Appendix I

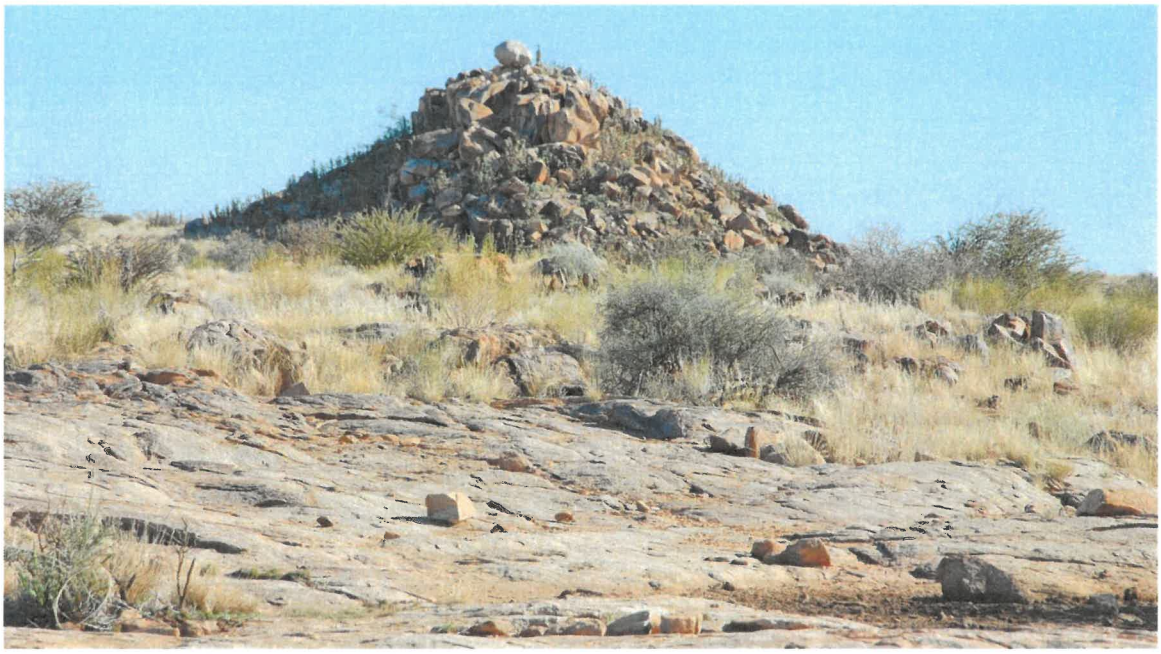
Freshwater Specialist report

WITVLEI BOERDERY TRUST

Kakamas, Northern Cape

Fresh Water Report
Proposed Rock Quarry
Plot 2372 of Alheidt, Kakamas

A requirement in terms of the National Water Act (36 of 1998).
August 2022



EnviroAfrica
Environmental Management and Impact Assessment
Omgewingsbestuur en Impakbeoordeling

WATSAN Africa

Index

Abbreviations

Critical Biodiversity Area	CBA
Department of Fisheries, Forestry and the Environment	DFFE
Department of Water and Sanitation	DWA
Ecological Importance	EI
Ecological Sensitivity	ES
Ecological Support Area	ESA
Environmental Impact Assessment	EIA
Electronic Water Use License Application (on-line)	eWULAA
Government Notice	GN
Metres Above Sea Level	masl
National Environmental Management Act (107 of 1998)	NEMA
National Freshwater Environment Priority Area	NFEPA
National Water Act (36 of 1998)	NWA
Northern Cape Department of Environment and Nature Conservation	DENC
Present Ecological State	PES
South Africa National Biodiversity Institute	SANBI
Water Use License Application	WULA

List of Figures

List of Tables

1 Introduction

Mr CA Bruwer is an established entrepreneur, industrialist and farmer of the Kakamas area. He is deeply entrenched into the local and regional construction and building industry, especially as a provider of ready mixed aggregate. He now endeavours to start his own rock quarry, complete with a crusher and mechanical screen, to provide crushed rock for aggregate, not only for his own undertaking, but also for the needs in the region.

Mr Bruwer is the owner of the farm registered as Plot 2372, Kakamas South, Kai !Garib Municipality, Northern Cape. He wished to establish this rock quarry on his farm. The Farm is registered at the deeds office as the Witvlei Boerdery Trust.

Mr Bruwer appointed Enviro Africa of Somerset West to conduct the legally required EIA. The mandatory public participation process currently is underway (Figure 1).

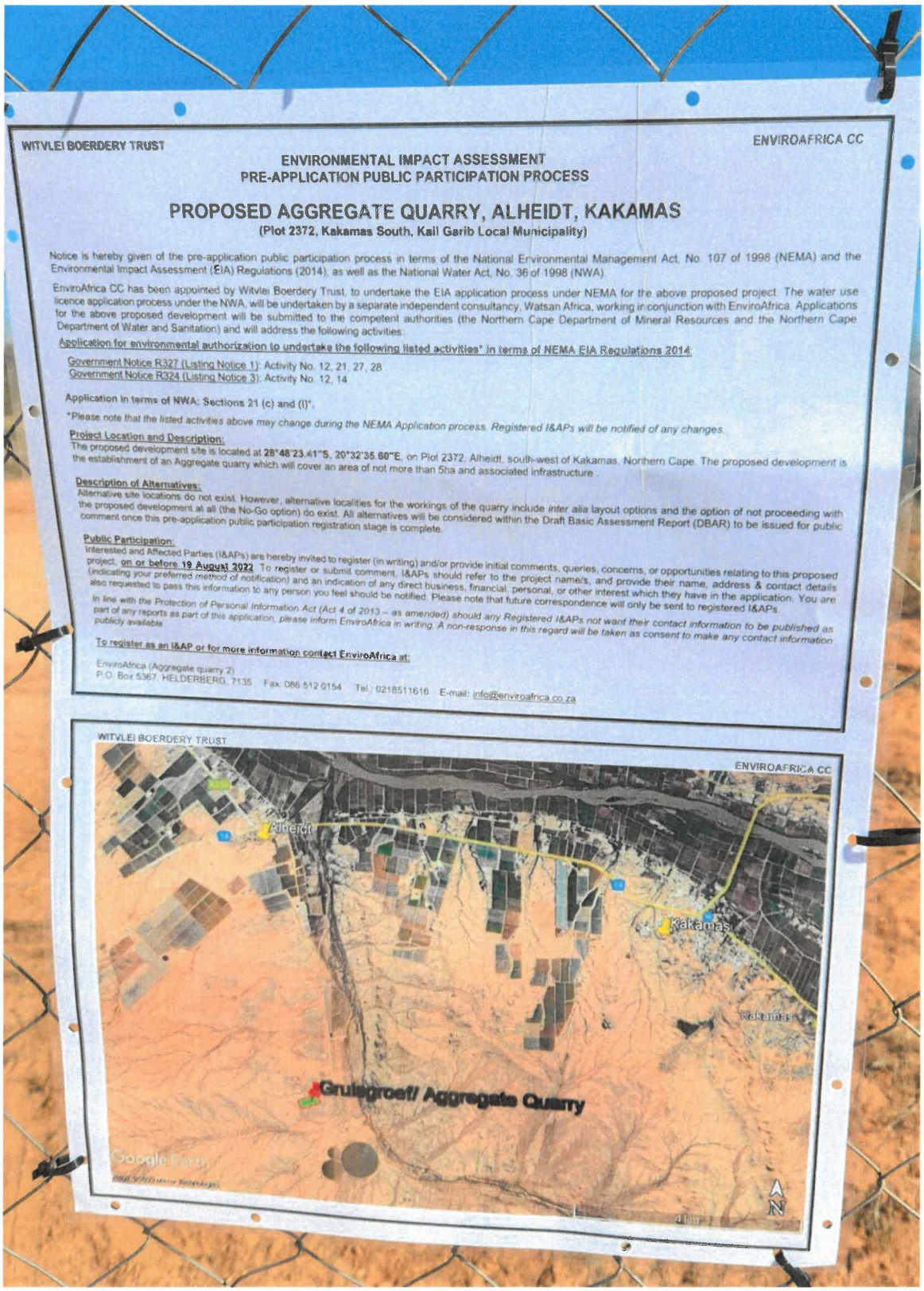
According to current legislation, official approval is required to start and operate the proposed quarry, because it cuts through drainage lines. These drainage lines are acknowledged as legitimate water resources. Dr Dirk van Driel of WATSAN Africa in Cape Town was appointed to conduct the required WULA. The WULA site visit was conducted on 7 August 2022.

The WULA must be submitted on the DWS' on-line eWULAAS facility, along with the required documentation. The Freshwater Report is one of the specified documents. This report must be compiled according to a set format, content and standardized environmental evaluations, to satisfy the requirements of the NWA S21(c) and S21(i).

The EIA reports draw on the information supplied in the Freshwater Report and addition evaluations have been added for this purpose.

Importantly, the Freshwater Report must contain a completed Risk Matrix, signed by a registered SACNASP specialist scientist.

The proposed quarry is one of several development on the property, among other agriculture and sand winning. For each of these ventures, a Freshwater Report was drafted, all to be considered for official approval.



WITVLEI BOERDERY TRUST

ENVIROAFRICA CC

ENVIRONMENTAL IMPACT ASSESSMENT
PRE-APPLICATION PUBLIC PARTICIPATION PROCESS

PROPOSED AGGREGATE QUARRY, ALHEIDT, KAKAMAS

(Plot 2372, Kakamas South, Kai! Garib Local Municipality)

Notice is hereby given of the pre-application public participation process in terms of the National Environmental Management Act, No. 107 of 1998 (NEMA) and the Environmental Impact Assessment (EIA) Regulations (2014), as well as the National Water Act, No. 36 of 1998 (NWA).

EnviroAfrica CC has been appointed by Witvlei Boerdery Trust, to undertake the EIA application process under NEMA for the above proposed project. The water use licence application process under the NWA, will be undertaken by a separate independent consultancy, Watsan Africa, working in conjunction with EnviroAfrica. Applications for the above proposed development will be submitted to the competent authorities (the Northern Cape Department of Mineral Resources and the Northern Cape Department of Water and Sanitation) and will address the following activities:

Application for environmental authorization to undertake the following listed activities* in terms of NEMA EIA Regulations 2014:

Government Notice R327 (Listing Notice 1): Activity No. 12, 21, 27, 28
Government Notice R324 (Listing Notice 3): Activity No. 12, 14

Application in terms of NWA: Sections 21 (c) and (i)*.

