Leon and Carmen Humphreys

Kimberley

WATER USE LICENCE APPLICATION

Portion 18 Farm 387 Gordonia

Fresh Water Report

In terms of the National Water Act (36 of 1998)

September 2019

EnviroAfrica
Environmental Management and Impact Assessment
Omgewingsbestuur en Impakbeoordeling

WATSAN Africa

Index

1 Introduction

The Destination River Resort at Groblersdal on the banks of the Lower Orange River in the Northern Cape is currently developed. A restaurant and some of the units have already been completed and the remaining building and construction programme is now in full swing.

However, a Pre-Compliance Notice in terms of Section 24 (g) of the National Environmental Management Act NEMA, 107 of 1998) has been issued. According to this notice, apart from a number of other directives, an Environmental Impact Assessment (EIA) will have to be carried out. The owners of the resort, Mr Leon Humphries and Mrs Carmen Humphries subsequently appointed Enviro Africa of Somerset West to start the EIA procedures.

A Water Use Licence Application (WULA) in terms of the National Water (NWA, 36 of 1998) is required. The WULA is an integral part of the EIA. Dr Dirk van Driel of WATSAN Africa was appointed to submit the WULA to the Department of Water and Sanitation's regional office in Kimberley.

The WULA requires a Fresh Water Report, now dubbed the Technical Report. This report follows a particular outline and content that has been developed over a number of years. The report is to supply adequate information for the decision-making authorities to make an informed decision.

The WULA requires the completion of the Risk Matrix, as published on the DWS webpage. This determines if the development can go ahead under a General Authorisation or a License. The last is a higher form of authorisation to be issued by the DWS head office in Pretoria.

The second part of the WULA is the completion of the official application forms, of which there are a number. This will be, upon completion, submitted to the DWS in Kimberley.

There is a similar resort along the Orange River named the River Destiny Lodge. To avoid confusion and for the purpose of this report, the property of interest will be referred to as the Groblershoop Resort.

2 Legal Framework

The proposed development "triggers" sections of the National Water Act. These are the following:

S21 (c) *Impeding of diverting the flow of a water course*

Some part of the proposed development will have an impact on the flow of the water in the Orange River during high flow and peak flow conditions.

S21 (i) *Altering the bed, bank, course of characteristics of a water course.*

Some part of the proposed development will alter the characteristics of the banks of the Orange River.

Government Notice 267 of 24 March 2017

Government Notice 1180 of 2002. *Risk Matrix.*

The Risk Matrix as published on the DWS official webpage must be completed and submitted along with the Water Use Licence Application (WULA). The outcome of this risk assessment determines if a letter of consent, a General Authorization or a License is required.

Government Notice 509 of 26 August 2016

An extensive set of regulations that apply to any development in a water course is listed in this government notice in terms of Section 24 of the NWA. No development take place within the 1:100 year flood line without the consent of the DWS. Of the flood line is not known, no development may take place within a 100m from a water course without the consent of the DWS.

Likewise, the development triggers a part of the National Environmental Management Act, NEMA, 107 of 1998).

The EIA Regulations of 2014 No.1 Activity 12 states that no development may take place within 32 m of a water course without the consent of the Department of Environmental Affairs and its provincial representatives. A part of the development is in the river and the river bed. Consequently, this regulation is relevant to this application.

3 Climate Groblershoop

http://www.saexplorer.co.za/south-africa/climate/groblershoop_climate.asp

Groblershoop normally receives about 108mm of rain per year, with most rainfall occurring mainly during autumn. The chart below (lower left) shows the average rainfall values for Groblershoop per month. It receives the lowest rainfall (0mm) in June and the highest (32mm) in March. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Groblershoop range from 19°C in June to 33°C in January. The region is the coldest during July when the mercury drops to 2°C on average during the night. Consult the chart below (lower right) for an indication of the monthly variation of average minimum daily temperatures.

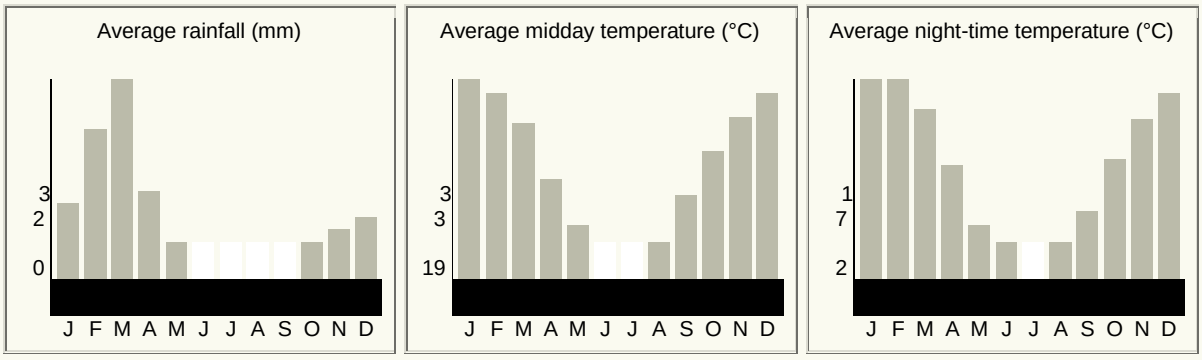


Figure 1 Climate Groblershoop

Groblershoop and surrounds is located in the Nama Karoo, which is from all points of view an arid area. For 4 months of the year there is no rainfall at all.

The regional economy depends, for the most part, on water abstraction from the Ornga River.

