APPENDIX L

Freshwater Specialist Report

CA Bruwer Konstruksie

Kakamas, Northern Cape

Fresh Water Report V1.2

Proposed Sand Mining Operation on

Plot 2372 of Alheidt, Kakamas

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

August 2018

EnviroAfrica

WATSAN Africa

Index

1 Introduction

Mr Charel Bruwer of CA Bruwer Konstuksie CC has established himself and his company as a recognised member of the Kakamas business community and has rendered valuable services over a number of decades. He now plans on developing a sand mine on Plot 2372 on Alheidt to the south west of Kakamas in the Northern Cape. Once the mining activities has been concluded, the land will be used for agricultural purposes.

An Environmental Impact Assessment (EIA) in terms of the National Environmental Management Act (107 of 1998) is required for the approval of any mining activity. Enviro Africa of Somerset West was appointed to conduct the EIA.

The proposed mining is to take place across a dry drainage line, which triggers Section 21 (c) and (i) of the National Water Act (36 of 1998). A Water Use License Application (WULA) is required for the approval of the mining activity. This application is to be submitted to the Department of Water and Sanitation's regional office in Upington. Dr Dirk van Driel of WATSAN Africa was appointed to conduct the WULA.

The success of the WULA is very much dependent on the concomitant Fresh Water Report (now named the Technical Report). This report is to provide adequate information to the decision-making authorities, among other the DWA, to approve or disapprove the proposed mining activity.

Together with the Fresh Water Report a Risk Matrix is to be submitted. The Risk Matrix will asst the DWA do decide if a General Authorisation of a License application will be required.

Prior to the submission of the WULA documents, a submission will have to be made to the Department of Mineral Resources for their approval as well.

It is emphatically stated that this Fresh Water Report is for the approval of the envisage sand mining venture. Although the end use of irrigated agricultural land is mentioned for as far as it pertains to the mining license, The DWA may ask for a separate WULA for agricultural use, or that this application be expanded to include the agricultural use.

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 sand mine is spanning the banks of a drainage line. The drainage line would be altered, should the development go ahead.

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

The proposed sand mine will alter the characteristics of the banks of the drainage line.

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, 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. The proposed sand mine is in a drainage line, which fully qualifies as a water course. Consequently, this regulation is relevant to this application.

3 Climate

Upington close to Kakamas normally receives about 94mm of rain per year, with most rainfall occurring mainly during autumn. The chart below (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.

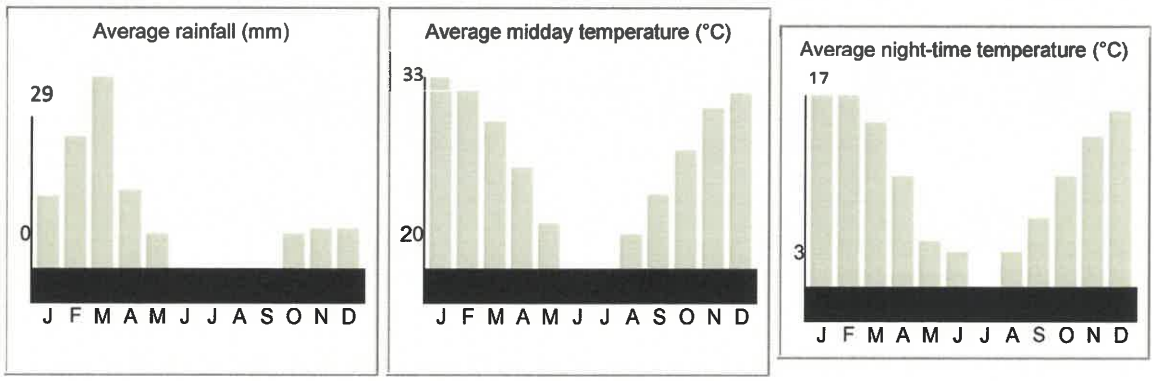

Figure 1 Upington Climate

It is evident from Figure 1 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 Sub -Catchment

