setosum	Namib petal-bush	ACANTHACEAE	
Prosopis grandulosa	Honey mesquite	FABACEAE	Category 2 invader
Sisyndite spartea	Desert broom	ZYGOPHYLLACEAE	
Zygophyllum microcarpum	Armoedsbossie, Ouooibos	ZYGOPHYLLACEAE	

6.9 SIGNIFICANT AND/OR PROTECTED PLANT SPECIES

6.9.1 Nationally protected plants species

The National Forests Act (NFA) of 1998 (Act 84 of 1998) provides for the protection of forests as well as specific tree species (GN 71 6 of 7 September 2012). Five tree species have geographical distribution that may overlap this study area (Table 1).

Table 4: NFA 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
Acacia haematoxylon	Grey camel thorn, Vaalkameeldoring	169	Largely confined to red Kalahari sand, usually on dunes, hammocks or sandy plains.
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.
Euclea pseudebenus	Ebony guarri, Ebbehout – ghwarrie	598	Generally occurring along dry water courses.
Ozoroa namaquensis	Gariep resin tree, Gariep-harpuisboom	373.2	Generally confined to rocky outcrops in dwarf-shrub savanna, but sometimes along dry water courses.

Both *Acacia erioloba* and *Boscia albitrunca* was observed at Onseepkans, **but none within the study area**.

6.9.2 Provincially protected plant species

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.

Two species protected in terms of the NCNCA was encountered within the study area (Refer to Table 3). **Flora permits will have to be obtained** for the likely impact on individuals from these species.

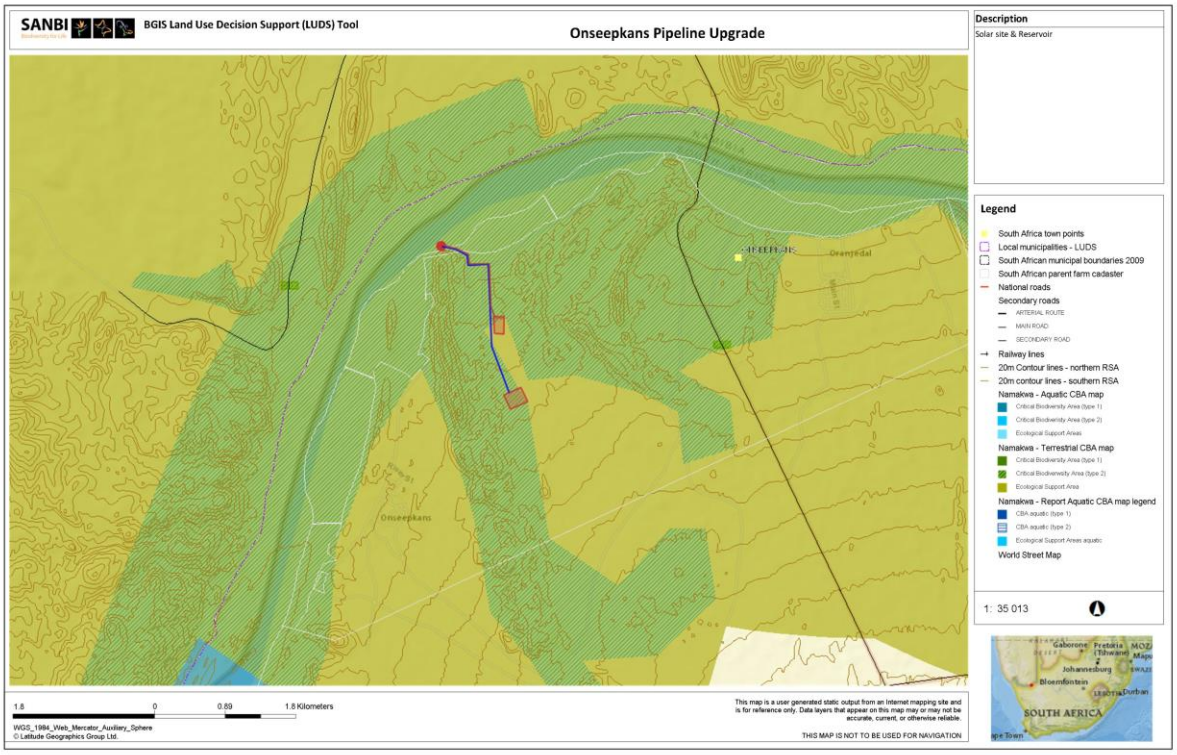
6.10 Fine-Scale mapping (CBA's)

The Namakwa District Biodiversity Sector Plan (Figure 8) is intended to help guide land-use planning, environmental assessments and authorisations; and, natural resource management in order to promote sustainable development. It has been developed to further the awareness of the unique biodiversity in the area, the value this biodiversity represents to people and promote the management mechanisms that can ensure its protection and sustainable utilisation (Draft Namakwa District Biodiversity Sector Plan, Version 2).