*Please note that the listed activities above may change during the NEMA Application process. Registered I&APs will be notified of any changes.

Project Location and Description:
The proposed development site is located at **28°48'23.41"S, 20°32'35.60"E**, on Plot 2372, Alheidt, south-west of Kakamas, Northern Cape. The proposed development is the establishment of an Aggregate quarry which will cover an area of not more than 5ha and associated infrastructure .

Description of Alternatives:
Alternative site locations do not exist. However, alternative localities for the workings of the quarry include *inter alia* layout options and the option of not proceeding with the proposed development at all (the No-Go option) do exist. All alternatives will be considered within the Draft Basic Assessment Report (DBAR) to be issued for public comment once this pre-application public participation registration stage is complete.

Public Participation:
Interested and Affected Parties (I&APs) are hereby invited to register (in writing) and/or provide initial comments, queries, concerns, or opportunities relating to this proposed project, **on or before 19 August 2022**. To register or submit comment, I&APs should refer to the project name/s, and provide their name, address & contact details (indicating your preferred *method of notification*) and an indication of any direct business, financial, personal, or other interest which they have in the application. You are also requested to pass this information to any person you feel should be notified. Please note that future correspondence will only be sent to registered I&APs.

In line with the Protection of Personal Information Act (Act 4 of 2013 – as amended) should any Registered I&APs not want their contact information to be published as part of any reports as part of this application, please inform EnviroAfrica in writing. A non-response in this regard will be taken as consent to make any contact information publicly available

To register as an I&AP or for more information contact EnviroAfrica at:

EnviroAfrica (Aggregate quarry 2)
P.O. Box 5367, HELDERBERG, 7135 Fax: 086 512 0154 Tel.: 0218511616 E-mail: info@enviroafrica.co.za

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Figure 1 Public Participation

2 Legal Framework

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

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

The proposed rock quarry is adjacent to natural drainage lines that are identified in the NWA and its regulations as legitimate water resources. The drainage lines could possibly be altered, should the development go ahead.

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

The proposed pipeline may alter the characteristics of the drainage lines.

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. If the 1:100-year flood line flood line is not known, no development may take place within a 100m from a water course without the consent of the DWS. Likewise, no development may take place within 500m of a wetland without the consent of the DWS.

National Environmental Management Act (107of 1998)

NEMA and regulations promulgated in terms of NEMA determines that no development without the consent and permission of the DEA and its regional agencies, in this case the DENC of the Northern Cape Provincial Government, may take place within 32m of a water course. The mostly dry drainage lines are perceived to be legitimate water courses.

3 Climate

Upington close to Kakamas normally receives about 94mm of rain per year, with most rainfall occurring mainly during autumn. The chart below (Figure 2, lower left) shows the average rainfall values for Upington per month. It receives the lowest rainfall (0mm) in June and the highest (29mm) in March. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Upington range from 19.8°C in June to 33°C in January. The region is the coldest during July when the mercury drops to 2.8°C on average during the night.

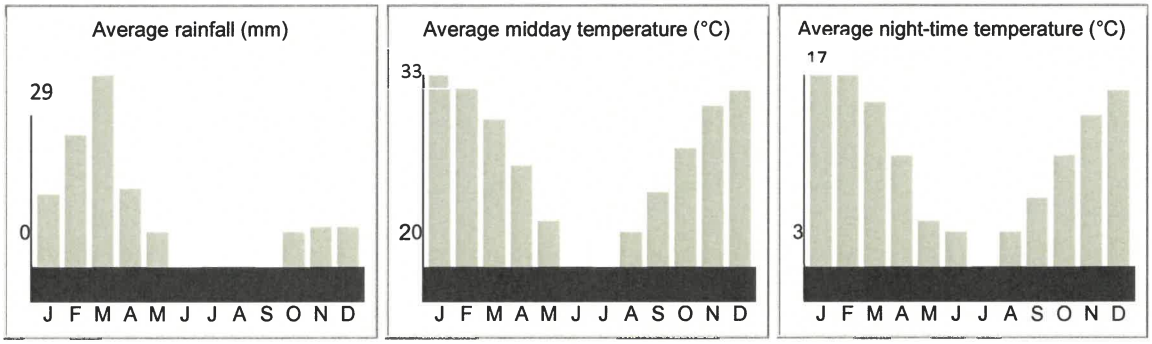

Figure 2 Upington Climate

It is evident from Figure 2 that this is an arid region. The drainage lines exist because of sudden and intense downpours that occur only once in several years. These must have been formed over millennia since historical times. The contribution to the flow in the Orange River is negligible.

4 Quaternary Catchment

The CA Bruwer proposed rock quarry is in the D53J quaternary catchment.

5 Conservation Status

The South African National Biodiversity Institute (SANBI) indicated the vegetation type at the proposed mining area as Bushmanland Arid Grassland. It is listed as Least Threatened.

Despite the general lack of water, the Hartbees River next to the site is classified as a National Freshwater Ecosystem Priority Area (NFEPA).

Swarthaak *Senegalia mellifera* is the dominant tree in the drainage lines, with a camel thorn tree *Vachellia eriobola* sparsely scattered over the landscape.

6 Location

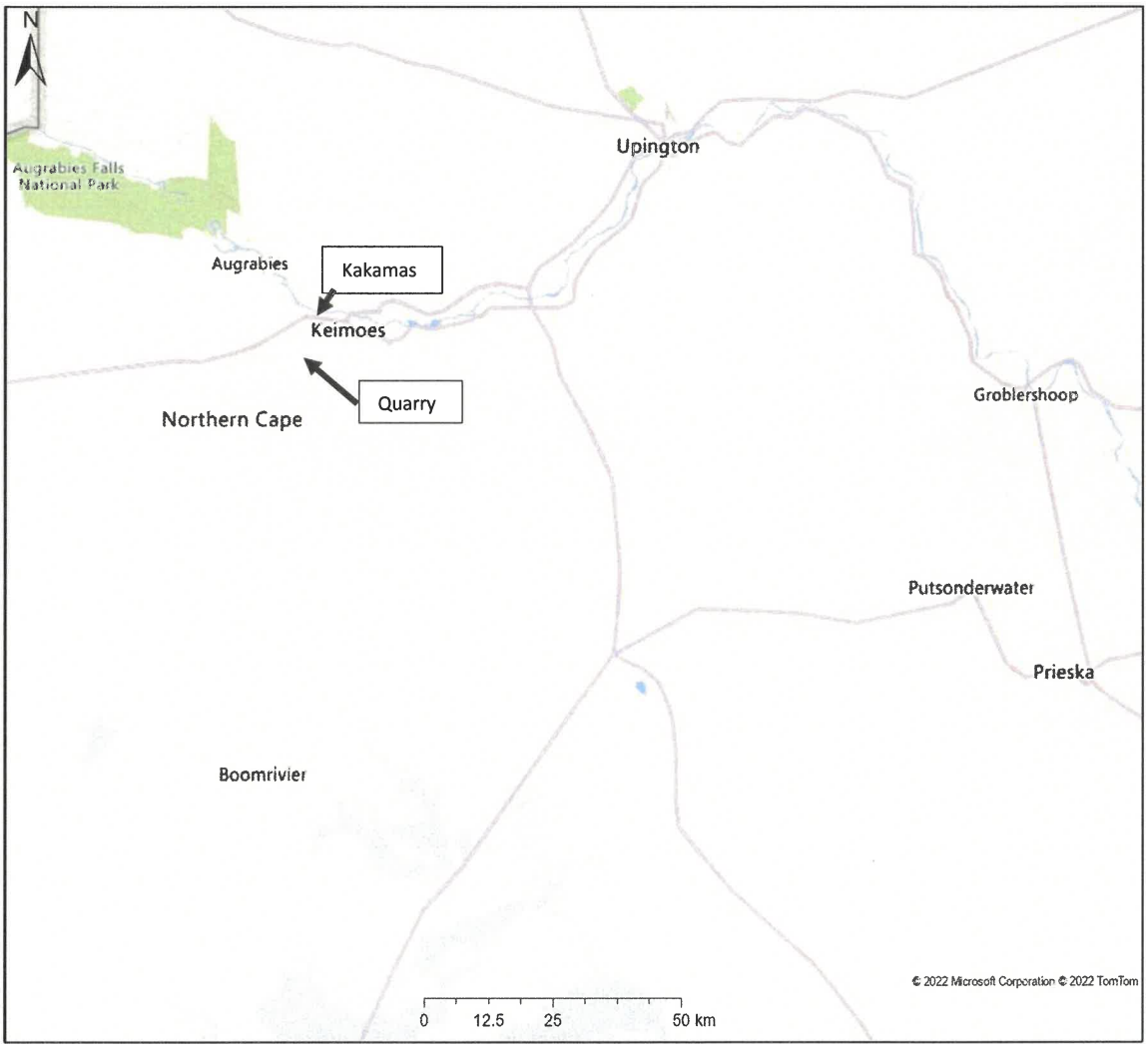

Figure 3 Location

The quarry is located 8 km southwest of the town of Kakamas, as the crow flies. Take the N14 out of Kakamas to the west for 13.5km and turn on the gravel road to the south for another 9.4km. The turnoff to the property is on the right-hand side.

The coordinates are:

28°48'18.28"S and 20°32'28.44"E

Figure 4 Demarcated mining area

The 5ha mining area is shown in Figure 4. The actual quarry will be much smaller. The granite that will be mined is exposed on the surface (Figure 5) in a ridge from south to north.

Figure 5 Granite

The mine will according to estimations provide gravel for the next 30 years and beyond.

7 Mining Operation

The rock will be blasted with dynamite. The loosened rock will be uploaded with a large front-end loader and dumped into a hopper. A conveyer will feed the rock into a crusher. From the crusher the rock will be conveyed into a screen where the broken rock, now gravel, will be sorted in sizes. The various grades and sizes of gravel will be stockpiled on the site. Tipper trucks will be uploaded with gravel and it will then be transported to wherever it is required in the building and construction industry.

The portable crusher and screen will be driven with diesel engines.