The sub-catchment is located in the D53J quaternary catchment

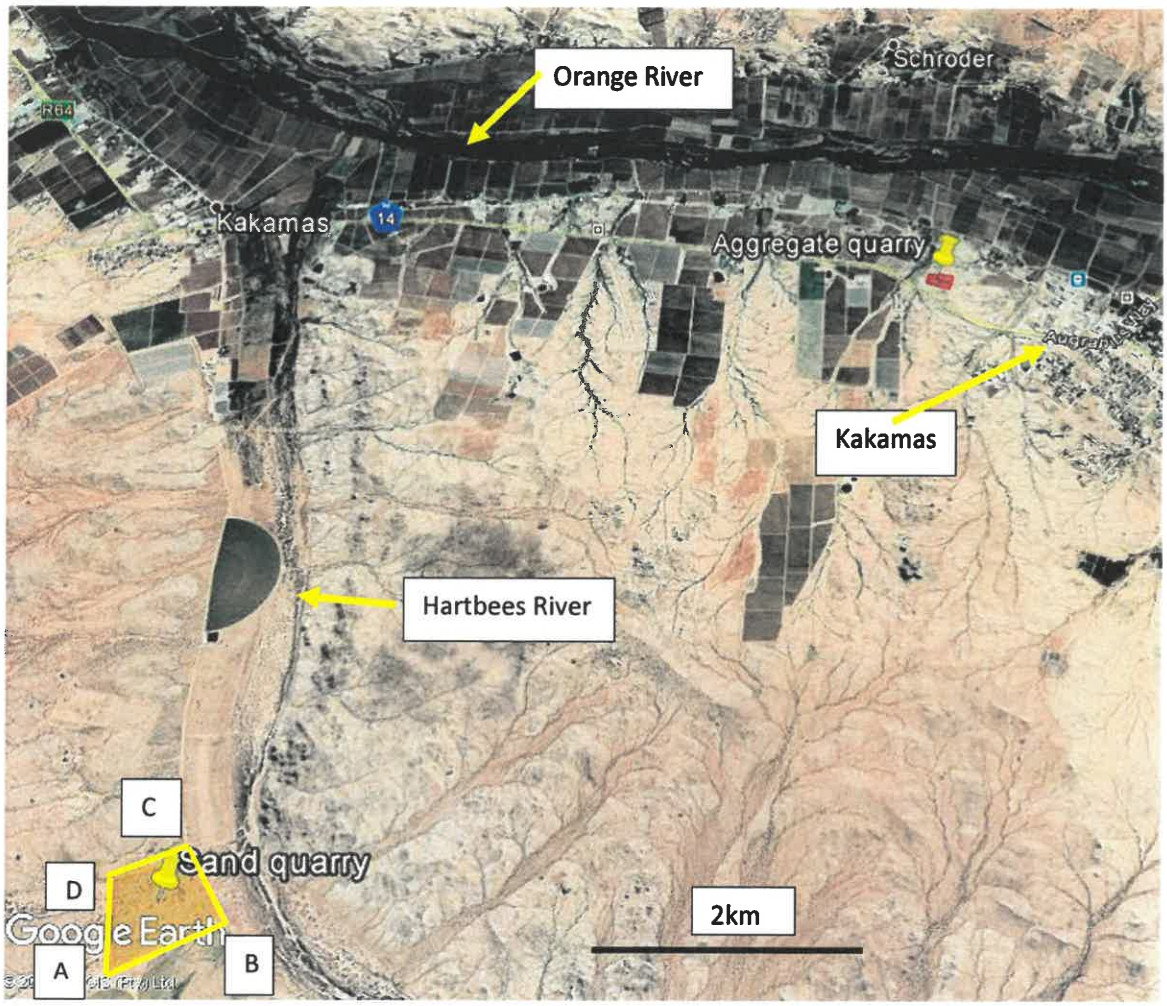

Figure 2 Location of proposed sand mine

The proposed sand mine (Figure 2) of 5 hectares is located 7.5 km to the south west of the town of Kakamas and 6.5 km south of the Orange River. It is 250 m away from the Hartbees River.