The purpose of this document is to ensure that biodiversity information can be accessed and utilized by local municipalities within the Namakwa District Municipality (NDM) to inform land use planning and development as well as decision making processes within the NDM. To achieve this, this biodiversity profile information has been incorporated into the environmental planning section of the Spatial Development Frameworks (SDF's) for each of the six local municipalities in the district. This information includes maps and land use guidelines, which form part of the Integrated Development Plans (IDP's) of the municipalities. Thus, it is hoped that environmental considerations will be better taken into account within land use planning processes, especially within the identified Critical Biodiversity Areas (CBA) – which are areas that have been identified through conservation planning processes as irreplaceable, as well as key to the maintenance of ecosystem services.

In terms of the National Environment Management Act (NEMA) 107 of 1998, all organs of state are obligated to take biodiversity considerations into account and to ensure decisions are informed by the most up to date information. NEMA also states that, although the environment is a functional area of concurrent national and provincial legislative competence, all spheres of government and all organs of state must co-operate with, consult and support one another. Use of the CBA map and associated land use guidelines will support municipalities and other sectors as they provide a common reference point of Critical Biodiversity Areas in the NDM for incorporation into multi-sectorial planning processes.

Figure 8: The Namakwa District Biodiversity Sector plan indicating identified CBA area in and around Onseepkans



According to the CBA map for the Onseepkans area it is clear that the proposed sites as well as the whole of Onseepkans is located within proposed CBA 1 or CBA 2 areas. Ideally one would like to limit potential impact on the proposed CBA areas, but in this case it will be almost impossible. However, the impacts on the CBA's are already mitigated to a large degree by the placement of the sites next to existing roads and within areas already impacted by agricultural development and urban creep. However, it is still recommended that good environmental control must be implemented during construction and rehabilitation, especially in this arid region where re-instatement of natural vegetation would be especially difficult after disturbance.

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 urban part of Onseepkans and the current land-use it is not expected that game will be abundant in the vicinity of the sites. In addition the localised impact of the various sites should minimise such impacts. 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. Impacts will be temporary and 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. The proposed activity is not expected to have a significant impact on avi-fauna.

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 area are non-perennial rivers. Various seasonal streams have been encountered on the various sites. In most cases the sites was chosen to minimise or negate possible impact on even small seasonal streams. A few drainage lines might be impacted, but can be re-instated during rehabilitation. A wetland expert has been appointed to assess impact on river systems and as this report will give a comprehensive analysis of impacts on river systems it is not further discussed in this report.

6.13 INVASIVE ALIEN INFESTATION

A number of *Prosopis grandulosa* (a category 2 invader) were encountered scattered on almost all proposed sites. 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