The precise lay-out of the crushing operation is not yet known but will be like the numerous crushers that are currently in operation throughout the country. Figure 6 is a random internet image of such a plant.

Figure 6 Generalization of a crusher and screen

The crushed, screen, stockpiles and all associated structures will be fitted into the 5ha demarcated mining area.

The only water that will be needed for the entire operation is for dust control. The volume used will not exceed 100m^3 per month. He water will be sourced from an existing borehole on the property. This water will be used on the crusher, at the point where the rock will be crushed. Reportedly, there will be no effluent. Water will be lost along with the moist that remains on the crushed rock. If any is left after stockpiling

and loading, it will be transported from the site on laden trucks leaving the site to deliver the product.

Ablutions at the nearby farmhouse are available for workers at the envisaged quarry and the crusher. Alternatively, portable toilets can be arranged that are to be serviced by an acknowledged local company.

There is no reason to believe that the water out of the borehole is not fit for human consumption. Alternatively, bottled water for workers on site can be provided.

Trash will be collected in household wheelie bins and disposed of at the nearby municipal waste disposal site.

8 The Hartbees River, Sak River and the Pans

Several projects have been completed in the area and the next paragraphs were taken out of previous reports (Van Driel, 2019).

The proposed rock quarry is not far from the Hartbees River. The Hartbees River rises as the Sak River on the highlands to the south of Sutherland more than 450km to the south (Figure 7).

The catchment area of this river system is large and covers a sizable chunk of the Bushmanland and the western Karoo.

A series of pans separate the Sak River from the Hartbees River. Verneukpan is perhaps the one that is better known because the historical land speed record was set there. The Hartbees River only flows when these pans overflow. This happened in 1999 and in 2010. It is expected that these overflows will occur less often in future as water abstraction from the Sak River for agriculture increases.

It is however important to note that the Sak River do not contribute towards the Mean Annual Runoff (MAR) of the Orange River (Department of Water and Environmental Affairs, 2006, p8). This is an arid region and its contribution is negligible. The flow of the Orange River is mainly because of the contribution of the Lesotho Highlands.

The banks of the Hartbees River have been impacted since historical times, with agriculture leaving its mark. At this time there are several active agricultural concerns. In addition, there are several sand mines, some in the bed of the river, which are reportedly legally licenced entities.

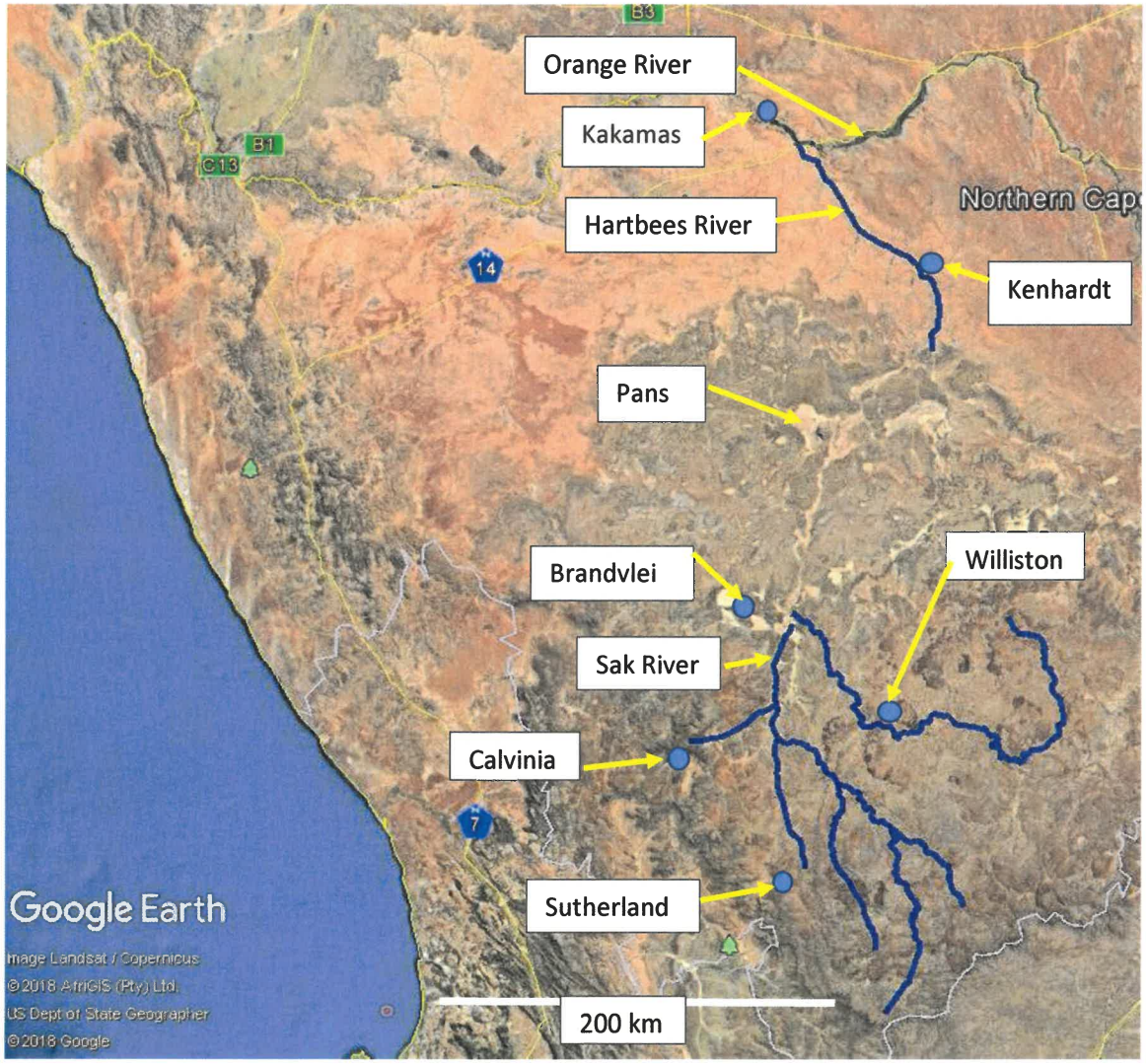

Figure 7 Sak / Hartbees River system

9 Drainage Lines

The landscape around much of the Lower Orange River and the Sak River is dominated by a dense succession of drainage lines. They spread along the river with many smaller tributaries to cover the entire area. The iron oxides in the sands renders a red hue that is visible from space on the Google Earth images. These reds are concentrated in the drainage lines, making them even more visible (Figure 8).

The drainage lines are mostly dry, with water only during rains and perhaps shortly thereafter. During the odd thunderstorm, drainage lines can come down in flood. These floods maintain the drainage line's morphological integrity, as sediments are moved and these water ways are scoured out.

Because rainfall events are far apart, the drainage lines must have been form over millennia, even since geological times.

Much of the discussion in this report is about these drainage lines.

Around the Orange River and even the Sak River, large-scale agriculture has changed the drainage lines into drainage channels among the vineyards and orchards. The upper reaches away from the rivers are less impacted, even near-pristine, as intense agriculture is not possible, apart from those areas where water is piped over long distances from the Orange River.

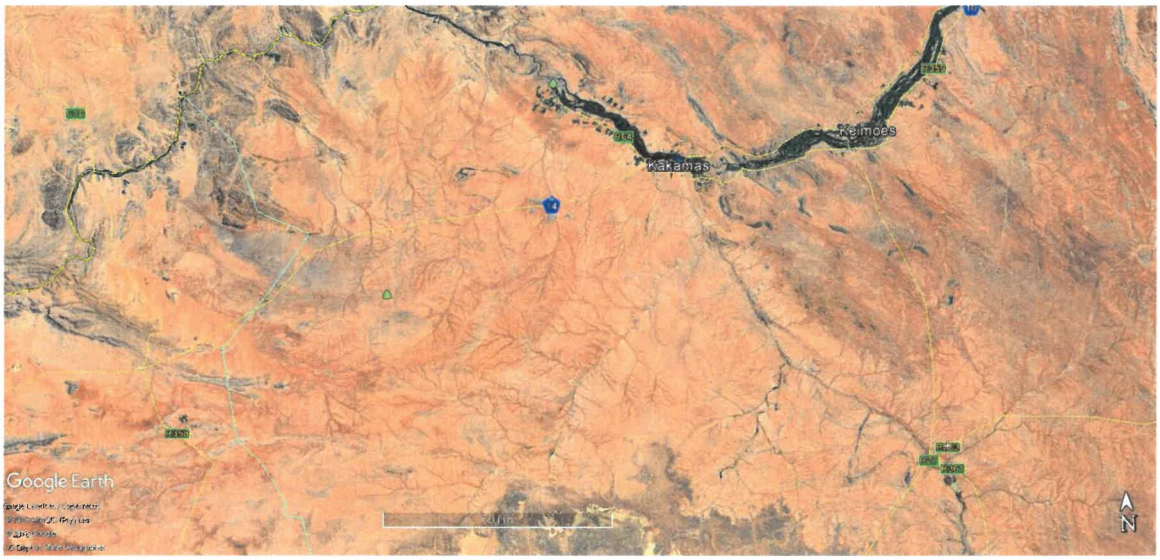

Figure 8 Drainage Lines

10 Sub-Catchments

The sub-catchments in which the quarry, agricultural and other developments are to take place have been demarcated in Figure 9.

The dimensions of each of these sub-catchments has been recorded in Table 1.

Sub-catchment 1 is much bigger that the others, with a strongly developed drainage line.

The proposed rock quarry is in Sub-Catchment.