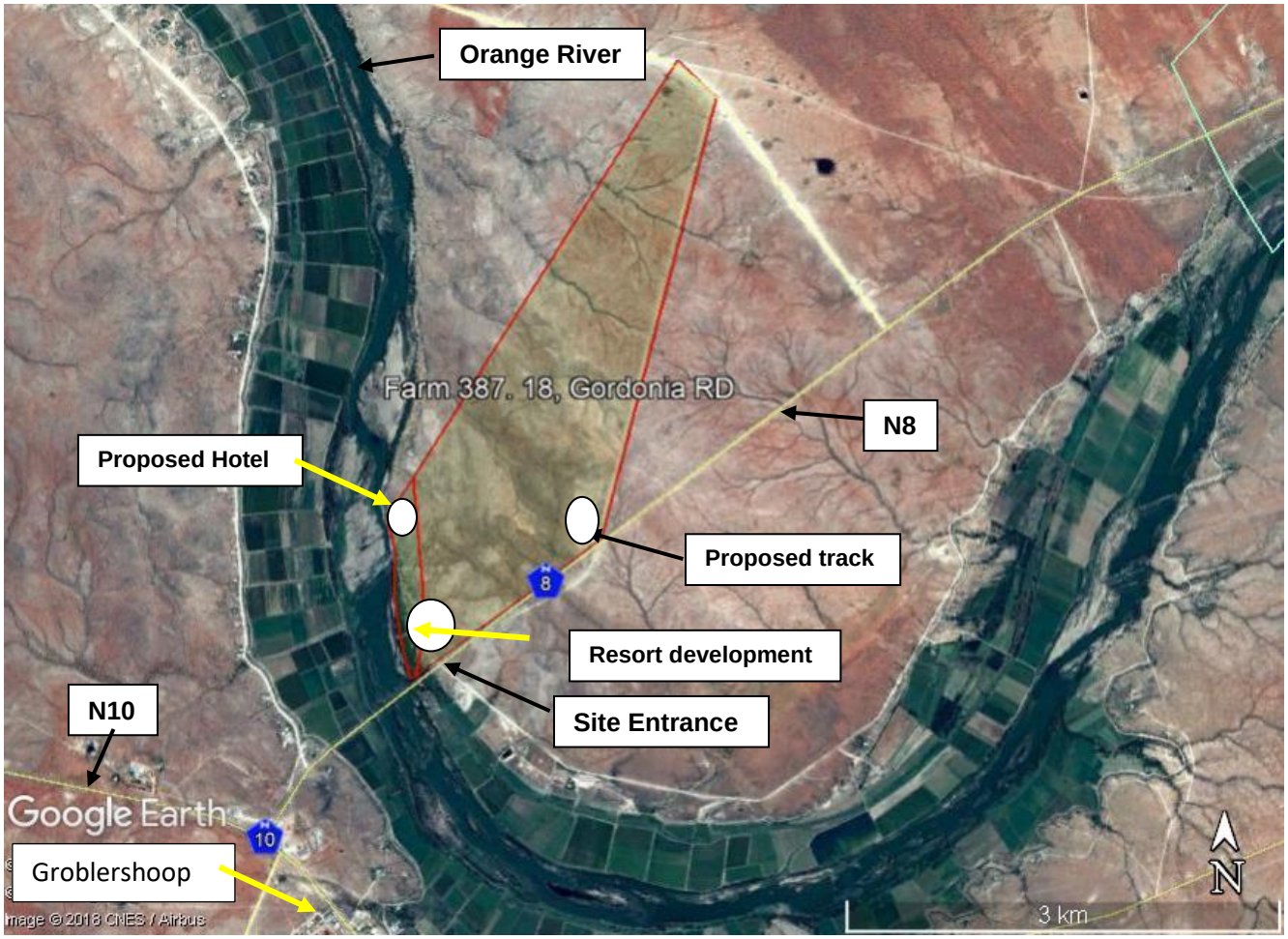


Figure 2 Proposed Resort (Enviro Africa)

4 The Resort

The Orange River meanders in generally an east-west direction, but the bend in the river at Groblershoop is flowing to the north. The envisaged resort is located along the eastern bank of the river, opposite from Groblershoop, across the N8 road bridge (Figure 2).

The resort consists of a number of an entrance (Figure 3), luxury chalets (Figure 4), luxury tented accommodation, an up-market restaurant (Figure 5), a double story hotel right on the river's bank, a compound for economic accommodation (Figure 6) and apart from sporting facilities, a camping and caravan site on the river (Figure 7).

Figure 3 Entrance

Figure 4 Chalets

Figure 5 Restaurant

Figure 6 Economic accommodation

The camping site (Figure 7) is detached from the river bank by a channel (Figure 8). This channel previously was a part of the braided Orange River, but is now dry. It is likely to flood during high flows and peak flows, to cut the camping site off from the bank. There is no bridge to the camping site. The channel has been transformed into a road, complete with street lights.

The camping site has hard structures such as an ablution block, swimming pool and restaurant.

Figure 7 Camping site

Figure 8 Channel

The rest of the proposed development is above the high flow mark and will probably not be affected by a large flood.

The river bank is densely overgrown with trees, mostly *Vachellia* and *Senegalia* (previously *Acacia*) and *Searsia* trees.

Higher up the bank the area is arid, with a sparse vegetation.

The NASA satellite recorded the site in 2016 when the development was not yet started (Figure 9). Since then the restaurant and a number of units as well as the entrance has been constructed. During the site visit on 14 August 2018 the construction phase was in full swing, with building material being offloaded and with many workers on the ground.

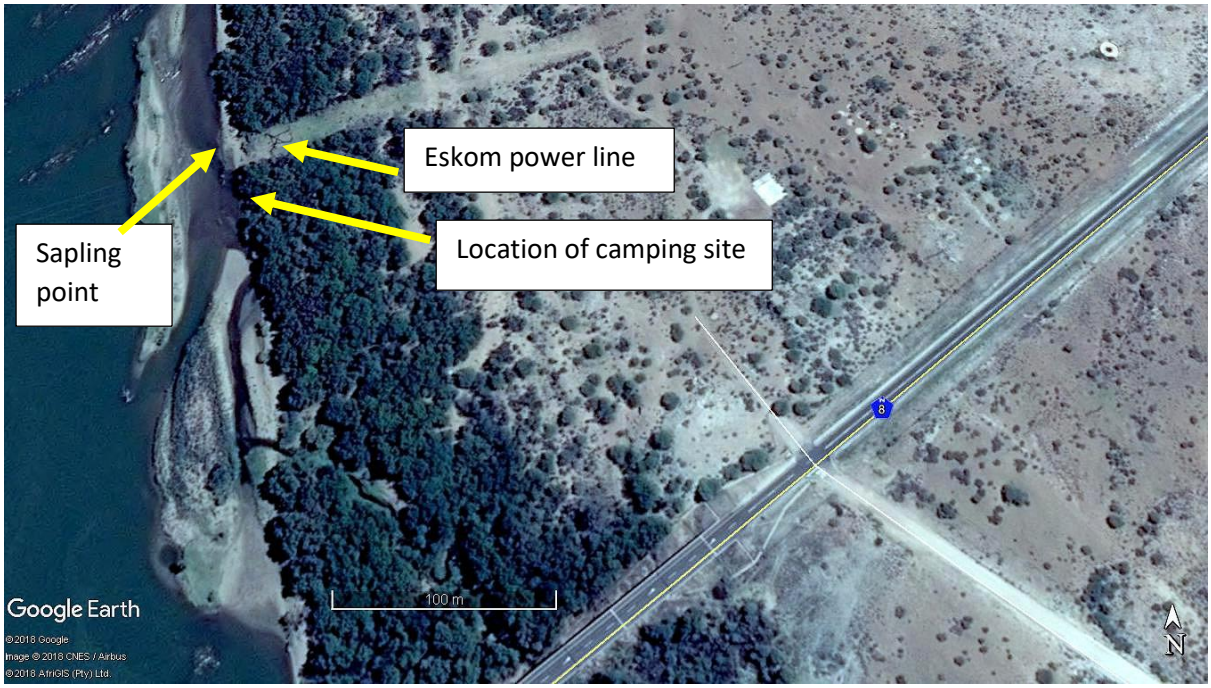


Figure 9 2016 Google Image

5 Drainage Lines

The banks of the Orange River in the region is characterised by dry drainage lines, which are most visible on Google Earth images. The drainage lines are of particular interest to the DWS and their presence on building sites triggers S21 (c) and (i) of the NWA.

These drainage lines and their catchments are a most prominent feature of the landscape (Figure 10). In these drainage lines are signs that water flowed there. There are definite signs of mobilisation and deposition of sand in the dry drainage lines. The area is arid, with the occasional summer thunder storm. Some of these storms are of irregular frequency, sudden, severe, of considerable magnitude and strong enough to move sandy sediments and to maintain the integrity of the drainage lines. There are such drainage lines on the land, but not directly in the way of any of

the developments. Structures are constructed in the sub-catchments, but not right over a drainage line.

The drainage lines flow underneath the N8 trunk road towards the west. They are entirely cut off from the Orange River by extensive farming activities, particularly vineyards. The natural flow path to the river has been replaced by a network of canals and levees.