The Hartbees River as well as the Orange River is densely flanked with mostly dry drainage lines. It is a most prominent feature of the regional topography. Likewise, the proposed sand mine is located close right on one such drainage line close to the confluence with the Hartbees River.

The sub-catchment of this drainage line covers an area of 18 929 hectares and has a circumference of 57 km. It is 46 km long and 12 km wide.

There were definite signs on the sandy bottom in the middle of the drainage line of moving water and subsequent sediment transport (Figure 4) on 15 August 2018 during the site visit. Elsewhere the drainage line is up to 30m wide with less signs of transport of sediments by moving water (Figure 5). Apart from this there was no sign of any other aquatic habitat. There was no vegetation that indicates a riparian zone, even though there was more vegetation along the drainage lines in the low-lying areas than on the hills. The drainage line was dry during the site visit on 14 August 2018 and resembled the arid characteristics of the surrounding area.

Figure 3 Sub-Catchment

The erosion potential of these loose sands is high, but because of the limited rainfall there are no dongas as are so pertinent in higher rainfall areas. Where the sand is underlain by shallow calcrete, perhaps half a metre or less, as is obvious in many of these dry drainage lines in the region, the sand is washed away to the harder substrate, but not any deeper.

The elevation at the top of the catchment is 888m and below the mining site 678m. Over 46km this gives a mean slope on only 0.24%. The gentle slope is not conducive to the generation of strong currents that can move sediments.

Figure 4 Demarcated drainage line

Figure 5 Wide drainage line

5 The Hartbees River, Sak River and the Pans

The Hartbees River rises as the Sak River on the highlands to the south of Sutherland more than 300km to the south. 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 as well as all of the drainage lines along the Orange 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 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.

Likewise, there is a large centre pivot right next to the earmarked mining area (Figure 6). An existing water right from the Orange River is in place for this activity.

Figure 6 Centre pivot irrigation system

6 Ephemeral Organisms

Following exception period of flow in the Hartbees River, pools remain in the river bed. These pools may last for several weeks, after which they dry up to once again form a part of the arid landscape.

These temporary pools are known as ephemeral waters and during the hydroperiod (when there is water) exhibit a particular community of organisms, of which swimming fairy shrimps (Crustacea, Malacostraca) are the most obvious. The farming community and others noticed these shrimps and now the concern has been expressed that the proposed mining would have a deleterious impact on them.

Ephemeral pans of the Northern Cape, such as Verneukpan and Hakskeenpan exhibit a particular ecology. When it rains, a pan suddenly floods, which only happens occasionally.

When flooded, so is surmised, an entire ecology springs to life. Micro-algae (primary producers) reproduce rapidly in the nutrient-laden water to form a source of food for the microbial grazers (secondary producers) and a complicated chain of microbial predators, with macro-invertabrates at the top of the food chain. These may be dense clouds of swimming fairy shrimps.

The pan dries up as suddenly as it flooded. As the last of the moist evaporates, the planktonic organisms perish, but leaving behind a wealth of spores and eggs. These sink into the red soil, in among the cracks that typically develop in these drying pans, to sub-terraneously withstand the scorching temperatures of the harsh Kalahari sun and the sub-zero temperatures of winter nights for months and even years on end.

These are very special organisms with highly adapted life cycles. They successfully survive in their dormant state under extreme conditions on the floor of the pan, ready to explode into life at the next flood event.

According to local knowledge, the very same happens in the ephemeral pools of the Hartbees River.

Research about life in the Northern Cape's ephemeral pans is ongoing.

(http://www.saeon.ac.za/2016%20Postdoc%20Ad%20SAEON%20-%20Landscape%20Ecology%20of%20Pans.pdf)

As scientific research is published, the impact of mining would be increasingly predictable.

Apart from anecdotal evidence, very little is known about these organisms in the Hartbees River. Because of the popular concern, it is addressed for this WULA. It is however, unlikely that the proposed mining operation would have any impact or bearing on the yet unknown ecology of the Hartbees River and will therefore not further be considered. The mine is not in the river bed and too far away from the river to have any likely impact on downstream ephemeral populations.