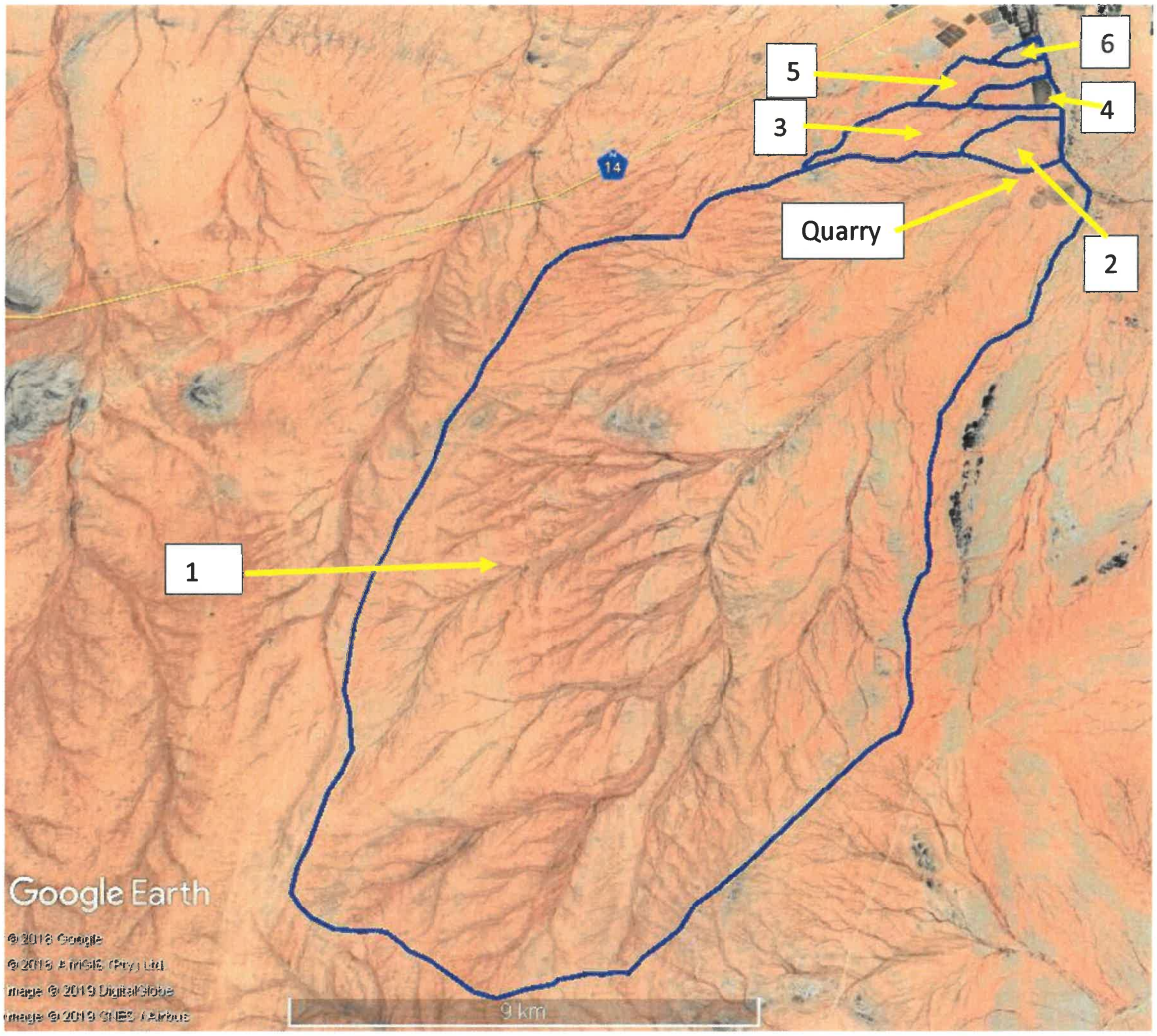

Figure 9 Sub-Catchments

Table 1 Sub-Catchment statistics

No.	Surface Ha	Circumference km	Length km	Width km	Elevation Top masl	Elevation Bottom masl	Slope m vertical in 100m horizontal
1	19207	58	22.9	11.8	833	659	0.75
2	267	6.6	2.4	1.5	703	659	0.73
3	518	14.1	12.6	2.7	749	659	6.4
4	137	5.5	2.2	0.8	691	655	6.5
5	232	7.9	3.3	1.4	707	655	6.6
6	60	3.4	1.3	0.5	686	653	9.7

11 Sheet Wash Plain

Next to the farm road along the Hartbees River, the drainage lines fan out to connect to one another in a broad and continuous fan, interconnected, with no visual demarcation between drainage lines. This is visible on Google Earth Images, as well as on the ground. During rainfall events, storm water spreads out all over, in a braided fashion, and the flow of water migrates sideways, left and right, to create this continuous fan of braided drainage lines known as sheet wash plains.

The drainage lines only have water during very large rainfall events. Most of the time the drainage lines are dry, for months and even years on end.

The slope of sub-catchments 1 and 2 is very gradual. The slopes of sub-catchments 3 to 6 are much steeper, with 6 the steepest. It can be expected that steep slopes and large catchment areas will result in high velocities of surface water movement during rainfall events. None of these drainage lines are deeply incised. It seems as if the surface area combined with the slope in none of these sub-catchments result in sediment transport of a large enough volume to create proper water course banks. Instead, the drainage lines fan out over a wide area, in some places up to 100m wide, with gradual banks.

12 Quarry Site Drainage Lines

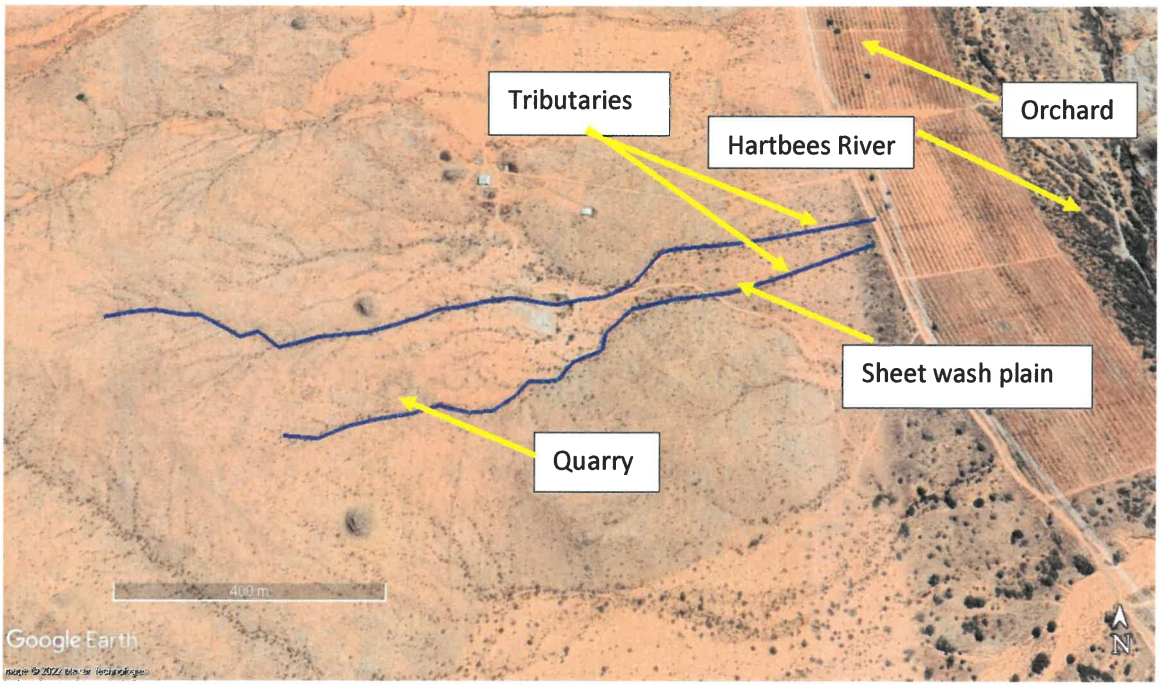

Figure 10 Quarry site drainage lines

Two small tributaries of the very large Sub-Catchment 1 drainage line are within the 100m controlled zone and this triggered the need for a S21(c) and S21(i) WULA. The exposed granite touches upon one of these small tributaries (Figure 16). These two tributaries end up in a sheet wash plain downstream of the proposed quarry. The sheet wash plain ends up against the road and the pecan nut orchard. Here the drainage line has been obliterated and does not exist anymore. The confluence with the Hartbees River is not visible anymore.

The proposed quarry site is 1.3km away from the Hartbees River. It is too far away to have any impact on the Hartbees River, especially with a notable agricultural impact on the banks of the Hartbees River.

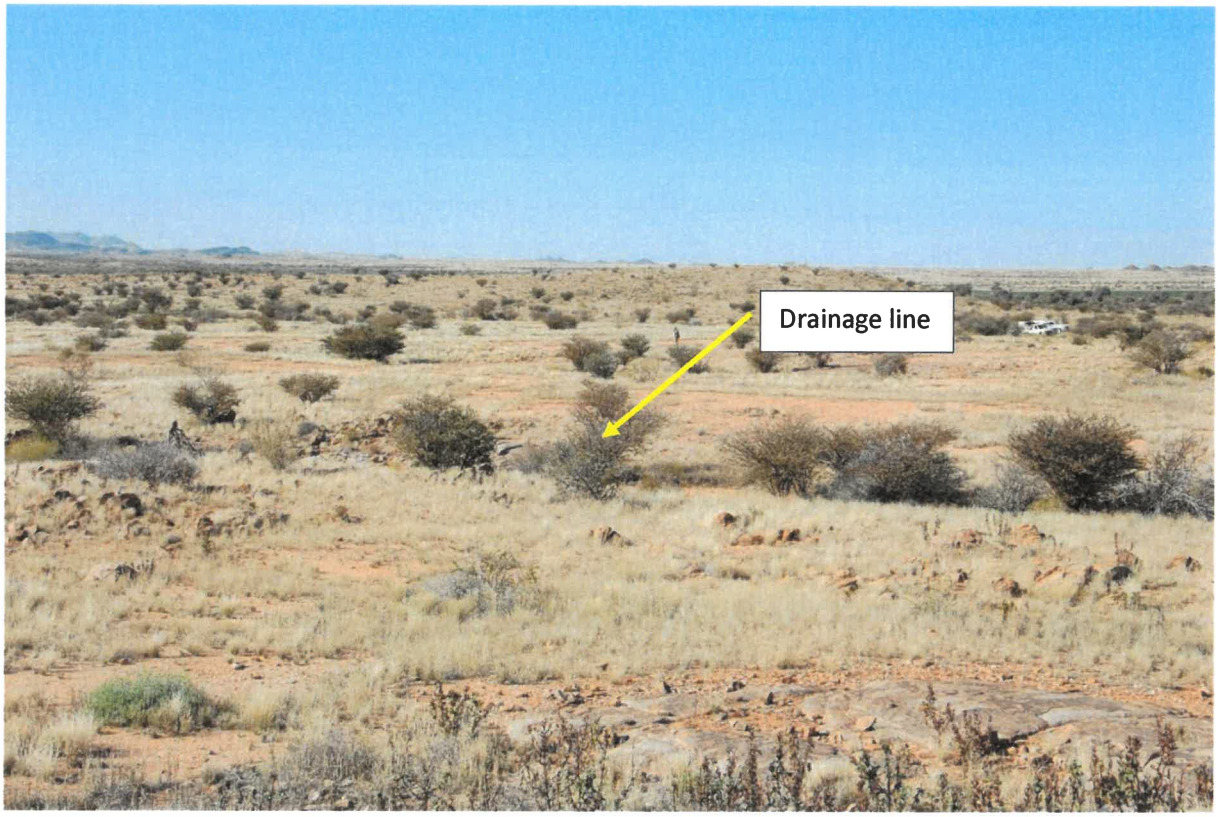

Figure 1 Drainage line

13 Present Ecological State

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

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.