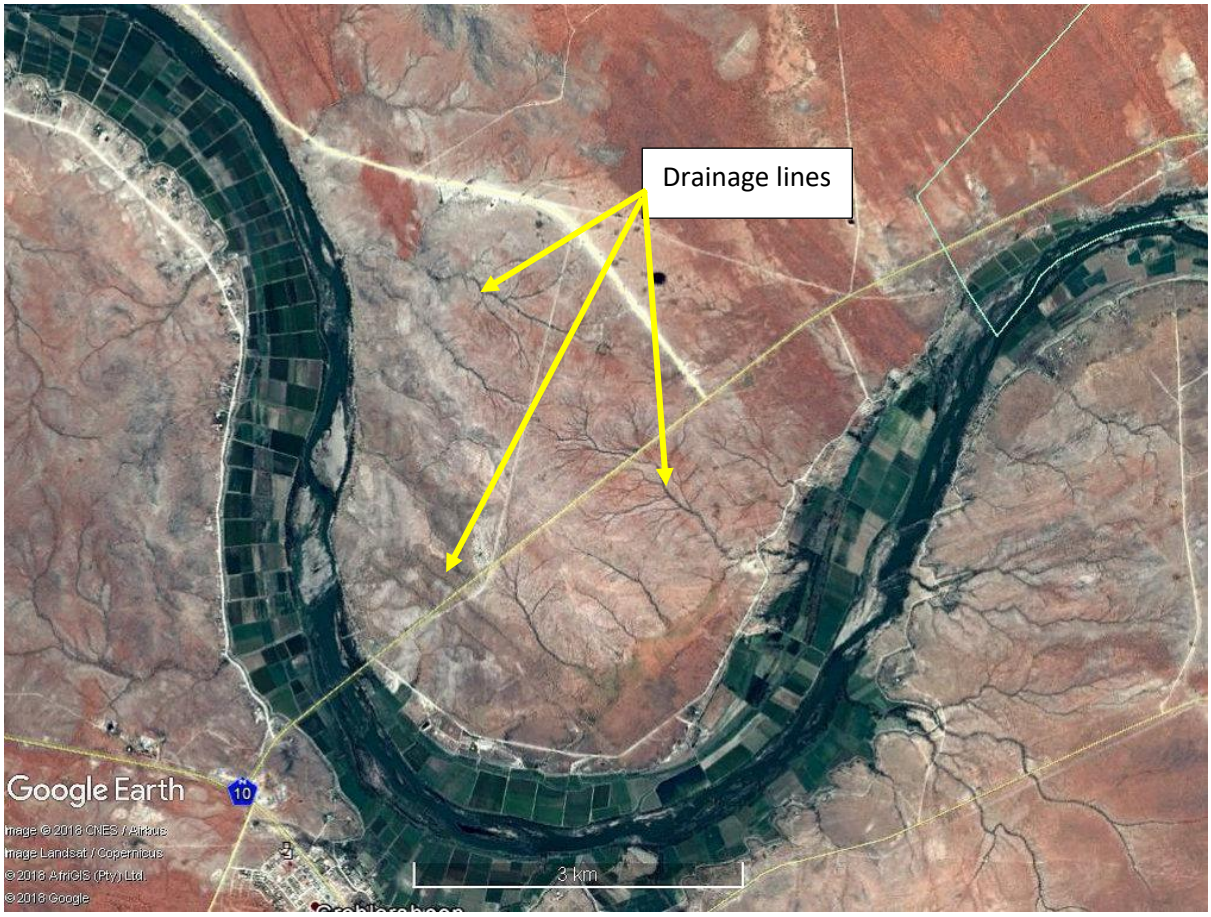


Figure 10 Drainage lines

The resort development is less than 100m away from some of these drainage lines and even closer than 32m. Therefore, a WULA is required.

6 Flooding

The Orange River rises on the mountains of Lesotho. It is the largest river in South Africa. The catchment covers 900 000km2.

The rainfall on the Lesotho highlands exceeds 180mm per year. The rainfall on the Atlantic Sea board is less than 100mm per year. 90% of the runoff is produced on the highlands. The rainfall and the subsequent flows are most variable, from droughts to serious floods.

Flooding is an aspect of life on the banks of the Orange River. It is a serious problem for agriculture. During the 1988 flood more than $126 million of damage was suffered.

There are more than 400 km of irrigation canals to irrigate 20 000 ha of land on the banks of the river from Boegoeberg to Augrabies.

For more information:

www.waterworld.com/articles/wwi/print/volume-29/issue-1/regional-spotlight/south-africa-managing-flood-risk/managing-flood-risk-on-the-orange-river-south-africa.html

More than 800 km of levees have been constructed on the banks of the river for flood control. For the protection of irrigated lands. This was with variable success. In 1988 there was a major flood. Many of the levees failed.

Floods are now better controlled since the construction of the Gariep Dam and the Vanderkloof Dam. Despite of the dams, floods still occur. A major advantage is that the dams provide an early warning system. This leaves people the opportunity to get out of harm's way.

The Groblershoop resort is from 7 to 12 meters above the base flow level of the Orange River (Figure 11). It is evident that the resort is not prone to the occasional floods. However, the camping area will predictably be cut off from the banks in event of a flood and will be under water during a major flood.

The DWA timely announces these flood events. The camping area can then be evacuated. The owners of the resort accept that flood damage is unavoidable and they are willing to accept the risks, costs and re-building of the camping area and other parts of the resort that may suffer flood damage. Despite the risk and loss, the venture remains a financially viable and profitable undertaking. Like so many similar businesses along the Orange River, flood risk is not perceived as adequate reason to stop development.

Figure 11 Steep river bank below camping site

6.1 Flood Lines

GN 509 of 2017 requires that no development should be allowed anywhere closer than 100m from a river. Alternatively, it should be above the 1:100 year flood line.

The flood line can be established for the 4km downstream of the N8 road bridge. The firm African Environmental Development specialises in determining the flood lines, but would charge R65 000 for their information. The price renders such an exercise beyond the reach of the WULA budget.

CWT in Pretoria is another such company.

South African National Space Agency (SANSA) of the national Department of Science & Technology mapped flood prone areas in South Africa (Figure 12). According to this map the Groblershoop resort is not prone to floods. However, the camping area is indicated as a part of the flood path of the river.

It remains for the DWS to indicate if the information presented here is adequate for an informed decision or if a flood line determination should be carried out.

Figure 12 Flood prone areas

7 Trees

Damage to the banks of the Orange River during larger floods have been contained by the heavy stand of mostly indigenous trees (Sawada & Smith, 1991). Erosion and deposition were evident further away from the river, but not in dense tree stands. Trees are most important for flood protection. It is therefore in the direct interest of people living on the banks, as much as it is for the Groblershoop Resort, to protect these trees. It is necessary to open up the undergrowth for the purpose of creating the resort. However, this should be done with the utmost care and under strict control. It should not be left to workers alone to decide where trees should be cut down or even pruned.

8 Water Provision, Sanitation and Solid Waste Management.

Water for domestic use and for the resort is supplied by the local municipality at standard rates.

Water for irrigation of the grounds is taken from the Orange River. Reportedly, this is an existing legal water use. There is a small electric pump om the river's bank (Figure 13).

Sewage is collected in a conservancy tank. The tank is emptied twice a week with a tanker truck, which then carts the sewage away to the municipal wastewater treatment works, again at standard rates.

Solid waste is collected in the usual domestic 140 litre wheelie bin. The waste is disposed off on the municipal waste disposal site at standard rates.

Figure 13 Water pump

9 Water Courses

Two water courses are of interest for this assessment.

The first is the Orange River below the Groblershoop Resort for which baseline data must be collected. This should provide information which could be crucial in the future. Apart from the WULA requirement, it may become necessary to evaluate impacts from the resort in the future, which would not be possible without this baseline information. This information is limited by the nature of a WULA. Only the small volume of information is gathered that directly pertains to the WULA and that is allowed for by the WULA budget.

The second water course is the drainage line. In this case there are a number of such drainage lines.

10 Water Quality

A water sample was taken at the sampling point in the Orange River from a sampling points underneath the Eskom power line. The sample was frozen soon after and subsequently delivered at Quantum Laboratories in Malmesbury.

