KAI !GARIB

MUNICIPALITY

Fresh Water Report

for the proposed new

WASTEWATER TREATEMENT WORKS

Augrabies, District Kakamas

A requirement in terms of the National Water Act (36 of 1998).
June 2025

bvi 50 YEAR CELEBRATION EST 1967-2017

• ENGINEERING • PROCUREMENT • MANAGEMENT

EnviroAfrica

Environmental Management and Impact Assessment
Omgewingsbestuur en Impakbeoordeling

Executive Summary

Augrabies is a small town to the northwest of Kakamas in the Northern Cape, along the southern bank of the Orange River. It does not have a wastewater treatment works. Sewage is stored in conservancy tanks from where it is transported in tanker trucks to the Kakamas wastewater treatment works. Transport costs are high and unsustainable.

Moreover, the Kakamas wastewater treatment works is not coping with the current demands. These demands will increase as the population grows. The treated sewage effluent is released into the Orange River. This effluent does not meet national effluent standards.

The national Department of Water and Sanitation with its Regional Bulk Infrastructure Grant programme established the possibility for the construction of a new WWTWs on the outskirts of Kakamas. The civil engineering consultance company BVi of Upington produced a feasibility study for regional wastewater treatment works, among other for Augrabies.

The environmental authorisation process for these envisaged wastewater treatment works has now commenced. Enviro Africa Northern Cape was appointed to carry out the environmental impact assessment in terms of the National Environmental Management Act. This process has started and is ongoing. Likewise, WATSAN Africa of Knysna has been appointed to deal with the water use license applications in term sof the National Water Act.

Government Notice 509 in terms of the National Water Act demands that a Risk Matrix be completed. The Risk Matrix indicated that a General Authorisation is the appropriate level of authorisation.

The impacts of the proposed Augrabies wastewater treatment works on a small and already impacted sub-catchment are negligible. The Department of Water and Sanitation and its regional office may therefore exclude some of the Section 21 articles of the National Water Act from the mandatory Water Use Licence Application.

Index

Abbreviations

Critical Biodiversity Area	CBA
Department of Fisheries, Forestry and the Environment	DFFE
Department of Water and Sanitation	DWS
Ecological Importance	EI
Ecological Importance and Sensitivity Class	EISC
Ecological Sensitivity	ES
Ecological Support Area	ESA
Environmental Impact Assessment	EIA
Electronic Water Use License Application (on-line)	eWULAAS
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
Present Ecological State	PES
Section of an Act of Parliament	S
South African Council of Natural Scientific Professions	SACNASP
South Africa National Biodiversity Institute	SANBI
Wastewater Treatment Works	WWTWs
Water Use License Application	WULA

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1 Introduction

Several small towns along the lower Orange River, in the Kakamas district, do not have WWTWs, like the town of Augrabies, of which the sewage is collected in conservancy tanks, from where it is transported in tanker truck to the Kakamas WWTWs. The Kakamas WWTW's is an anaerobic pond system of which the current capacity is too small to adequately treat wastewater from Kakamas, let alone from that of the surrounding towns. Treated sewage effluent does not meet official quality standards.

The local authority, the Kai !Garib Municipality appointed the civil engineering consultancy BVi of Upington to conduct a pre-feasibility study. This study was designed to provide answers to the district's current distraught wastewater situation. The study recommended that Augrabies should consider having its own small WWTWs. Bearing the current and ongoing transport costs was deemed financially unsustainable.

One of the first steps to realise a WWTWs for Augrabies is to start the processes for the official environmental approvals.