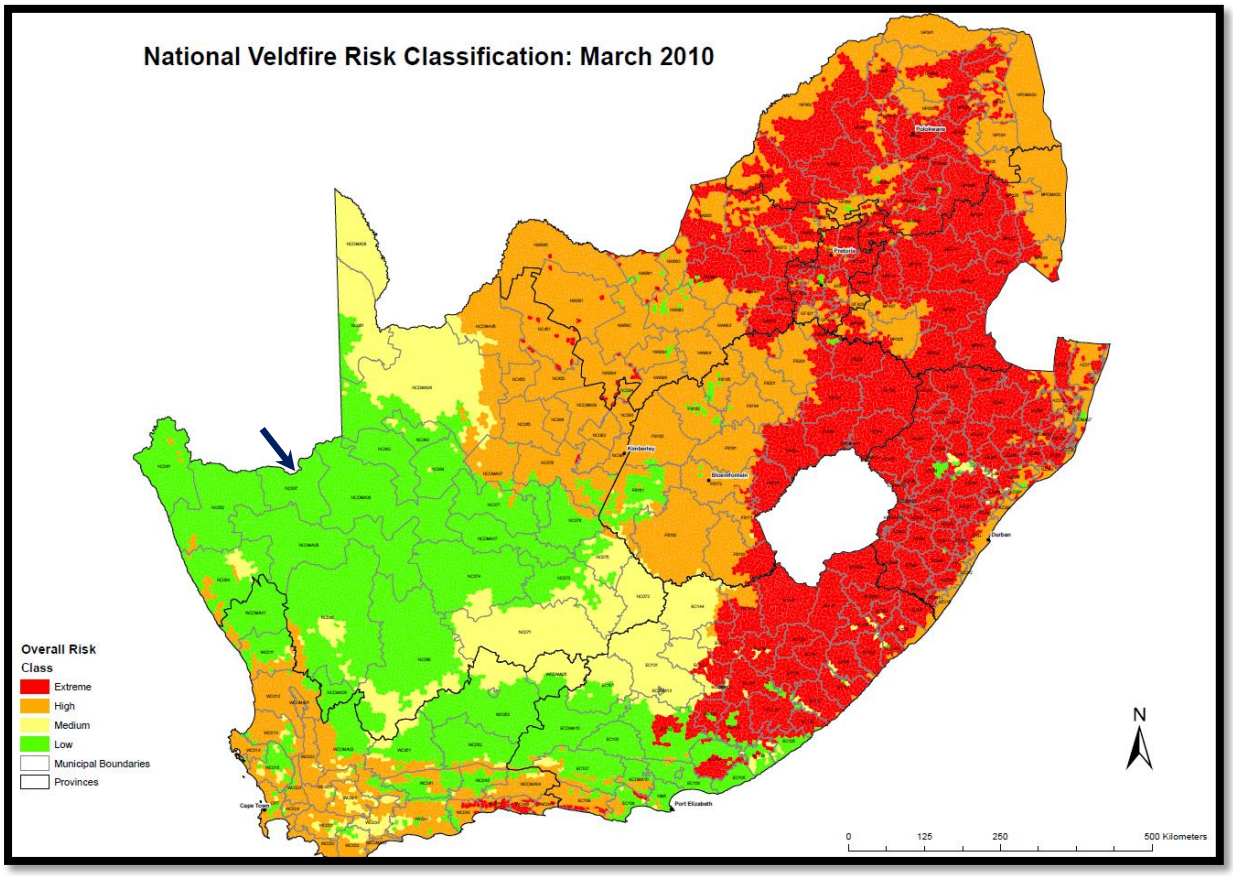
be retained in special areas demarcated for that purpose, but those occurring outside demarcated areas must be controlled. **In this case all *Prosopis* individuals should be removed from the footprint and its immediate vicinity wherever they are encountered.**

6.14 VELD FIRE RISK

Onseepkans is situated on the border between South Africa and Namibia in a hyperarid desert type region which is not prone to fire (Mucina & Rutherford, 2006). The revised veldfire risk classification (Forsyth, 2010) in terms of the National Veld and Forest Fire Act 101 of 1998 was promulgated in 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.

Onseepkans is located in a region supporting desert vegetation, with a **low fire risk classification**. Although, the fire risk is low 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.

Figure 9: South African National Veldfire Risk Classification (March 2010)



6.15 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 5: Summary of biodiversity features encountered and their possible significance