7 Mining Operation

The proposed mine is located at the following coordinates (Table 1):

Table 1 Mining Area Coordinates

Point	Coordinates	Distance (m)
A B C D	28°48"48.47"S; 20°32'54.14"E 28°48"36.74"S; 20°33"16.02"E; 28°48"25.71"S; 20°33'05.45"E 28°48"31.15"S; 20°32"47.34"E	AB 700 BC 500 CD 500 DA 600

The sand will be simply scooped with a front-end loader and dumped onto a waiting truck. The sand will be transported to a site in Kakamas where it will be graded. The mined material contains a percentage of course grit and even small pebbles that must be removed before the sand is suitable for the building trade. The course material will be sold separately and evidently there is a market for that as well.

There will be no sand washing on the mining site. There will be no sorting of sand on the mining site. The only machinery will be the loader and trucks.

This means that there will be only 2 or 3 people present on the site during the mining operation.

Drinking water for staff will be provided in purchased pe-packed containers. A portable toilet will be provided that will be serviced by an acknowledged service provider. Any waste will be collected in the usual 140 litre wheelie bin and the waste will be transported to the Kakamas municipal waste disposal site.

An emergency kit will be kept on the premises to clean up any accidental oil and diesel spills.

In the middle of the drainage line, the depth of sand is only 0.9m. This part will not be mined. Out of the drainage line the sand is 2m deep and even deeper. In no event will mining take place lower than the lowest point in the drainage line.

The life cycle of the mine will be approximately 3 years.

Following the cessation of operations, the mining area will be levelled and landscaped. The land will be used for irrigation farming, mainly lucerne and other fodder crops. The current plan is to erect a large centre pivot irrigation system. Again, existing water rights from the Orange River will in place for the envisaged venture.

8 Impacts

The lowering of the ground around the drainage line may cause the flow to be re-directed towards another position for the confluence with the Hartbees River. This can be prevented if the mined-out area could be finally landscaped in such a way that the flow path remains the same as it is today.

The drainage line would obviously be altered because of the mining activities, with the vegetation removed and then transformed into agricultural land. The decision-making authorities will have to decide, according to the information at hand and standing official policy, if this would be acceptable.

Like all surface mining of sand, the shallow ground water holding capacity of the sub-catchment would be reduced. Again, that water may be so little that is does not make a material difference to the overall water balance. It would help if some sand is left on the clay substrate below.

Not a part of this WULA, but worth mentioning; once the land is transformed for agricultural purposes, return flow could become an issue. The lower part of the drainage line as well as the Hartbees River could receive water, which would have been arid under natural conditions.

9 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.

Apart from the occasional vehicle that moves about on the property and grazing cattle, there are no other impacts on the sub-catchment. Hence the A classification for the instream-habitat.

The low-lying areas where the drainage lines are, have more vegetation than the higher ground, probably because there is slightly more moisture in the soil and because it is less exposed to high winds. But other than that, there is no discernible riparian zone.

However, the movement of water down the drainage lines, together with sediments and the scouring effect, probably explains the absence of trees and vegetation other than grasses and some scrub right in the drainage lines. This probably and naturally removes most of the seeds and very young samplings.

The hydraulic connectivity between the drainage line and the surrounds has not been compromised. Rain water moves down to the clay layer between 0.9m and 3m. This horizon of clay acts as an aquitard below the permeable sand, on top of which the shallow ground water spreads sideways and downhill towards the Hartbees River. This explains the presence of more vegetation around the drainage lines.