Table 1 Water Quality Orange River at Groblershoop Resort

Constituent		Value
Temperature	°C	10.5
pH		8.4
Electrical Conductivity	mSm^{-1}	26.2
Turbudity	NTU	10.2
Dissolved Oxygen	mgl^{-1}	9.2
Ammonia	mgl^{-1}	0.09
Total Nitrogen	mgl^{-1}	22
Total Phosphorus	mgl^{-1}	0.07

There was enough oxygen in the water to sustain healthy aquatic life (Table 1). The water was rather fresh, not salty. The water was not as turbid as it usually is, despite the strong flow. The water is rather alkaline, as is often measured in the lower Orange River.

The ammonia concentration is low, which indicates that the river here is not subject to faecal pollution, be it from farm animals or human settlement. Phosphorus binds to the ground and is not easily washed out, despite a hefty application on agricultural lands, hence the low concentration in the Orange River as well. However, the nitrogen concentration id extremely high, indicating a massive release from agriculture. It is surmised that upstream of the sampling point, from a drainage line now transformed into a canal, a volume of irrigation return flow is flowing into the Orange River.

11 Biomonitoring

The sampling point (Figure 14) was selected underneath the Eskom power line because it was readily accessible. It was separated from the main stream by an island, as is often the case in these braided rivers.

The coordinates of the sampling point are as follows:

28°52’31.41”S
21°59’13.18”E

The sampling point was at an elevation of 853m above sea level.

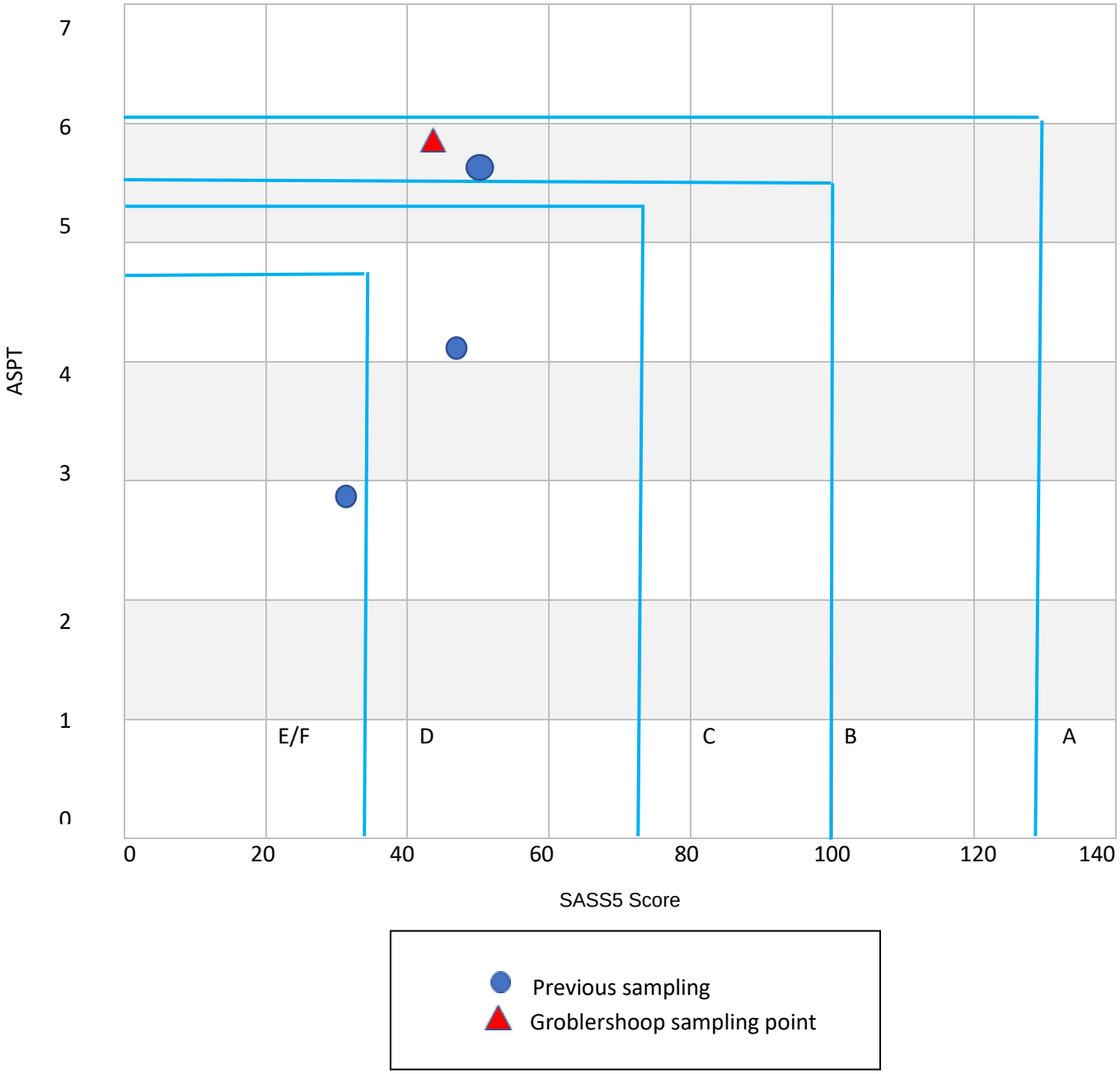
The habitat at the sampling point consisted of a sandy bottom right next to the river’s edge, with little else to add to variability. There was emerging vegetation such as *Phragmitis* reeds. Submerged vegetation was represented by recently flooded terrestrial grasses.

The current was some 20cms^{-1}, but much faster in the middle of the river.

Figure 14 Sampling Point

There were stones-in-current, but with no boat to reach them, sampling could not be done there.

Field measurements were carried out with a YSI instrument.



Integrity Class	Description
A	Pristine; not impacted
B	Very Good; slightly impacted
C	Good; measurably impacted with most ecological functioning intact
D	Fair; impacted with some loss of ecological functioning
E	Poor; loss of most ecological function
F	Very Poor; loss of all ecological function

Figure 15 Lower Orange River Biomonitoring Results

Biomonitoring was done according to the methodology as described by Dickens & Graham (2002).

The water was cold. There was adequate dissolved oxygen to support aquatic life.

With such limited habitat variability, macroinvertebrate biodiversity was limited as well.

The SASS5 score come to 41, with an average score per taxon (ASPT) of 5.9 (Table 1, Appendix). This is reasonably high for mature river habitat. In fact, it can be placed in the B category, which slightly impacted. It measured up favourably with other scores that have been recorded by WATSAN Africa in the Orange River in similar habitats from Groblershoop to Augrabies (Figure 1).

The demarcation of categories according to Dickens (2009), as established by Dallas (2007) was followed (Figure 14).

This high score may well be because of the very strong flow in the river over the weeks during and prior to the sampling. A reduced score can be expected as the flow weakens and as a result impacts on water quality increases.

12 **Present Ecological State** (PES)

The PES and EIS are protocols that have been produced by Dr Neels Kleynhans (Table 2 and 3) in 1999 of the then DWAF to assess river reaches. The scores given are solely that of the practitioner and are based on expert opinion.

12.1 Present Ecological State Orange River

Much has been published on the ecological state of South African rivers and the Orange River is no exception. In fact, it seems somewhat arrogant to assess the Lower Orange River, even at the sampling point, with a team of one and with the financial backing of a single WULA. This is a large undertaking that is to be contemplated by a team of experts. Nevertheless, this is what the WULA requires.