Sub-catchment 1 is largely near pristine, with the only marked impact a couple of sheep grazing, but with a partial "plug" near the point of discharge. It has been classified as a "B", largely natural. The proposed development of the new patches of agricultural land and recent sand mining in the lower part would probably not change the classification of the sub-catchment. The Harbees River is nevertheless included, as to address any questions that may arise during the WULA process.

Table 3.1 Present Ecological State of the drainage line in Sub-Catchment 1

Instream	Score	Weight	Product	Maximum score
Water abstraction	25	14	350	350
Flow modification	15	13	195	325
Bed modification	18	13	234	325
Channel modification	19	13	247	325
Water quality	20	14	280	350
Inundation	22	10	220	250
Exotic macrophytes	24	9	216	225
Exotic fauna	24	8	192	200
Solid waste disposal	24	6	144	150
Total		100	2078	2500
% of total			83.1	
Class			B	
Riparian				
Water abstraction	25	13	325	325
Inundation	22	11	242	275
Flow modification	16	12	192	300
Water quality	20	13	260	325
Indigenous vegetation removal	18	13	234	325
Exotic vegetation encroachment	18	12	216	300
Bank erosion	23	14	322	350
Channel modification	18	12	216	300
Total			2007	2500
% of total			80.2	
Class			B	

Table 3.2 Present Ecological State of the Hartbees River

Instream	Score	Weight	Product	Maximum score
Water abstraction	15	14	210	350
Flow modification	18	13	234	325
Bed modification	20	13	234	325
Channel modification	20	13	260	325
Water quality	20	14	280	350
Inundation	18	10	180	250
Exotic macrophytes	22	9	198	225
Exotic fauna	24	8	192	200
Solid waste disposal	24	6	144	150
Total		100	1932	2500
% of total			77.2	
Class			C	
Riparian				
Water abstraction	15	13	325	325
Inundation	18	11	198	275
Flow modification	18	12	216	300
Water quality	20	13	260	325
Indigenous vegetation removal	22	13	286	325
Exotic vegetation encroachment	18	12	216	300
Bank erosion	20	14	280	350
Channel modification	20	12	240	300
Total			2021	2500
% of total			80.8	
Class			B	

It seems preposterous for one person to come up with a score for the Hartbees River, as this is in the domain of a team of specialists. However, such a grand undertaking is beyond the scope and budget of the usual WULA. Since this is required for approval, an assessment is submitted, together with its shortcomings.

Upstream the Sak and Hartbees River's water is heavily used for agriculture and irrigation. However, when the occasional flood happens, the volume of water that flows down the catchment is of such a magnitude that it overruns the abstraction capacity by far. The abstraction does indeed shorten the hydroperiod of the river system.

This assessment pertains to the lower Hartbees River. At the CA Bruwer development (Figure 21), the river and its riparian zone is relatively intact. Near the confluence with the Orange River, it has been canalized for the protection of vineyards against floods.

Figure 11 Hartbees River at CA Bruwer

The proposed quarry is not expected to change the status of the Hartbees River.

14 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 4).

There are no fish in the drainage lines, as there is no permanent water. There are no fish in the mostly dry Lower Hartbees River. According to this assessment, which is prescribed for WULA's, the drainage lines and Hartbees River are not important.

No other endangered species, either plant or animal, were detected in or near the drainage line. A protected tree, Camel thorn *Vachellia erioloba* is listed as "least concern" on the SANBI Red List but is not particular associated with the riparian zone of drainage lines. Another protected tree of the area, the shepherd's tree *Boscia albitrunca,* was not noticed on the proposed quarry site of in the drainage line near the site.

Table 4 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)

15 Ecological Sensitivity

The question arises, according to the ES definition, if the drainage lines would recover to its original ecological state prior to any human impact. If the CA Bruwer quarry and its associated infrastructure were to be removed, following the closure of the quarry, would the drainage lines recover?

There will be a direct impact on the southern tributary of the drainage line that passes the quarry. Once the quarrying starts, the impact would be irreversible, the damage would be permanent. In this sense the drainage line can be considered as ecologically sensitive. The northern tributary would not be impacted.

16 EISC

The DWS demand that the drainage line be placed in a category according to the EISC methodology (Table 5). The EISC is one of the essential items that is required for the Risk Matrix.

The EISC of the drainage line at the proposed quarry was rated as "Moderate", as the upper catchment was near pristine, but the lower part was heavily impacted. A median score 1.6 seems like the appropriate number.

Table 5 EISC for Drainage Line No. 1

Determinant	Drainage Line
Rare and endangered species	0
Populations of unique species	0
Species / Taxon richness	2
Diversity of habitat	2
Migration Route/ Breeding and feeding	2
Sensitivity to water quality changes	2
Flood storage, energy dissipation, particulate / element removal	2
Protection status	1
Ecological integrity	3
Average	1.6

EISC

Very High 4, High 3, Moderate 2, Low 1, None 0

Confidence Rating

Very High 4, High 3, Moderate 2, Low 1

The confidence rating was moderate, as all estimations were field observations and not laboratory analyses.

Table 6 EISC for the Hartbees River at CA Bruwer

Determinant	Drainage Line
Rare and endangered species	0
Populations of unique species	0
Species / Taxon richness	2
Diversity of habitat	2
Migration Route/ Breeding and feeding	3
Sensitivity to water quality changes	2
Flood storage, energy dissipation, particulate / element removal	3
Protection status	1
Ecological integrity	3
Average	1.8

The Hartbees River scores higher at 1.9 but is still in the "Moderate" EISC category.

17 Mitigating Measures

The mitigating measures pertain to the two small drainage lines adjacent to the proposed rock quarry site. The southern one will be more impacted than the northern one.

The quarry will touch upon the southern drainage line and can even be excavated right through it. This impact would be severe and cannot be avoided if the quarry is to go ahead. The acceptability of this impact must be weighed against the importance of the drainage line and if a part drainage line can be sacrificed for the economic good of the community. Eventually, there will be a trench of 10m wide and 10m deep, touching upon the drainage line. This trench will widen and deepen as excavation continues over the next 30 years.

The best way to look at this is probably to see to it that the impact is only localized and does not expand and grow downstream along the drainage line. Hence, machinery, stockpiles and vehicles must preferably stay out of the drainage line.

It is customary to place a berm above a mine to divert storm water around the mine and to prevent storm water from entering the mine. The part of the sub-catchment above the dam is very small and the rainfall is tantamount to desert conditions, so it seems not necessary to construct extended cut-off berms above the quarry. Sudden downpours cannot be excluded. A berm can be placed in the drainage lines to divert stormwater elsewhere and prevent it from flowing into the pit.

Dust control is of the essence, as dust can settle on the drainage lines and associated riparian habitat. This is not only dust from the crusher but from transporting gravel on trucks away from the site. This may require additional dust control and the spraying of water on areas where the trucks are loaded and where they move about. Dust will be ill tolerated on the adjacent orchards.

An access road will have to be constructed from the quarry to the farm road downstream to a point right between the two drainage lines (Figure 1), the shortest route. This farm road crosses the southern drainage line prior to its connection to the main dirt road. The crossing is of concern, as trucks are bound to leave their mark here. The road must be maintained so that is does not widen and deepen. Some reinforcement of the banks may be required, such as riprap or gabions. Sudden flows down the drainage line must not be allowed to cause any erosion.

Accidental diesel spills can be a problem. Storage for diesel must be properly bunded. If a spill occurs, it must be cleaned up by trained staff and with equipment stored as a kit on site. Clean-up kit must be regularly inspected according to a set schedule and record must be kept of these inspections.

The 40mm HDPE water pipeline from the borehole to the crusher will probably have to be trenched, shallow, just under the surface. This will have a negligible environmental impact.

Ore transported from mines often requires special measures so that it does not fall off from trucks and end up in the environment. Crushed granite is not known for its water polluting qualities and if small quantities end up on the roads and in drainage lies, it does not pose significant threats. A lot of it is not permissible.

18 Impact Assessment

Some of the decision-making authorities prescribe an impact assessment according to a premeditated methodology (Table 26.2, Appendix).

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

Table 7 Impact Assessment

Description of impact Construction phase

Installation of the crusher plant and mechanical screen
Levelling the ground for stockpiles and infrastructure
Trenching of the water pipe.
Construction of berms in the drainage lines
Construction of the access road

Mitigation measures

Construction must remain within the demarcated footprint.
Prevent dust, dirt and rubble moving down the drainage lines
Refrain from making new roads, use existing roads.
Conserve 32m riparian zone wherever possible.

Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Local	High	Permanent	Low	Probable	Certain	Irreversible	Irreplaceable
With mitigation measures								
Negative	Local	Medium	Permanent	Very Low	Probable	Sure	Irreversible	Irreplaceable

Table 7 Impact Assessment

Description of impact Operational phase

Blasting rock. Upload blasted material.
Operation of the crusher plant and mechanical screen
Stockpiling the sorted product
Affecting dust control.
Loading and transporting the product

Mitigation measures

Prevent dust, dirt and rubble moving down the drainage lines
Work within the demarcated footprint
Maintain the access road
Monitor the drainage lines for damage and prevent deterioration of the drainage lines.
Prevent diesel spills, clean up when required and maintain spillage clean-up equipment

Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Local	High	Permanent	Low	Probable	Certain	Irreversible	Irreplaceable
With mitigation measures								
Negative	Local	Medium	Permanent	Very Low	Probable	Sure	Irreversible	Irreplaceable

Description of impact Rehabilitation and Closure

Removal of crusher and associated machinery
Removal of remaining stockpiles
Levelling and landscaping

Mitigation measures

Prevent dust, dirt and rubble moving down the drainage lines
Work within the demarcated footprint
Monitor the drainage lines for damage and prevent deterioration of the drainage lines.

Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Local	Low	Permanent	Low	Probable	Certain	Irreversible	Irreplaceable
With mitigation measures								
Negative	Local	Low	Permanent	Very Low	Probable	Sure	Irreversible	Irreplaceable

Following paragraphs will show that these small drainage lines do not carry any "Significance" and the impact must be weighed against this. Even though one of the drainage lines will probably be intersected by a mining pit, with a severe impact, its significance is low, which renders the impact acceptable.

Mitigating measures cannot prevent the damage done by a mining pit to a small drainage line. Mitigating measures can limit the impact to the designated footprint and prevent the impact spreading over a wider area and more drainage lines.

Following rehabilitation and closure 30 years and more into the future, the pit will remain, but the surrounds will be left as it was prior to quarrying.

19 Numerical Significance

Decision-makers often press on a numerical score for Significance, in this event the significance of the impact that the sinking of the new borehole had on the local and regional aquatic environment. This evaluation is an attempt to put a numerical value to an Impact Assessment. The score takes into consideration both the environmental value of the site and the degree of impact.

Table 26.3, p43, Appendix provides a system for allocation values for each of the parameters Conservation Value, Extent, Duration, Severity and Likelihood with regard to possible impacts on the aquatic environment. These values are then entered into the equation on p44 to derive at a value for Significance. The value for Significance can subsequently be evaluated according to Table 26.3.2.

Table 23.3.2 provides a yardstick for decision-making to allow or disallow a development with its concomitant impact on the aquatic environment.

The scores that were given are entirely those of the specialist, based on his or her knowledge and experience. These scores form a bases for debate and consensus, should contemporaries and decision-makers wish to add to the process.

The scores apply under the assumption that mitigation measures will be in place.

The Significance comes out as "Low", even though the impact is severe, because these small tributaries of a drainage line bear so little conservation value. The lower reach of the sub-catchment is already heavily impacted. Next to these impacts, the proposed rock quarry seems small.

Table 8 Significance Score

Parameter	Value
Conservation value	1
Likelihood	5
Duration	5
Extent	1
Severity	5
Significance	16

20 Risk Matrix

The assessment was carried out according to the interactive Excel table that is available on the DWS webpage. Table 9 is a replica of the Excel spreadsheet that has been adapted to fit the format of this report. The numbers in Table 9 (continued) represent the same activities as in Table 9, with sub-activities added.

The original risk assessment as on the DWS webpage has been submitted on the eWULAA on-line system.

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 Matrix covers the same impacts as that of the Impact Assessment.

For the Risk Matrix it is assumed that all mitigation measures are in place.

Table 9 Risk Matrix

No.	Activity	Aspect	Impact	Significance	Risk Rating
1	Construction Phase	Installation of the crusher plant and mechanical screen Levelling the ground for stockpiles and infrastructure Trenching of the water pipe. Construction of berms in the drainage lines Construction of the access road	Dust, dirt and rubble and moving down the drainage lines	24	Low
2	Operational phase	Blasting rock. Upload blasted material. Operation of the crusher plant and mechanical screen Stockpiling the sorted product Affecting dust control. Loading and transporting the product	Destruction of a drainage line reach	24	Low
3	Rehabilitation and closure PV installation	Removal of crusher and associated machinery Removal of remaining stockpiles Levelling and landscaping	More rubble and dust moving down the drainage lines	24	Low

Table 19 Continued Risk Rating

No	Flow	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Conse-quence
1	1	1	1	1	1	1	1	3
2	1	1	3	3	2	1	3	5
3	1	1	1	1	1	1	1	3

No	Frequency of activity	Frequency of impact	Legal issues	Detection	Likelihood	Significance	Risk Rating
1	1	1	5	1	8	24	Low
2	4	1	5	1	11	55	Low
3	1	1	5	1	8	24	Low

Because of the severe impact on the drainage line, its destruction in a short reach of the drainage line, the operation of the quarry scores on the very margin of a low impact. Because the impact is only on this short reach, the score is limited to "Low".

The Risk Matrix indicated that a General Authorization would be in order. A License is not indicated.

21 Resource Economics

The goods and services delivered by the environment, in this case drainage lines, seep and the small wetland, 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 12) is an accepted manner to visually illustrate the resource economic footprint the drainage line, from the data in Table 10.

The star shape of the spider diagram (Figure 12) very small, almost insignificant and therefore predictable won't attract the attention of the decision-makers. From a Resource Economics point of view, it would not matter much if a small reach of the drainage line is impacted upon.

Table 10. Goods and Services

Goods & Services	Drainage lines Score
Flood attenuation	2
Stream flow regulation	2
Sediment trapping	2
Phosphate trapping	1
Nitrate removal	1
Toxicant removal	1
Erosion control	2
Carbon storage	1
Biodiversity maintenance	2
Water supply for human use	0
Natural resources	0
Cultivated food	1
Cultural significance	0
Tourism and recreation	0
Education and research	0

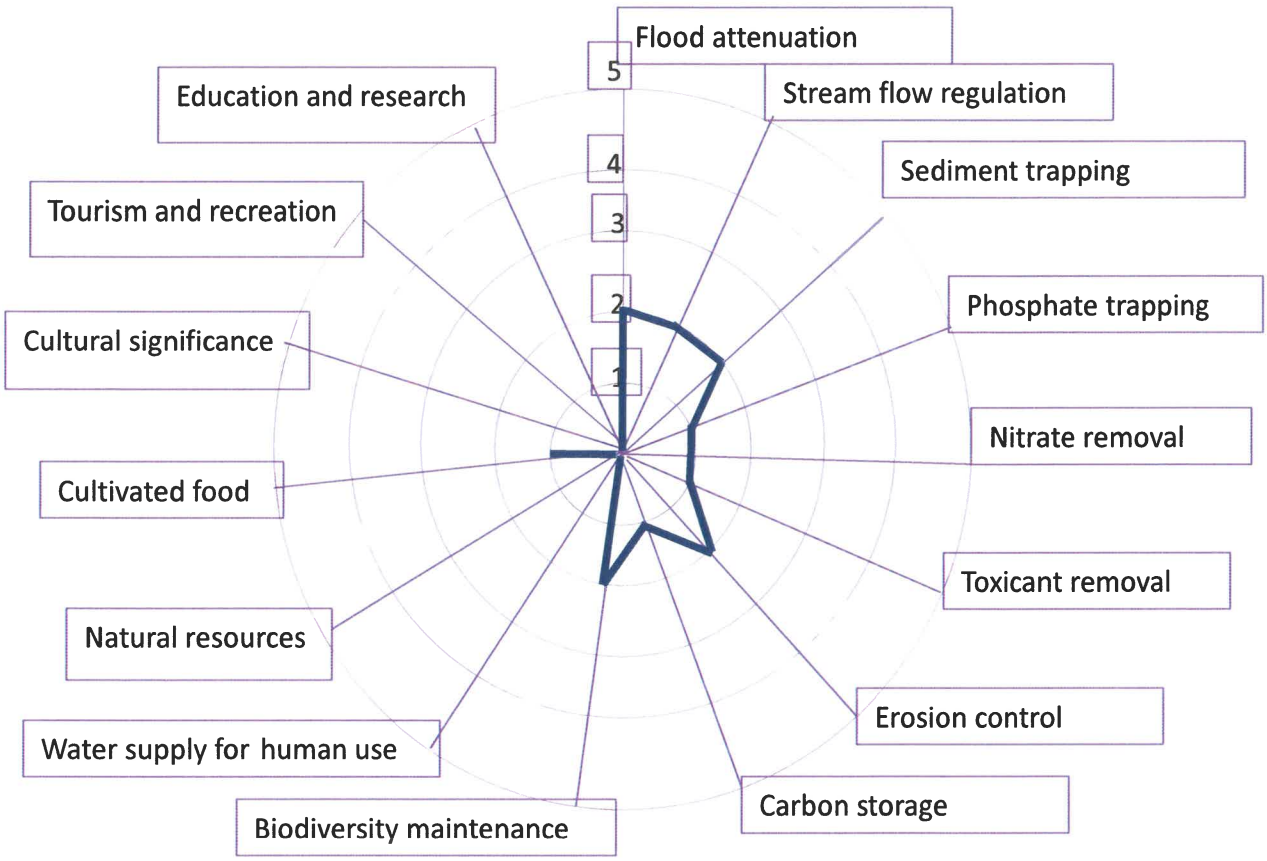

Figure 12. Resource Economics Footprint

22 Conclusions

An anthropogenic activity can impact on any of the ecosystem drivers or responses and this can have a knock-on effect on all other drivers and responses. This, in turn, will predictably impact on the ecosystem services (Figure 13). The WULA and the EAI must provide mitigation measured for these impacts.

Figure 13 has been adapted from one of the most recent DWS policy documents.