Table 2 Habitat Integrity

Drainage Line Habitat Integrity				
Instream	**score**	**weight**	**Product**	**Maximum Score**
Water Abstraction	25	14	350	350
Flow modification	25	13	325	325
Bed modification	24	13	312	325
Channel modification	24	13	312	325
Water quality	24	14	336	350
Inundation	24	10	240	250
Exotic macrophytes	23	9	207	225
Exotic fauna	12	8	96	200
Solid waste disposal	22	6	132	150
max score		100	2310	2500
% of total			92.40	
Class			**A**	
Riperian Zone				
Water abstraction	25	13	325	325
Inundation	24	11	264	275
Flow modification	25	12	300	300
Water quality	24	13	312	325
Indigenous vegetation removal	23	13	299	325
Exotic vegetation encroachment	24	12	288	300
Bank erosion	20	14	280	350
Channel modification	24	12	288	300
		100	2356	2500
% of total			94.24	
Class			**A**	

The drainage line and its surrounds, which could be taken for riparian area, are near-natural, hence the A classification.

Should the mining activity punch holes through the clay, the shallow un-confined ground water will predictably move further down through these "leaks" into the secondary, probably more confined aquifer that may be out of reach of the vegetation. This damage would be irreversible. Should this happen, the classification would move down even further.

It would be advantageous to the envisaged agricultural development if enough sand would remain on the clay layer for the crops to take root. It would be as advantageous if leave the clay layer intact, as shallow ground water would remain available for crops instead of escaping further down into the ground.

Table 3 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

10 Ecological Importance

The EIS 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 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.

The next step in this assessment would be to consider the fish in the Orange River at the confluence of the Hartbees River. The distance from the mining site to the Orange River was considered to be too long to warrant further assessment. Moreover, the flow contribution of the Hartbees River to the Orange River is too low to warrant such an assessment.

Table 4. Ecological Importance (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)

If the mining has been concluded, the classification for instream and riparian would probably be reduced to D, despite of rehabilitation.

This is in stark contrast with the next-door sub-catchment, which has been entirely transformed into an agricultural concern with a giant centre pivot irrigation system. If the same is to happen to the drainage line in question, the classification will predictably drop even lower. The decision-making authority will have to contemplate if this outcome is to be included in the current WULA.

This has to be considered against the background that these drainage lines are not important as far as aquatic habitat is concerned, as will be illustrated in the following assessments.

11 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.

If left to its own devices, the drainage line would remain as it is now, without the need for protection measures. However, if the sand winning and subsequent 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.

12 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.

It is fully accepted that the current drainage line will be fundamentally changed if the mining operation should go ahead and that no mitigation measure can be employed to stop this.

The following pertains to Table 5:

- Local means the drainage line below and adjacent to the drainage line.
- Regional means downstream of the drainage line into the Hartbees River.
- Short term means the operational period, that is the time during which sand is removed from the mining area.
- Long term means the end state of the mining operation. Once changed into agricultural land, it is not foreseen that this status would ever change.
- 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.

It is surmised that the most potential damage could have been done during the initial removal of the vegetation prior to the lifting of the sand. The rest of the subsequent impact is probably less and therefore rated at only medium.

Table 5 Summary of possible impacts

Possible Impact		Extent	Duration	Intensity	Significance	Probability	Confidence
Clearing of site. Vegetation removal	Without mitigation	Regional	Medium term	High	Medium	Probable	High
	With mitigation	Local	Short term	Low	Low	Low	High
Lifting of sand	Without mitigation	Regional	Medium term	Medium	Medium	Probable	High
	With mitigation	Local	Short term	Low	Low	Low	High
Transportation of sand	Without mitigation	Regional	Medium term	Medium	High	Probable	High
	With mitigation	Local	Short term	Low	Low	Low	High
Rehabilitation of mining site	Without mitigation	Regional	Long term	Medium	High	Probable	High
	With mitigation	Local	Long term	Low	Low	Low	High
Transform to agricultural land	Without mitigation	Regional	Long term	Medium	High	Probable	High
	With mitigation	Local	Long term	Low	Low	Low	High

13 Mitigation Measures

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

The main threat because of the mining phase is the movement of sediments down the drainage line and into the Hartbees River.

Mining should be done in blocks or sections. Once a block is mined out, it should be immediately rehabilitated. The area should be levelled and landscaped.

Any signs of erosion 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 path of the drainage line should remain the same as far as possible, despite of the mining.