The river at Groblershoop, as elsewhere, has been impacted by major dams, large-scale water abstractions, an influx of agricultural chemicals, encroachment of reeds and exotic macrophytes, translocated and exotic fish, levees, bridges and many other infarctions. Hence the river was scored a C, which signifies that it has been impacted, but despite these impacts still exhibits appreciable ecological functioning. The riparian zone scores a D, which signifies that ecological functioning has been lost.

There is a good chance that other practitioners would score the river very much the same.

Table 2 Habitat Integrity according to Kleynhans, 1999

Category	Description	% of maximum score
A	Unmodified, natural	90 – 100
B	Largely natural with few modifications. A small change in natural habitats and biota, but the ecosystem function is unchanged	80 – 89
C	Moderately modified. A loss and change of the natural habitat and biota, but the ecosystem function is predominantly unchanged	60 – 79
D	Largely modified. A significant loss of natural habitat, biota and ecosystem function.	40 – 59
E	Extensive modified with loss of habitat, biota and ecosystem function	20 – 39
F	Critically modified with almost complete loss of habitat, biota and ecosystem function. In worse cases ecosystem function has been destroyed and changes are irreversible	0 - 19

Table 3 Present Ecological State Orange River at Groblershoop

Instream	Score	Weight	Product	Maximum score
Water abstraction	12	14	168	350
Flow modification	12	13	156	325
Bed modification	20	13	260	325
Channel modification	22	13	286	325
Water quality	15	14	210	350
Inundation	15	10	150	250
Exotic macrophytes	10	9	90	225
Exotic fauna	15	8	120	200
Solid waste disposal	18	6	108	150
Total		100	1428	2500
% of total			57.1	
Class			C	
Riparian				
Water abstraction	12	13	156	325
Inundation	12	11	132	275
Flow modification	20	12	240	300
Water quality	22	13	286	325
Indigenous vegetation removal	15	13	195	325
Exotic vegetation encroachment	5	12	60	300
Bank erosion	18	14	252	350
Channel modification	8	12	96	300
Total			1417	2500
% of total			56.7	
Class			D	

12.2 Present Ecological State of the Drainage Lines

The question now arises if a dry drainage line without a discernible riparian zone carries adequate weight or is worthy of such an assessment. The answer is yes, indeed, as this is the way nature intended it to be, a dry drainage line.

The drainage lines have already been impacted by the N8 truck road. Some of the flow is restricted and redirected.

The Groblershoop Resort drainage line was assigned a class B (Table 4) for the instream assessment. Only a part of the sub-catchment has been lost to agriculture, while a large part still remains intact. This would obviously change when the site is developed, probably to class D or E, with the original morphology significantly altered.

Table 4 Present Ecological State of the Drainage Lines

Instream	Score	Weight	Product	Maximum score
Water abstraction	24	14	336	350
Flow modification	20	13	260	325
Bed modification	20	13	243	325
Channel modification	18	13	280	325
Water quality	20	14	210	350
Inundation	15	10	150	250
Exotic macrophytes	23	9	207	225
Exotic fauna	20	8	120	200
Solid waste disposal	20	6	160	150
Total		100	1428	2500
% of total			80.1	
Class			B	
Riparian				
Water abstraction	24	13	260	325
Inundation	24	11	264	275
Flow modification	15	12	180	300
Water quality	24	13	260	325
Indigenous vegetation removal	12	13	156	325
Exotic vegetation encroachment	20	12	240	300
Bank erosion	19	14	266	350
Channel modification	12	12	144	300
Total			1770	2500
% of total			70.8	
Class			C	

The riparian zone was placed into a category C, not only because of the loss of habitat due to agriculture, but because of clear signs that earth moving machinery has been active in some parts of the area. There is not much of a riparian zone to begin with, with no riparian vegetation or hydromorphic soils.

Table 5. Ecological Importance according to endangered organisms (Kleynhans,1999).

Category	Description
1	One species or taxon are endangered on a local scale
2	More than one species or taxon are rare or endangered on a local scale
3	More than one species or taxon are rare or endangered on a provincial or regional scale
4	One or more species or taxa are rare or endangered on a national scale (Red Data)

13 Ecological Importance

The Ecological Importance (EI) is based on the presence of especially fish species that are endangered on a local, regional or national level (Table 5).

13.1 Ecological Importance Drainage Lines

There are no fish in the drainage line, as there is no permanent water. According to this assessment, which is prescribed for WULA's, the drainage line is not important.

No other endangered species, either plant or animal, were detected in or near the drainage line.

13.2 Ecological Importance Orange River

The Orange River is most important, according to this assessment.

According to Skelton (1993) 11 species of fish occur in the Lower Orange River. These are the following:

Barbus trimaculatus
B paludinosus
Labeobarbus kimberleyensis (Near threatened)
L aenus
Labeo umbratus
L capensis
Cyprinus carpio
Austroglanis sclateri (Widespread elsewhere)
Clarias gariepinus
Pseudocrenilabrus philander (Threatened locally but abundant elsewhere)
Tilapia sparrmanii

For upstream habitats some more are listed:

Pseudobarbus quathlabae
Barbus hospus

Below the Augrabies Falls:

Mesobola brevianalis (critically endangered)

Those in blue are endangered to some extent. However, the only one that causes real concern in the largemouth yellow fish *Labeobarbus kimberleyensis*. It is endemic to the Orange River system and hence is threatened not only on a local scale, but on a national scale as well. This puts the Lower Orange in category 4.

This yellow fish is artificially cultured and hence is not in any real danger of extinction.

Those indicated in red are exotic or translocated fish.

Much has been published on parasites of fish in the Orange River and a Fish Health Index, but only a snipped local knowledge is mentioned here.

According to the owners of the Kalahari River and Safari Co. along the northern bank of the Orange River on the Riemvasmaak Road, mature blue kurper *Oreochromus mossambicus* are regularly captured in increasing numbers. It now takes at least 4 man-days to capture a single yellow fish. Yellow fish are generally infected with cestode bladder worms, while darters (*Anhinga rufa*) that predate on these fish are heavily infected with tape worms. It seems as if the translocated Tilapia are not affected by these parasites.

14 Ecological Sensitivity

Ecological Sensitivity (ES) is often described as the ability of aquatic habitat to assimilate impacts. It is not sensitive if it remains the same despite of the onslaught of impacts. Put differently, sensitive habitat changes substantially, even under the pressure of slight impacts.

The Ecological Sensitivity also refers to the potential of aquatic habitat to bounce back to an ecological condition closer to the situation prior to human impact. If it recovers, it is not regarded as sensitive.

14.1 Ecological Sensitivity Orange River

The Orange River at Groblershoop has absorbed numerous and deep-cutting human impacts. Yet is still functions as an aquatic ecosystem. In the highly improbable event of ceased human impact, the river here would probably bounce back to its previous glory. In this respect the river cannot be categorised as sensitive. It is dreaded among conservation minded people that the Lower Orange River might have some more capacity to absorb further impact.

14.2 Ecological Sensitivity Drainage Lines

Likewise, if left to its own devices, the drainage line would remain as it is now, without the need for protection measures. However, if the agricultural development is allowed to proceed, the drainage line would probably never recover to any resemblance of its current state. In this regard it can be considered to be ecologically sensitive.

15 Impact Assessment

Some of the decision-making authorities prescribe an impact assessment according to a premeditated methodology.

The main benefit of this exercise is that it allows for the evaluation of mitigation measures. Later follows a Risk Assessment. This is different from the Impact Assessment as it does not attempt to weigh the success of mitigation measures.