BIODIVERSITY ASPECT	SHORT DESCRIPTION	SIGNIFICANCE RATING
Geology & soils	Geology & soils vary only slightly in the larger study 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. **Possible Impact = low**
Land use and cover	Covered by natural veld in relative good condition. Utilized for grazing.	The area is been utilised for grazing and agriculture. Species diversity is low and represents a drought resistant low shrubland very sparsely vegetated with a high percentage of grasses. The grazing potential is low. **Possible Impact is considered to be low and localised**.
Vegetation types	Eastern Gariep Plains Desert Eastern Gariep Rocky Desert	Both vegetation types are classified as "Least threatened", and in both cases a very high percentage of the vegetation still remains, but very little of this vegetation is currently formally protected and conservation measures will have to put in place to ensure conservation targets are met. In addition the Namakwa District Biodiversity Sector Plan includes most of Onseepkans within CBA 1 or CBA 2 priority conservation areas. Fortunately the proposed sites and associated infrastructure is small scale and are for the most placed in areas already disturbed and with existing access. **Possible impact is considered as low-medium** (very localised).
Conservation priority areas.	In terms of the Namakwa District Biodiversity Sector Plan	According to the Namakwa District Biodiversity Sector Plan most of the Onseepkans has been identified as either CBA 1 or CBA 2 priority conservation areas. Fortunately the proposed sites and associated infrastructure is small scale and are for the most placed in areas already disturbed and with existing access. The aim should be to minimise further disturbances and to locate the sites in or near areas already disturbed. **Possible impact is considered as medium** (but very localised).
Protected plant species	Species observed that are protected nationally or provincially.	No nationally protected species was encountered within the proposed footprint. Two species protected in terms of the NCNCA was observed (both locally abundant). A flora permit will have to be applied for the likely impact on a small number of *Euphorbia* species as well as the possible impact on two *Boscia foetida* individuals. **Possible impact = low** (very 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. The activity is thus not expected to have a significant impact on fauna or avi-fauna. **Possible Impact low**.
Rivers & wetlands	A number of smaller streams and drainage lines were observed on both sites.	Assessed in the wetland expert report.
Invasive alien infestation	*Prosopis* species was observed on both sites.	All invasive alien species must be removed during the construction. **Possible Impact = positive**.

7. 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

7.1 NATURE OF THE IMPACT

The further upgrades to the proposed Onseepkans bulk water supply system entails the placement construction of a new extraction point, a reservoir for water storage and a solar site to supply electricity for the management of the system (pumps etc.). The footprint is well defined and located in areas already impacted or even degraded as a result of agriculture, grazing and urban creep.

The construction of the new solar- and reservoir site entails the establishment of an additional permanent footprint of <6 ha in total (a very small area in terms of its surroundings). The construction of these features is thus seen as localised and small scale.

7.2 EVALUATION OF ENVIRONMENTAL IMPACTS

Both Eastern Gariep Plains Desert and Eastern Gariep Rocky Desert, has been classified as least threatened, but both falls within the South African Desert Biome, in this case fringing on the Namibian desert. The Desert

Biome is a hyperarid region of great age and one with extraordinary high diversity of organisms (including many endemics), adaptions and includes both winter- and summer rainfall areas, making it one of the most interesting hyperarid regions of the world. Compared with other desert regions, plant species richness is very high (especially the Richtersveld) and does not differ much from that of the Succulent Karoo (Mucina & Rutherford, 2004). However, not all parts of this biome are equally rich in species diversity. Plant species richness of the western Gariep Lowland Desert vegetation unit, is thought to be less rich than that of for example the Richtersveld and is described by Mucina & Rutherford (2004) as moderate.

7.2.1 Threatened or protected ecosystems

According to the *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 both vegetation types are considered **Least Threatened**. In addition very little of the original vegetation type has been lost (less than 2% in both instances). Unfortunately, very little of either vegetation type is formally conserved.

The impacts associated with the solar- and reservoir site is seen as small scale and localised, with very little potential of having any significant impact on the ecosystem status of either of these vegetation types.

The impact on threatened or protected ecosystems is thus rated as very low.

7.2.2 Special habitats

The vegetation itself is not considered to belong to a threatened or protected ecosystem and is classified as "Least threatened", but according to the Namakwa District Biodiversity Sector Plan most of Onseepkans and its immediate surroundings has been classified as either CBA 1 or CBA 2 areas and are thus rated as significant biodiversity features. Ideally the sites should have been placed outside of these CBA areas. It is, however, also a fact that many of the areas within the proposed CBA areas are already much degraded or even transformed as a result of the agricultural and rural development within Onseepkans. The aim should thus be to minimise further disturbances and to locate the sites in or near areas already disturbed.

No special habitats, were encountered on site (e.g. quartz patches or broken veld), which could sustain significant smaller ecosystems. The impacts on river systems are not discussed in this report as a wetland expert has been appointed to evaluate this aspect of the project.

It is considered unlikely that the proposed project will have a significant impact on special habitats if the impact mitigation recommendations are adhered to.

The impact is thus rated as low-medium.

7.2.3 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). However, the Onseepkans settlement footprint is associated with a much higher impact than that of the surrounding natural veld.