Similar mining operation require berms and cut-off trenches to divert storm water away from the mining site. The rainfall in this instance is low. Consequently, no such infrastructure is required. Even during a very high rainfall event, it is not foreseen that enough sediments would be transported to pose a threat to the Hartbees River and lower down into the Orange River.

The single most threat to the Hartbees River during the subsequent end use is the agricultural return flow because of over-irrigation. This is overly evident in so many of these originally dry natural drainage lines turned into agricultural drainage channels. The impact on river's water quality is negative and deleterious. It is therefore expected that the ground moisture levels will be scientifically monitored and that irrigation will be adjusted accordingly, with return flow limited, if not eliminated altogether.

Mining waste, agricultural waste, 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.

The transport of sand present special problems, as the laden trucks can imprint deep tracks into the sandy access route and onto the mining area. These tracks constitute preferential storm water flow paths. These should be filled in and compacted. Storm water escape furrows should be constructed and maintained to divert storm water away from the access route all the way to the N14 trunk road. Pooling of storm water should be prevented.

Should a diesel spill occur, the contaminated soil should be lifted and disposed of on a suitable landfill site.

From the assessment it is evident that these mitigation measures can be successfully implemented. This is apart from a fundamentally changed drainage line that cannot be ameliorated. Best practice and an appropriate level of management will assure that the aquatic as well as terrestrial environment can be protected and not impacted upon more than is foreseen by the envisaged mining operation and subsequent agricultural development.

14 Risk Assessment

The assessment was carried out according to the interactive Excel table that is available on the DWS webpage. Table 6 is a replica of the Excel spreadsheet that has been adapted to fit the format of this report. The numbers in Table 6 (continued) represent the same activities as in Table 5.

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

Table 6 Risk Assessment

No.	Activity	Aspect	Impact	Significance	Risk Rating
1	Clearing of the site. Vegetation removal	Mobilisation of sediments	Sediments in Hartbees River	26	Low
2	Lifting of sand	Mobilisation of sediments	Sediments in Hartbees River	26	Low
3	Transport of sand	Mobilisation of sediments	Sediments in Hartbees River	26	Low
4	Rehabilitation of mining site	Mobilisation of sediments	Sediments in Hartbees River	26	Low
5	Operation agricultural land	Agricultural return flow	Transformation of aquatic habitat	80	Medium

Table 6 Continued Risk Rating

No	Flow	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Conse-quence
1	1	1	2	1	1.25	1	1	3.25
2	1	1	2	1	1.25	1	1	3.25
3	1	1	2	1	1.25	1	1	3.25
4	1	1	2	1	1.25	1	1	3.25
4	1	1	2	1	1.25	1	1	3.25
5	2	2	2	2	2	3	3	7

No	Frequency of activity	Frequency of impact	Legal issues	Detection	Likelihood	Significan-ce	Risk Rating
1	1	1	5	1	8	26	Low
2	1	1	5	1	8	26	Low
3	1	1	5	1	8	26	Low
4	1	1	5	1	8	26	Low
5	2	2	5	1	10	80	Moderate

The environmental risk to aquatic environment because of the envisaged mining operation are low. The risks of sand ending up in the Hartbees River are low, assuming that all mitigation measures are in place.

However, the environmental risk to the aquatic environment directly downstream of the envisaged agricultural development is rated as medium. There is a risk that agricultural return flow will change the downstream drainage line to the Hartbees River into a wet area that is naturally dry most of the time. This return flow will probably contain fertilizers. The result would predictably be a substantial growth of reeds such as *Phragmitis australis*. This is commonplace in similar development in the area.

This impact is not expected to stretch into the Hartbees River. The confluence is 250m away from the proposed mining area and the growth of reeds, although difficult to predict, would probably not stretch further down the drainage line more than 100m. Hence the environmental risk to the Hatrbees River is rated as low.

15 Resource Economics

The goods and services delivered by the environment, in this case the drainage line 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 7) is an accepted manner to visually illustrate the resource economic footprint the drainage line, from the data in Table 7.