15.1 Impact Assessment Orange River

The following pertains to Table 6:

- Local means the Orange River next to the Groblershoop Resort.
- Regional means downstream of the Groblershoop Resort.
- Short term means the time during the construction phase.
- Long term means the operational period, that is the time during which the resort entertains guest on an ongoing basis.
- Probability is expressed with a 5-point scale: Improbable, Low, Medium, High, Probable.
- The Confidence Level can either be low, medium or high. The same applies to Intensity and Significance.
- Significance is the combined effects of Extent, Duration and Intensity.

Table 6 Summary of possible impacts

Possible Impact		Extent	Duration	Intensity	Significance	Probability	Confidence
Preparation of the land	Without mitigation	Regional	Medium term	High	Medium	Probable	High
	With mitigation	Local	Short term	Low	Low	Low	High
Construction phase	Without mitigation	Regional	Medium term	Medium	Medium	Probable	High
	With mitigation	Local	Short term	Low	Low	Low	High
Operational phase	Without mitigation	Regional	Medium term	Medium	High	Probable	High
	With mitigation	Local	Short term	Low	Low	Low	High

15.2 Mitigation Measures pertaining to the Orange River

During the site visit it was clear that the clearing of the land of vegetation, the construction of infrastructure such as roads, water provision, electricity, sewerage, accommodation and all else was happening simultaneously, with much purpose and urgency.

The main object of mitigation measures should be to keep silt out of the Orange River. In this arid region there is not much chance of that, except if an occasional thunder storm breaks out. Mitigation measures would be to complete as much of the resort prior to the rainy season, to keep the footprint as small as possible, to grass destabilised areas as soon as possible and to pave the indicated areas as soon as possible.

Building rubble should be kept out of the river.

The tree lining on the river banks should be preserved as far as possible. New trees should be planted where necessary.

The camping site was already grassed over, with the irrigation in place. During the operational phase, over irrigation should be prevented, with no return flow into the river.

During the operational phase the conservancy tank should be emptied regularly. Should an accidental overflow occur, residues should be cleaned up professionally, with health threats reduced and chances for pollution of the river eliminated.

The management should be alert and vigilant if it comes to floods. Warnings from the DWS should be taken seriously and people should be timeously evacuated, if necessary.

The conservancy tank should be emptied before a flood happens. The electrical supply should be switched off.

These mitigation measures can be applied successfully with the appropriate level of best practice and keen management.

15.3 Mitigation Measures pertaining to the Drainage Lines

The possible impacts during the life cycle of the development can, as for the Orange River, be summarised in Table 1. There is no need to duplicate the table for the drainage lines, as the causes of the impacts are the same. The mobilisation of sediments lies at the core of the impact, be it in the river or down the drainage lines.

No activities should be allowed outside of the demarcated development area. Machinery, waste and rubble should not be allowed to accumulate anywhere in the natural vegetation.

The main threat because of the establishment of the development is the movement of sediments down the drainage line. A part of the sub-catchment would be entirely transformed by the construction activities. This transformation should be affected during the dry season, when the likelihood of sudden thunder storms is at its least.

Any signs of erosion in the altered drainage line should be addressed immediately after downpours. Eroded areas should be filled in and the compacted. It should be planted with suitable vegetation. Irrigation may be required to establish this vegetation. If necessary, berm and contours should be constructed to direct storm water away to less susceptible areas.

The flow paths of the drainage lines should remain the same as far as possible, despite of the agricultural development.

Building rubble and other waste and litter should not be allowed to pass down the channel.

Vehicles and other disturbances should be kept out of the altered drainage lines as to prevent any disturbance that could result in erosion.

16 Risk Assessment

The assessment was carried out according to the interactive Excel table that is available on the DWS webpage. Table 7 is a replica of the Excel spreadsheet that has been adapted to fit the format of this report. The numbers in Table 4 (continued) represent the same activities as in Table 6.

The original risk assessment as on the DWS webpage has been submitted on the included DVD.

This assessment has been designed to assist in the decision if a General Authorisation or a License is required, should the development be allowed.

The risk rating according to this assessment is generally low. This suggests that a General Authorisation should be in order.

This only applies if all of the mitigation measures are in place.

The highest environmental risk is the erosion of the Orange River banks if too many trees are removed and brush is cleared. This can effectively be prevented if the vegetation is preserved and new trees are planted where limits have been overstepped. This should be done with the aid of a specialist with specific knowledge of the area and its environmental issues.

The environmental risks attached to the Groblershoop Resort are less than most of that of the of the vineyards that flank the Orange River.

The risk matrix indicates that a General Authorisation would be in order and that a license is not required.

Table 7 Risk Assessment

No.	Activity	Aspect	Impact	Significance	Risk Rating
1.1	Prepare land for construction	Remove vegetation	Sediments in Orange River, bank erosion	26	Low
1.2			Sediments down the drainage lines	26	Low
2.1	Construction phase	Mobilise sediments	Sediments in Orange River	129	Low
2.2			Sediments down the drainage lines	39	Low
3.1	Operational phase	Sewerage system	Accidental spillage in Orange River	38.5	Low
3.2		Litter	Litter in river and drainage lines	23	Low
3.3		Irrigation return flow	Eutrophication in river	23	Low

Table 7 Continued Risk Rating

No	Flow	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Conse-quence
1.1	1	1	1	1	1	1	1	1
1.2	2	1	1	1	1.25	1	1	1.25
2.1	1	2	1	1	1	1	1	1
2.2	2	1	2	1	1.5	1	1	1.5
3.1	1	1	1	1	1	1	2	2
3.2	1	1	1	1	1	1	2	2
3.3	1	1	1	1	1	1	2	2

No	Frequency of activity	Frequency of impact	Legal issues	Detection	Likelihood	Significan-ce	Risk Rating
1.1	1	1	5	1	8	8	Low
1.2	1	1	5	1	8	10	Low
2.1	1	1	5	1	8	8	Low
2.2	1	1	5	1	8	12	Low
3.1	2	2	5	1	10	20	Low
3.2	2	2	5	1	10	20	Low
3.3	2	2	5	1	10	20	Low

17 Resource Economics

The goods and services delivered by the environment, in this case the Groblershoop Resort drainage lines is a Resource Economics concept as adapted by Kotze *et al* (2009). The methodology was designed for the assessments of wetlands, but in the case of the drainage line the goods and services delivered are particularly applicable and important, hence it was decided to include it in the report.

The diagram (Figure 14) is an accepted manner to visually illustrate the resource economic footprint the drainage line, from the data in Table 8.

The Lower Orange is most important in all aspects. If Table 1 was to be completed for the Orange River it would have scored 5 for all of the aspects that were to be evaluated. If Figure 1 was to be drafted, it would have been a perfect circle. The methodology is perhaps not suited to the larger and economically significant rivers. It was never meant for this purpose.