The proposed impact is seen as small scale and localised, located within a larger area already impacted (larger portions thereof) as a result of agricultural practices and rural development. It is considered highly unlikely that the project will have any significant additional impacts on corridors or conservancy networks.

The impact is thus rated as very low.

7.2.4 Protected species

No protected tree species was observed in the study area.

Two species protected in terms of the NCNCA was observed (both locally abundant). A flora permit will have to be applied for the likely impact on a small number of *Euphorbia* species as well as the possible impact on two *Boscia foetida* individuals.

It is also important to understand 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 these biomes is low (Van Rooyen, 1988, *vide* Mucina & Rutherford, 2006). It is therefore very unlikely that any protected 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 medium-low.

7.2.5 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 30).
- Loss of local biodiversity and threatened plant species (Refer to page 31)
- Loss of ecosystem connectivity (Refer to page 32)

The site still supports natural vegetation which, according to the Namakwa District Biodiversity Sector Plan is considered to be of potential conservation value. In addition a number of protected species were encountered. However, the impact will be small scale and localised, no special habitats were encountered, it will not lead to significant loss of ecological processes, biodiversity or ecosystem connectivity and is not expected to have any significant impact on wildlife or avi-fauna.

Taking the above into account the direct impact on the environment is **rated as low.**

Mitigation:

- All full grown indigenous trees must be regarded as significant biodiversity features and all efforts must be made to protected and conserve any such tree.
- Permits must be obtained for the removal of any protected species which cannot be protected or avoided.
- 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 be done after construction.

7.2.6 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:

- Establishment of a temporary construction associated infrastructure or 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 low-medium.

7.2.7 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.

Having discussed the various possible environmental impacts above, it is concluded that:

- All aspects of the proposed project will be located within the larger Onseepkans settlement footprint, which are already impacted as a result of agricultural and urban settlement, especially if compared with the natural vegetation further away from the settlement.
- The number of species per broad geographical levels for this biome is low and it is therefore very unlikely that any single species will be confined to any of the proposed sites alone. However, a number of protected species were encountered.
- The impact on sensitive habitats, is regarded as low-medium, because of the fact that the Namakwa District Biodiversity Sector plans identifies Onseepkans and its surroundings as falling with a CBA area.
- On the other hand, because of the localised and temporary nature of the impact the impact on ecosystem function is regarded as very low, cumulative impact on ecology is regarded as very low and finally the impact on economic use of the vegetation is regarded as very low.

The proposed project will thus have a temporary and localised impact, which can, through the implementation of impact minimisation actions, be controlled and further reduced.

On the whole the cumulative impact is considered to be low-medium.

7.3 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 immediate additional impact on the vegetation, protected species or river corridors. However, the potential environmental improvement, better water management and conservation will also not be implemented and the canal will remain subject to flood damage, siltation and alien infestation, which will be associated with constant maintenance and repair (thus constant disturbance).

8. RECOMMENDATIONS & IMPACT MINIMIZATION

It is expected that the upgrade will result in improved water conservation and management and will also lead to additional agricultural options (job creation and social investment). In addition, the proposed upgrade will minimise future maintenance work (and thus negate the current regular disturbance resulting from working with heavy machinery next to the Orange River).

Having evaluated and discussed the various biodiversity aspects associated with the proposed development, the most significant possible impacts identified are:

- The Onseepkans settlement falls within identified CBA areas in accordance with the Namakwa District Biodiversity Sector Plans. However, all aspects of the proposed project will be located within the larger Onseepkans settlement footprint, which are already impacted as a result of agricultural and urban settlement, especially if compared with the natural vegetation further away from the settlement.
- The possible impact on small seasonal streams and drainage lines.
- The possible impact on protected species.

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

Lastly it is felt that with good environmental planning and control during construction (the appointment of a suitably qualified ECO and the implementation of an approved EMP) and good rehabilitation after construction could significantly reduce environmental impact.

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

8.1 IMPACT MINIMIZATION

8.1.1 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 Municipal approved waste disposal site.
- All invasive alien vegetation should be removed from all associated footprints within the various construction sites.
- All efforts must be made to protect mature indigenous trees within the proposed final footprint (and any other protected species that might be encountered on site).
- Permits must be obtained for the removal of any protected species which might be encountered.
- 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 rehabilitation must be implemented.