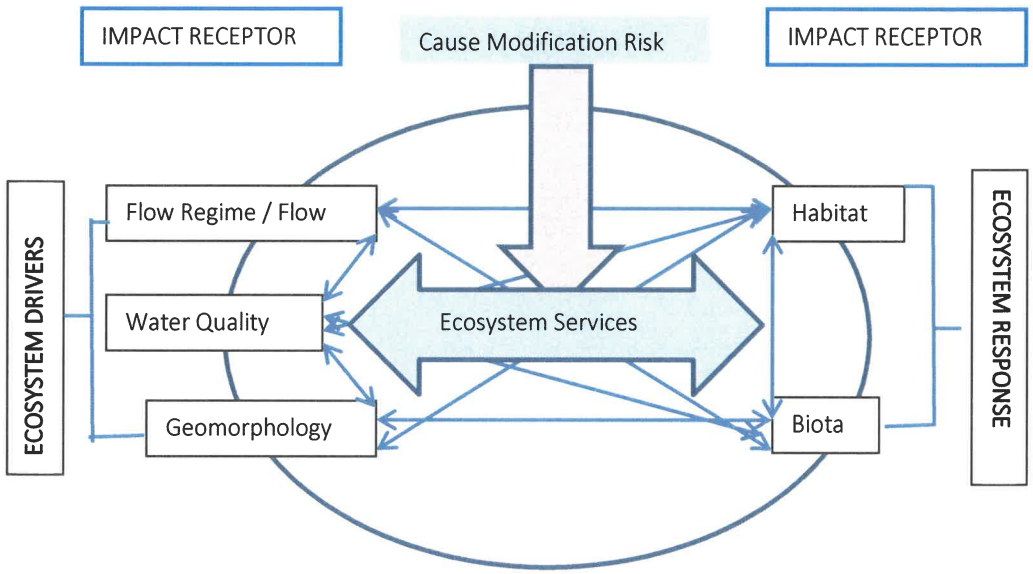

Figure 13 Minimum Requirements for a S21(c) and (i) Application

These drainage lines are driven by the very scant rainfall events, sudden and sometimes severe thunderstorms, spread out over millennia. Rainfall is interspersed by prolonged droughts. This gives rise to a sparse and drought resistant vegetation. The shallow ground water that migrates along these drainage lines provides just enough moist for higher vegetation to take root and to hold on under these very harsh climatic conditions. Drainage lines are ecologically important, as it provides denser and higher vegetation in an otherwise barren landscape, contributing to habitat variation, biodiversity and migration routes.

The upper sub-catchments of these drainage lines are mostly near-pristine, with only grazing. The lower parts are heavily impacted by agriculture and sand winning. This stark contrast is evident all over the region.

Likewise, the proposed rock quarry would be a relatively small impact on an already impacted lower sub-catchment. It would make little difference to what is already impacted on the ground. The cumulative impact would be marginally bigger.

As has been stated in similar reports, there aught to be an official policy to protect some of these sub-catchments and its drainage lines so that at least a limited number remains for conservation purposes.

It is recommended that the proposed rock quarry be officially approved. A General Authorization would be in order.

23 References

Kleynhans, C.J. 1999. *Assessment of Ecological Importance and Sensitivity*. Department of Water Affairs and Forestry. Pretoria.

Kotze, G., G. Marneweck, A. Batchelor, D. Lindley & Nacelle Collins. 2009. *A technique for rapidly assessing ecosystem services supplied by wetlands.* Water Research Commission, Pretoria.

Mucina, L. & M.C Rutherford. 2006. *The vegetation of South Africa, Lesotho and Swaziland.* SANBI, Pretoria.

Van Driel, D. 2022. *Fresh Water Report. Proposed Agricultural Development Plot 2372 of Alheidt, Kakamas*. WATSAN Africa, Cape Town

23 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 16 August 2022

24 Résumé

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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 Homeowner'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

Reports

- Process Review Kathu Wastewater Treatment Works
- Effluent Irrigation Report Tydstroom Abattoir Durbanville
- River Rehabilitation Report Slangkop Farm, Yzerfontein
- Fresh Water and Estuary Report Erf 77 Elands Bay
- 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
- Fresh Water Report Urban Development Witteklip Vredenburg
- Fresh Water Report Groblershoop Resort, Northern Cape
- Fresh Water Report CA Bruwer Quarry Kakamas, Northern Cape
- Fresh Water Report, CA Bruwer Sand Mine, Kakamas, Northern Cape
- Fresh Water Report, Triple D Farms, Agri Development, Kakamas
- Fresh Water Report, Keren Energy Photovoltaic Plant Kakamas
- Fresh Water Report, Keren Energy Photovoltaic Plant Hopetown
- Fresh Water Report Hopetown Sewer
- Fresh Water Report Hoogland Farm Agricultural Development, Touws River

- Fresh Water Report Klaarstroom Wastewater Treatment Works
- Fresh Water Report Calvinia Sports Grounds Irrigation
- Fresh Water Report CA Bruwer Agricultural Development Kakamas
- Fresh Water Report Zwartfontein Farm Dam, Hermon
- Statement Delsma Farm Wetland, Hermon
- Fresh Water Report Lemoenshoek Farms Pipelines Bonnyvale
- Fresh Water Report Water Provision Pipeline Brandvlei
- Fresh Water Report Erf 19992 Upington
- Botanical Report Zwartejongensfontein Sand Mine, Stilbaai
- Fresh Water Report CA Bruwer Feldspath Mine, Kakamas
- Sediment Yield Calculation, Kenhardt Sand Mine
- Wetland Demarcation, Grabouw Traffic Center
- Fresh Water Report, Osdrift Sand Mine, Worcester
- Fresh Water Report, Muggievlak Storm Water Canal, Vredenburg
- Fresh Water Report, Marksman's Nest Rifle Range, Malmesbury
- Biodiversity Report, Muggievlak Storm Water Canal, Vredenburg
- Strategic Planning Report, Sanitation, Afghanistan Government, New Delhi, India
- Fresh Water Report, Potable Water Pipeline, Komaggas
- Fresh Water Report, Wastewater Treatment Works, Kamieskroon
- Fresh Water Report, Turksvy Farm Dam, Upington
- Fresh Water Report, Groblershoop Urban Development, IKheis Municipality
- Fresh Water Report, Boegoeberg Urban Development, IKheis Municipality
- Fresh Water Report, Opwag Urban Development, IKheis Municipality
- Fresh Water Report, Wegdraai Urban Development, IKheis Municipality
- Fresh Water Report, Topline Urban Development, IKheis Municipality
- Fresh Water Report, Grootdrink Urban Development, IKheis Municipality
- Fresh Water Report, Gariep Urban Development, IKheis Municipality
- Fresh Water Report, Bonathaba Farm Dam, Hermon
- Botanical Report, Sand Mine Greystone Trading, Vredendal
- Botanical Report Namakwa Klei Stene, Klawer
- Fresh Water Report Buffelsdrift Quarry, George
- Fresh Water Report Styerkraal Agricultural Development, Onseepkans.
- Technical Report Arabella Country Estate Wastewater Treatment Works, Kleinmond
- Fresh Water Report Calvinia Bulk Water Supply
- Fresh Water Report Swartdam Farm Dams, Riebeeck Kasteel
- Fresh Water Report Erf 46959, Gordon's Bay
- Fresh Water Report Melkboom Farm Dam, Trawal
- Stormwater Management Plan, Bot River Bricks
- Freshwater Report, Bot River Bricks
- Freshwater Report Sanddrif Farm, Joubertina
- Freshwater Report Zouterivier Cell phone tower, Atlantis
- Biodiversity Report Birdfield Sandmine, Klawer
- Freshwater Report New Wave Dam, Klawer
- Freshwater Report Harvard Solar Energy Plant, Bloemfontein
- Freshwater Report Doorn River Solar Energy Plant, Virginia
- Freshwater Report Kleingeluk Farm, De Rust
- Freshwater Report, Solar Energy Plant, Klein Brak River
- Site Verification Report Laaiplek Desalination Plant

26 Appendix

26.1 Bushmanland Arid Grassland

VT 29 Arid Karoo and Desert False Grassveld (36%), VT 32 Orange River Broken Veld (36%) (Acocks 1953). LR 51 Orange River Nama Karoo (51%) (Low & Rebelo 1996).

Distribution Northern Cape Province: Spanning about one degree of latitude from around Aggeneys in the west to Prieska in the east. The southern border of the unit is formed by edges of the Bushmanland Basin while in the northwest this vegetation unit borders on desert vegetation (northwest of Aggeneys and Pofadder). The northern border (in the vicinity of Upington) and the eastern border (between Upington and Prieska) are formed with often intermingling units of Lower Gariep Broken Veld, Kalahari Karroid Shrubland and Gordonia Duneveld. Most of the western border is formed by the edge of the Namaqualand hills. Altitude varies mostly from 600–1 200 m.

Vegetation & Landscape Features Extensive to irregular plains on a slightly sloping plateau sparsely vegetated by grassland dominated by white grasses (*Stipagrostis* species) giving this vegetation type the character of semidesert 'steppe'. In places low shrubs of *Salsola* change the vegetation structure. In years of abundant rainfall rich displays of annual herbs can be expected.

Geology & Soils A third of the area is covered by recent (Quaternary) alluvium and calcrete. Superficial deposits of the Kalahari Group are also present in the east. The extensive Palaeozoic diamictites of the Dwyka Group also outcrop in the area as do gneisses and metasediments of Mokolian age. The soils of most of the area are red-yellow apedal soils, freely drained, with a high base status and <300 mm deep, with about one fifth of the area deeper than 300 mm, typical of Ag and Ae land types.

Climate Rainfall largely in late summer/early autumn (major peak) and very variable from year to year. MAP ranges from about 70 mm in the west to 200 mm in the east. Mean maximum and minimum monthly temperatures for Kenhardt are 40.6°C and –3.7°C for January and July respectively. Corresponding values for Pofadder are 38.3°C and –0.6°C. Frost incidence ranges from around 10 frost days per year in the northwest to about 35 days in the east. Whirl winds (dust devils) are common on hot summer days. See also climate diagram for NKb 3 Bushmanland Arid Grassland (Figure 7.2).