Table 8. Goods and Services

Groblershoop Drainage Lines

Goods & Services	Score
Flood attenuation	3
Stream flow regulation	3
Sediment trapping	3
Phosphate trapping	1
Nitrate removal	1
Toxicant removal	1
Erosion control	3
Carbon storage	1
Biodiversity maintenance	1
Water supply for human use	0
Natural resources	1
Cultivated food	1
Cultural significance	1
Tourism and recreation	0
Education and research	1

0	Low
5	High

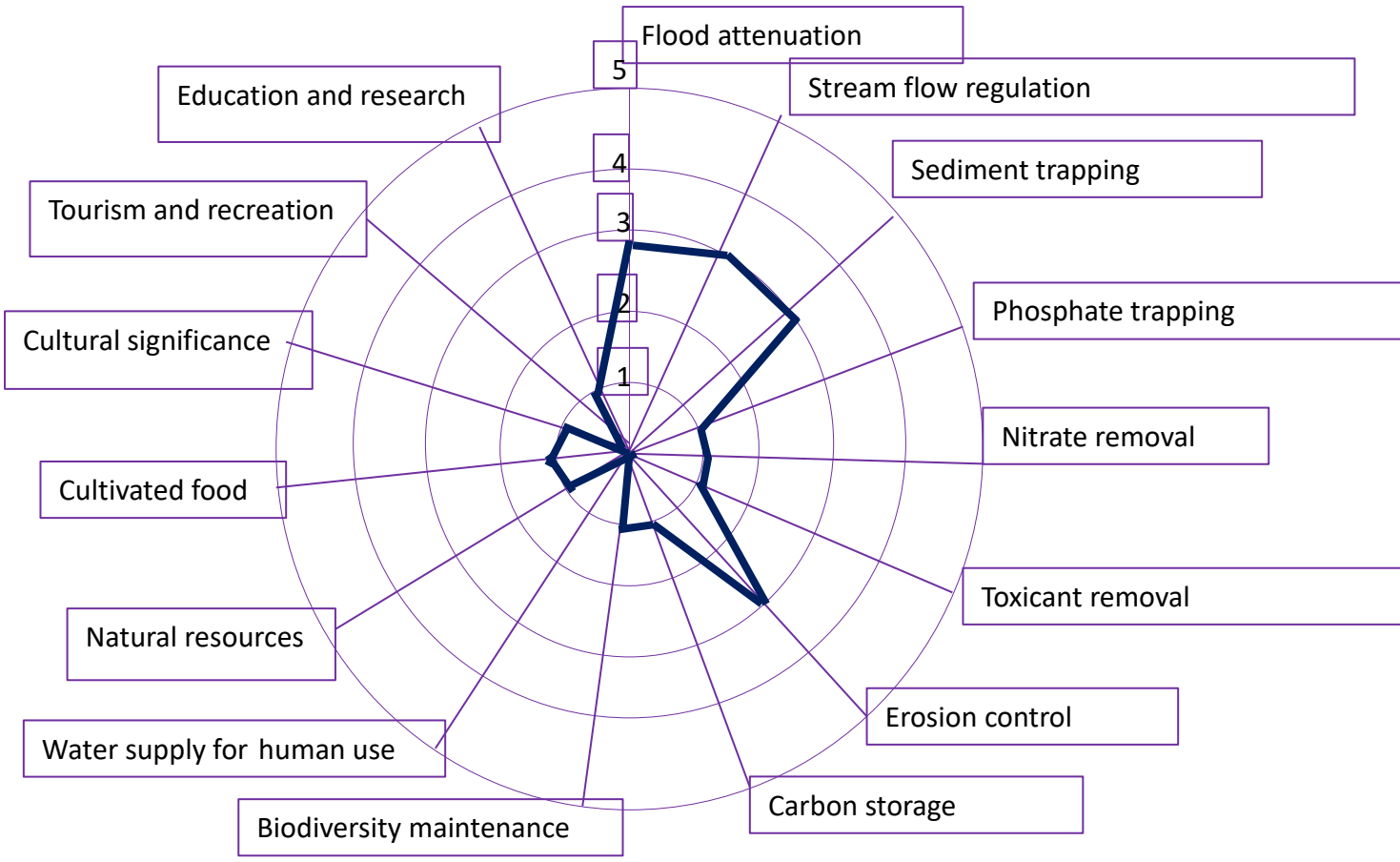


Figure 15. Resource Economics Footprint of the Groblershoop Resort drainage lines

It makes more sense to apply the methodology to the Groblershoop Resort drainage lines.

The size of the star shape of Figure 15 attracts the eyes of the decision-makers. This shape is very small, indicating that the water course has a small economic foot print. Apart from some flood attenuation, stream flow regulation and sediment trapping, the drainage line is not important.

18 Conclusions

Figure 16 has been adapted from one of the most recent DWS policy documents.

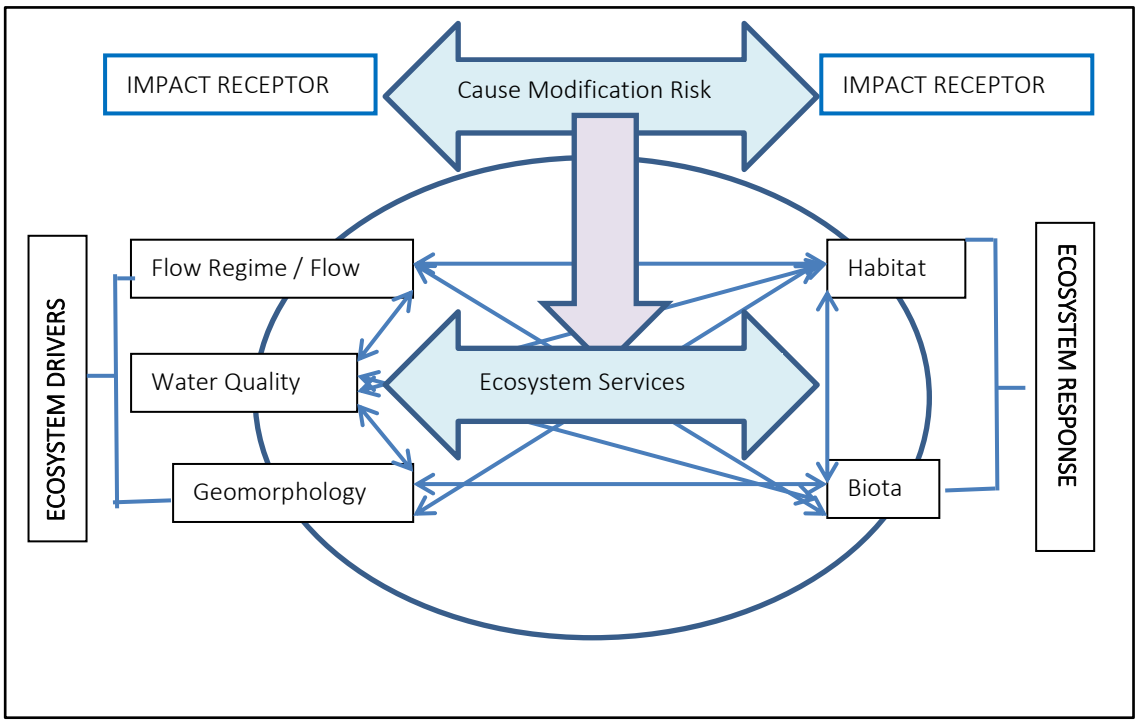


Figure 16 Minimum Requirements for a S21(c) and (i) Application

An anthropogenic activity can impact on any of the ecosystem drivers or responses and this can have a knock-on effect on all of the other drivers and responses. This, in turn, will predictably impact on the ecosystem services. The WULA and the EAI must provide mitigation measured for these impacts.

The main driver of the Orange River is the runoff from the Lesotho Highlands that provides the bulk of the flow down the river. The Vaal River provides less than a quarter of the flow.

It is important to understand that the catchment area of the Lower Orange River contribution to the mean annual runoff (MAR) is virtually zero and negligible Ann., 2009). The drainage lines combined and the Groblershoop Resort drainage lines separately are entirely insignificant.

The driver of the drainage line is the occasional flood that follows sudden and intense rainfall events. This is followed by prolonged droughts and intense summer heat that prevents the development of any viable aquatic habitat. This is apart from shallow ground water that explains the growth of a somewhat more prolific vegetation along

the drainage lines. These plants are by no means an indication of aquatic or riparian habitat.

The construction of the Groblershoop Resort would obviously and greatly alter some areas of the drainage line catchment area. However, the drainage line is not important in terms of aquatic habitat, aquatic biodiversity and economic footprint. The envisaged alteration would therefore not be a significant loss.