Table 7. Goods and Services

Goods & Services	Score
Flood attenuation	4
Stream flow regulation	4
Sediment trapping	4
Phosphate trapping	1
Nitrate removal	1
Toxicant removal	1
Erosion control	4
Carbon storage	1
Biodiversity maintenance	2
Water supply for human use	0
Natural resources	1
Cultivated food	1
Cultural significance	1
Tourism and recreation	0
Education and research	1

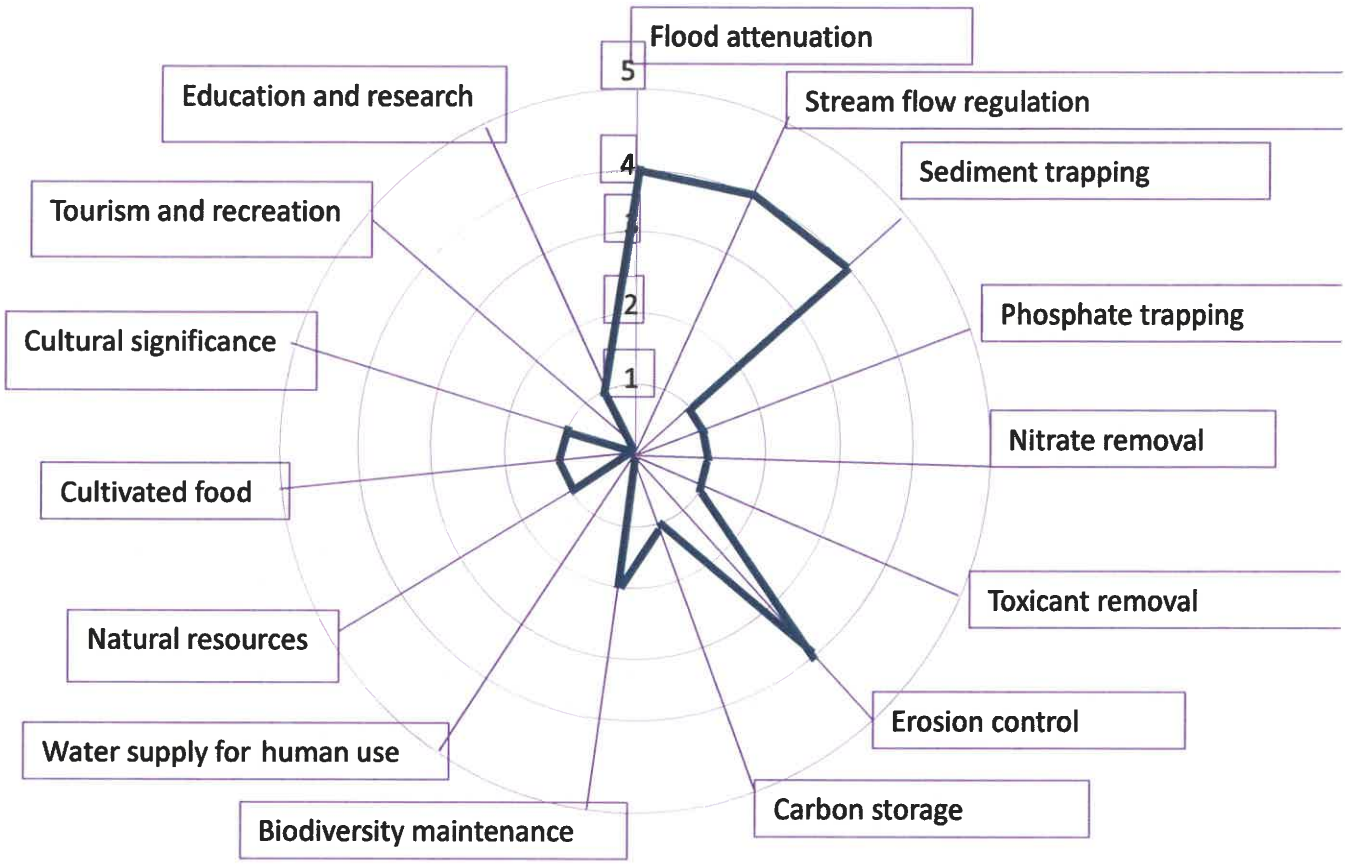

Figure 7. Resource Economics Footprint of the drainage line

The size of the star shape of Figure 14 attracts the eyes of the decision-makers. This shape is small, indicating that the water course has a small economic foot print. Apart from flood attenuation, stream flow regulation and sediment trapping, the drainage line is not important.