Important Taxa ([W]Western and [E]Eastern regions of the unit only) Graminoids: *Aristida adscensionis* (d), *A. congesta* (d), *Enneapogon desvauxii* (d), *Eragrostis nindensis* (d), *Schmidtia kalahariensis* (d), *Stipagrostis ciliata* (d), *S. obtusa* (d), *Cenchrus ciliaris*, *Enneapogon scaber*, *Eragrostis annulata*[E], *E. porosa*[E], *E. procumbens*, *Panicum lanipes*[E], *Setaria verticillata*[E], *Sporobolus nervosus*, *Stipagrostis brevifolia*[W], *S. uniplumis*, *Tragus berteronianus*, *T. racemosus*[E]. Small Trees: *Acacia mellifera* subsp. *detinens*[E], *Boscia foetida* subsp. *foetida*. Tall Shrubs: *Lycium cinereum* (d), *Rhigozum trichotomum* (d), *Cadaba aphylla*, *Parkinsonia africana*. Low Shrubs: *Aptosimum spinescens* (d), *Hermannia spinosa* (d), *Pentzia spinescens* (d), *Aizoon asbestinum*[E], *A. schellenbergii*[E], *Aptosimum elongatum*, *A. lineare*[E], *A. marlothii*[E], *Barleria rigida*, *Berkheya annectens*, *Blepharis mitrata*, *Eriocephalus ambiguus*, *E. spinescens*, *Limeum aethiopicum*, *Lophiocarpus polystachyus*, *Monechma incanum*, *M. spartioides*, *Pentzia pinnatisecta*, *Phaeoptilum spinosum*[E], *Polygala seminuda*, *Pteronia leucoclada*, *P. mucronata*, *P. sordida*, *Rosenia humilis*, *Senecio niveus*, *Sericocoma avolans*, *Solanum capense*, *Talinum arnotii*[E], *Tetragonia arbuscula*, *Zygophyllum microphyllum*. Succulent Shrubs: *Kleinia longiflora*, *Lycium bosciifolium*, *Salsola tuberculata*, *S. glabrescens*. Herbs: *Acanthopsis hoffmannseggiana*, *Aizoon canariense*, *Amaranthus praetermissus*, *Barleria lichtensteiniana*[E], *Chamaesyce inaequilatera*, *Dicoma capensis*, *Indigastrum argyraeum*, *Lotononis platycarpa*, *Sesamum capense*, *Tribulus pterophorus*, *T. terrestris*, *Vahlia capensis*. Succulent Herbs: *Gisekia pharnacioides*[E], *Psilocaulon coriarium*, *Trianthema parvifolia*. Geophytic Herb: *Moraea venenata*.

Biogeographically Important Taxon (Bushmanland endemic) Succulent Herb: *Tridentea dwequensis*.

Endemic Taxa Succulent Shrubs: *Dinteranthus pole-evansii*, *Larryleachia dinteri*, *L. marlothii*, *Ruschia kenhardtensis*. Herbs: *Lotononis oligocephala*, *Nemesia maxii*.

Conservation Least threatened. Target 21%. Only small patches statutorily conserved in Augrabies Falls National Park and Goegab Nature Reserve. Very little of the area has been transformed. Erosion is very low (60%) and low (33%).

Remarks This unit has a large longitudinal extent, with some species common in only part of the unit. Further research may lead to the split of this unit at a later stage.

References Acocks (1953, 1988), Du Toit (1996), L. Mucina (unpubl. data).

26.2 Methodology used in determining significance of impacts

The methodology to be used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives is provided in the following tables:

Table 26.2.1 Nature and type of impact

Nature and type of impact	Description
Positive	An impact that is considered to represent an improvement to the baseline conditions or represents a positive change
Negative	An impact that is considered to represent an adverse change from the baseline or introduces a new negative factor
Direct	Impacts that result from the direct interaction between a planned project activity and the receiving environment / receptors
Indirect	Impacts that result from other activities that could take place as a consequence of the project (e.g. an influx of work seekers)
Cumulative	Impacts that act together with other impacts (including those from concurrent or planned future activities) to affect the same resources and / or receptors as the project

Table 26.2.2 Criteria for the assessment of impacts

Criteria	Rating	Description
Spatial extent of impact	National	Impacts that affect nationally important environmental resources or affect an area that is nationally important or have macro-economic consequences
	Regional	Impacts that affect regionally important environmental resources or are experienced on a regional scale as determined by administrative boundaries or habitat type / ecosystems
	Local	Within 2 km of the site
	Site specific	On site or within 100m of the site boundary
Consequence of impact/ Magnitude/ Severity	High	Natural and / or social functions and / or processes are severely altered
	Medium	Natural and / or social functions and / or processes are notably altered
	Low	Natural and / or social functions and / or processes are slightly altered
	Very Low	Natural and / or social functions and / or processes are negligibly altered
	Zero	Natural and / or social functions and / or processes remain unaltered
Duration of impact	Temporary	Impacts of short duration and /or occasional
	Short term	During the construction period
	Medium term	During part or all of the operational phase
	Long term	Beyond the operational phase, but not permanently
	Permanent	Mitigation will not occur in such a way or in such a time span that the impact can be considered transient (irreversible)

Table 26.2.3 Significance Rating

Significance Rating	Description
High	High consequence with a regional extent and long-term duration High consequence with either a regional extent and medium-term duration or a local extent and long-term duration Medium consequence with a regional extent and a long-term duration
Medium	High with a local extent and medium-term duration High consequence with a regional extent and short-term duration or a site-specific extent and long-term duration High consequence with either local extent and short-term duration or a site-specific extent with a medium-term duration Medium consequence with any combination of extent and duration except site-specific and short-term or regional and long term Low consequence with a regional extent and long-term duration
Low	High consequence with a site-specific extent and short-term duration Medium consequence with a site-specific extent and short-term duration Low consequence with any combination of extent and duration except site-specific and short-term Very low consequence with a regional extent and long-term duration
Very low	Low consequence with a site-specific extent and short-term duration Very low consequence with any combination of extent and duration except regional and long term
Neutral	Zero consequence with any combination of extent and duration

Table 26.2.4 Probability, confidence, reversibility and irreplaceability

Criteria	Rating	Description
Probability	Definite	>90% likelihood of the impact occurring
	Probable	70 – 90% likelihood of the impact occurring
	Possible	40 – 70% likelihood of the impact occurring
	Unlikely	<40% likelihood of the impact occurring
Confidence	Certain	Wealth of information on and sound understanding of the environmental factors potentially affecting the impact
	Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact
	Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact
Reversibility	Reversible	The impact is reversible within 2 years after the cause or stress is removed
	Irreversible	The activity will lead to an impact that is in all practical terms permanent
Irreplaceability	Replaceable	The resources lost can be replaced to a certain degree
	Irreplaceable	The activity will lead to a permanent loss of resources.

26.3 Numerical Significance

Table 26.3.1 Conservation Value

Conservation Value		
Refers to the intrinsic value of the area or its relative importance towards the conservation of an ecosystem or species or even natural aesthetics. Conservation status is based on habitat function, its vulnerability to loss and fragmentation or its value in terms of the protection of habitat or species	Low 1	The area is transformed, degraded not sensitive (e.g. Least threatened), with unlikely possibility of species loss.
	Medium / Low 2	The area is in good condition but not sensitive (e.g. Least threatened), with unlikely possibility of species loss.
	Medium 3	The area is in good condition, considered vulnerable (threatened), or falls within an ecological support area or a critical biodiversity area, but with unlikely possibility of species loss.
	Medium / High 4	The area is considered endangered or, falls within an ecological support area or a critical biodiversity area, or provides core habitat for endemic or rare & endangered species.
	High 5	The area is considered critically endangered or is part of a proclaimed provincial or national protected area.

Table 26.3.2 Scoring system

Significance	Score	Description
Insignificant	4 - 22	There is no impact or the impact is insignificant in scale or magnitude as a result of low sensitivity to change or low intrinsic value of the site.
Low	23 - 36	An impact barely noticeable in scale or magnitude as a result of low sensitivity to change or low intrinsic value of the site, or will be of very short-term or is unlikely to occur. Impact is unlikely to have any real effect and no or little mitigation is required.
Medium / Low	37 - 45	Impact is of a low order and therefore likely to have little real effect. Mitigation is either easily achieved. Impacts may have medium to short term effects on the natural environment within site boundaries.
Medium	46 - 55	Impact is real, but not substantial. Mitigation is both feasible and fairly easily possible, but may require modification of the project design or layout. These impacts will usually result in medium to long term effect on the natural environment, within site boundary.
Medium High	56 - 63	Impact is real, substantial and undesirable, but mitigation is feasible. Modification of the project design or layout may be required. These impacts will usually result in medium to long-term effect on the natural environment, beyond site boundary within local area.
High	64 - 79	An impact of high order. Mitigation is difficult, expensive, time-consuming or some combination of these. These impacts will usually result in long-term change to the natural environment, beyond site boundaries, regional or widespread.
Unacceptable	80 - 100	An impact of the highest order possible. There is no possible mitigation that could offset the impact. The impact will result in permanent change. Very often these impacts cannot be mitigated and usually result in very severe effects, beyond site boundaries, national or international.

Parameter	1	2	3	4	5
Conservation value Likelihood Duration Extent Severity	Low Unlikely Temporary Site specific Zero	Medium /Low Possible Short term Local Very low	Medium More possible Medium term Regional Low	Medium / High Probable Long term National Medium	High Definite Permanent International High

Significance = Conservation value (Likelihood + Duration + Extent + Severity)

26.4 Risk Matrix Methodology

RISK ASSESSMENT KEY (Referenced from DWA RISK-BASED WATER USE AUTHORISATION APPROACH AND DELEGATION GUIDELINES)

Negative Rating

TABLE 1- SEVERITY

How severe does the aspects impact on the environment and resource quality characterisitics (flow regime, water quality, geomorfology, biota, habitat)

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means	

TABLE 2 – SPATIAL SCALE

How big is the area that the aspect is impacting on?

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catch	3
National (impacting beyond seconday catchment or provinces)	4
Global (impacting beyond SA boundary)	5

TABLE 3 – DURATION

How long does the aspect impact on the environment and resource quality?

One day to one month, PES, EIS and/or REC not impacted
One month to one year, PES, EIS and/or REC impacted but no change in status
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation
Life of the activity, PES, EIS and/or REC permanently lowered
More than life of the organisation/facility, PES and EIS scores, a E or F

TABLE 4 – FREQUENCY OF THE ACTIVITY

How often do you do the specific activity?

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

TABLE 5 – FREQUENCY OF THE INCIDENT/IMPACT

How often does the activity impact on the environment?

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

TABLE 6 – LEGAL ISSUES

How is the activity governed by legislation?

No legislation
Fully covered by legislation (wetlands are legally governed)
Located within the regulated areas

TABLE 7 – DETECTION

How quickly can the impacts/risks of the activity be observed on the environment (water resourc
Immediately
Without much effort
Need some effort
Remote and difficult to observe
Covered

TABLE 8: RATING CLASSES

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale

A low risk class must be obtained for all activities to be considered for a GA

TABLE 9: CALCULATIONS

Consequence = Severity + Spatial Scale + Duration
Likelihood=Frequency of Activity + Frequency of Incident +Legal Issues + Detection
Significance \Risk= Consequence X Likelihood