It is therefore recommended that the development should go ahead, subject to a General Authorisation, or even an official letter of consent. A Licence is should not be necessary.

19 References

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20 Appendix

SASS5 Score Sheet										
Date	14 Aug 18	**Taxon**	**Weight**	**Score**	**Taxon**	**Weight**	**Score**	**Taxon**	**Weight**	**Score**
Locality	Orange River	Porifera	5		**Hemiptera**			**Diptera**		
	Groblershoop	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3		Corixidae	3		Blepharoceridae	15	
		Oligochaeta	1		Gerridae	5		Ceratopogonidae	5	
Coordinates	28°45' 08.37"	Huridinea	3		Hydrometridae	6		Chironomidae	2	
	20°35'06.16"	**Crustacea**			Naucoridae	7	7	Culicidae	1	
		Amphipodae	13		Nepidae	3		Dixidae	10	
DO mg/l	9.22	Potamonautidae	3		Notonectidae	3		Empididae	6	
Temperature °C	10.5	Atyidae	8	8	Pleidae	4		Ephydridae	3	
pH	8.35	Palaemonidae	10		Veliidae	5		Muscidae	1	
EC mS/m	26.2	Hydracarina	8		**Megaloptera**			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	
SASS5 Score	41	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	7	Perlidae	12		**Trichoptera**			Tabanidae	5	
ASPT	5,9	**Ephemeroptera**			Dipseudopsidae	10		Tipulidae	5	5
		Baetidae 1 sp	4		Ecnomidae	8		**Gastropoda**		
Other Biota		Baetidae 2 sp	6	6	Hydropsychidae 1 sp	4		Ancylidae	6	
		Baetidae >3 sp	12		Hydropsychidae 2 sp	6		Bulinidae	3	
		Caenidae	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuridae	15		**Cased Caddis**			Thiaridae	3	
Comments		Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
		Prosopistomatida	15		Calamoceratidae	11		**Pelecipoda**		
		Teloganodidae	12		Glossostomatidae	11		Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6				
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4	4	Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		**Coleoptera**					
		Protoneuridae	8		Dyticidae	5	5			
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5				
		Gomphidae	6	6	Haliplidae	5				
		Libellulidae	4		Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Score				24			12			5

21 Declaration of Independence

I, Dirk van Driel, as the appointed independent specialist hereby declare that I:

- Act/ed as the independent specialist in this application
- Regard the information contained in this report as it relates to my specialist input/study to be true and correct and;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management act;
- Have and will not have vested interest in the proposed activity;
- Have disclosed to the applicant, EAP and competent authority any material information have or may have to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the environmental Impact Assessment Regulations, 2010 and any specific environmental management act.
- Am fully aware and meet the responsibilities in terms of the NEMA, the Environmental Impacts Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R543) and any specific environmental management act and that failure to comply with these requirements may constitute and result in disqualification;
- Have ensured that information containing all relevant facts on respect of the specialist input / study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties facilitated in such a manner that all interested and affected parties were provided with reasonable opportunity to participate and to provide comments on the specialist input / study;
- Have ensured that all the comments of all the interested and affected parties on the specialist input were considered, recorded and submitted to the competent authority in respect of the application;
- Have ensured that the names of all the interested and affected parties that participated in terms of the specialist input / study were recorded in the register of interested and affected parties who participated in the public participation process;
- Have provided the competent authority with access to all information at my disposal regarding the application, weather such information is favourable or not and;
- Am aware that a false declaration is an offence in terms of regulation 71 of GN No. R543.

Signature of the specialist: D VAN DRIEL

Name of the company: WATSAN Africa Date: 1 September 2018

22 Résumé

Dr Dirk van Driel
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Experience

WATSAN Africa, Cape Town. Scientist **2011 - present**

USAID/RTI, ICMA & Chemonics. Iraq & Afghanistan **2007 -2011**
Program manager.

City of Cape Town **1999-2007**
Acting Head: Scientific Services, Manager: Hydrobiology.

Department of Water & Sanitation, South Africa **1989 – 1999**
Senior Scientist

Tshwane University of Technology, Pretoria **1979 – 1998**
Head of Department

University of Western Cape and Stellenbosch University 1994- 1998 part-time

- Lectured post-graduate courses in Water Management and Environmental Management to under-graduate civil engineering students
- Served as external dissertation and thesis examiner

Service Positions

- Project Leader, initiator, member and participator: Water Research Commission (WRC), Pretoria.
- Director: UNESCO West Coast Biosphere, South Africa
- Director (Deputy Chairperson): Grotto Bay Home Owner's Association
- Member Dassen Island Protected Area Association (PAAC)

Membership of Professional Societies

- South African Council for Scientific Professions. Registered Scientist No. 400041/96
- Water Institute of South Africa. Member

Recent Reports &
Water Use License Applications

- Process Review Kathu Wastewater Treatment Works
- Effluent Irrigation Report Tydstroom Abattoir Durbanville
- River Rehabilitation Report Slangkop Farm, Yzerfontein
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- Ground Water Revision, Moorreesburg Cemetery
- Fresh Water Report Delaire Graff Estate, Stellenbosch
- Fresh Water Report Quantum Foods (Pty) Ltd. Moredou Poultry Farm, Tulbagh
- Fresh Water Report Revision, De Hoop Development, Malmesbury
- Fresh Water Report, Idas Valley Development Erf 10866, Stellenbosch
- Wetland Delineation Idas Valley Development Erf 10866, Stellenbosch
- Fresh Water Report, Idas Valley Development Erf 11330, Stellenbosch
- Fresh Water Report, La Motte Development, Franschhoek
- Ground Water Peer Review, Elandsfontein Exploration & Mining
- Fresh Water Report Woodlands Sand Mine Malmesbury
- Fresh Water Report Brakke Kuyl Sand Mine, Cape Town
- Wetland Delineation, Ingwe Housing Development, Somerset West
- Fresh Water Report, Suurbraak Wastewater Treatment Works, Swellendam
- Wetland Delineation, Zandbergfontein Sand Mine, Robertson
- Storm Water Management Plan, Smalblaar Quarry, Rawsonville
- Storm Water Management Plan, Riverside Quarry
- Water Quality Irrigation Dams Report, Langebaan Country Estate
- Wetland Delineation Farm Eenzaamheid, Langebaan
- Wetland Delineation Erf 599, Betty's Bay
- Technical Report Bloodhound Land Speed Record, Hakskeenpan
- Technical Report Harkerville Sand Mine, Plettenberg Bay
- Technical Report Doring Rivier Sand Mine, Vanrhynsdorp
- Rehabilitation Plan Roodefontein Dam, Plettenberg Bay
- Technical Report Groenvlei Crusher, Worcester
- Technical Report Wiedouw Sand Mine, Vanrhynsdorp
- Technical Report Lair Trust Farm, Augrabies
- Technical Report Schouwtoneel Sand Mine, Vredenburg
- Technical Report Waboomsrivier Weir Wolseley
- Technical Report Doornkraal Sand Mine Malmesbury
- Technical Report Berg-en-Dal Sand Mine Malmesbury
- Wetland Demarcation, Osdrif Farm, Worcester
- Technical Report Driefontein Dam, Farm Agterfontein, Ceres
- Technical Report Oewerzicht Farm Dam, Greyton
- Technical Report Glen Lossie Sand Mine, Malmesbury
- Preliminary Report Stellenbosch Cemeteries
- Technical Report Toeka & Harmony Dams, Houdenbek Farm, Koue Bokkeveld
- Technical Report Kluitjieskraal Sand & Gravel Mine, Swellendam