However, once the agricultural venture takes root, the scenario would change. Flood attenuation, nutrient, toxicant and sediment trapping and erosion control would become all important. The drainage line and surround would be intensively used for food production. Some of the environmental services rendered would increase in magnitude. The star shape would increase in size, but not for environmental conservation reasons. It would not contribute to biodiversity. The one leg of the star shape would shrink.

Even the reeds that would possibly grow in the drainage line below the agricultural land would serve a purpose. It would limit impacts. It is surmised that impacts would be prevented from moving further down the drainage line.

16 Conclusions

Figure 8 has been adapted from one of the most recent DWS policy documents.

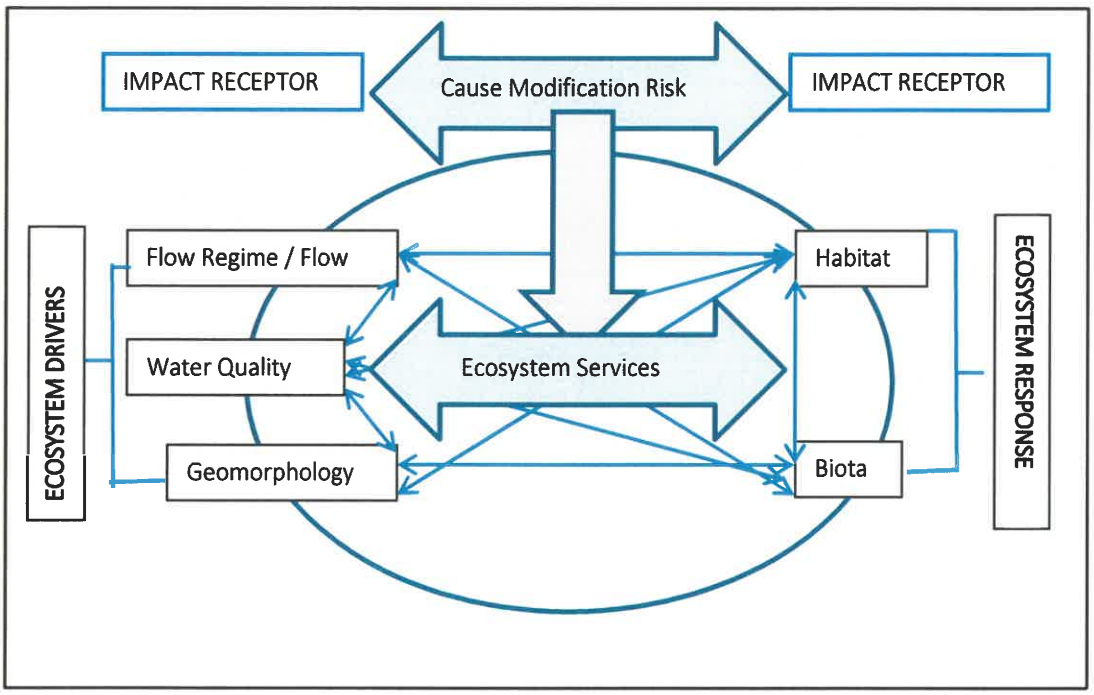

Figure 8 Minimum Requirements for a S21(c) and (i) Application

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

The planned mining activities and eventual agricultural expansion would obviously and greatly alter the drainage line. 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. Apart from this, the banks of the Hartbees River are already exploited, with habitat impacted upon in a varying degree.

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

17 References

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18 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:
Name of the company: WATSAN Africa Date: 23 August 2018

19 Résumé

Dr Dirk van Driel
PhD, MBA, PrSciNat, MWISA
Water Scientist

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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
- 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