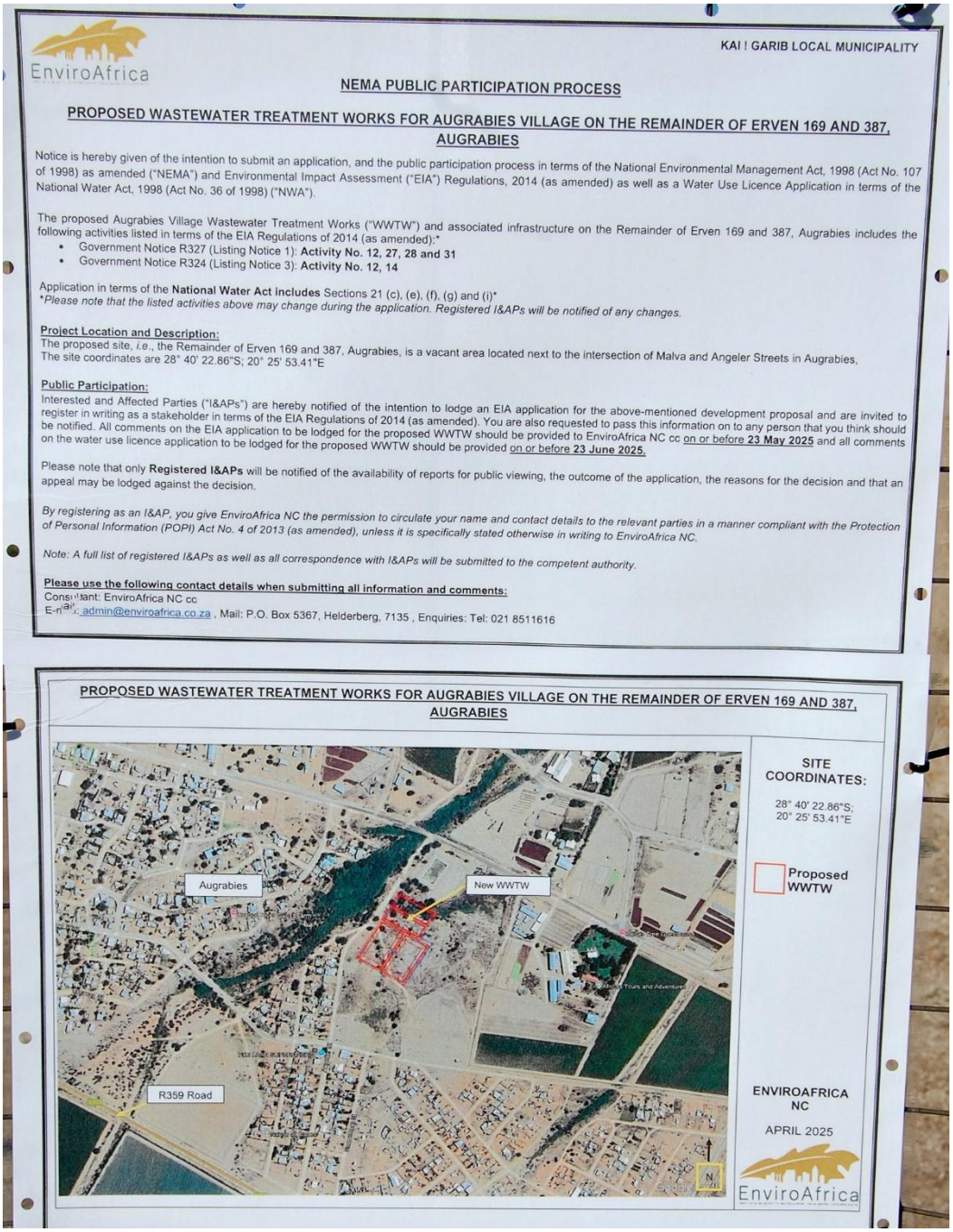
Enviro Africa (Northern Cape) was appointed to conduct the EIA in terms of NEMA. The public participation process is now ongoing (Figure 1).

Likewise, Dr Dirk van Driel of WATSAN Africa in Knysna was appointed to apply for a water use license in terms of the NWA. The report must contain adequate information for government officials to make an informed decision. The report has developed according to a set format and contents, with premeditated and standardised assessments.

GN 509 demands that a Risk Matrix be completed. The Freshwater Report must expain the numerical values that are assigned for the various aspects of the Risk Matrix. The Risk Matrix is a structured numerical mechanism to help decide about the correct level of authorisation. This can either be a General Authorisation of a License. The completed Risk Matrix must be signed by a registered SACNASP scientist.

The Freshwater Report must contain adequate information for the EIA as well. Hence, several specified assessments have been included.

A site visit was conducted on 9 April 2025, along with several other specialists concerned with this project.



EnviroAfrica

KAI ! GARIB LOCAL MUNICIPALITY

NEMA PUBLIC PARTICIPATION PROCESS

PROPOSED WASTEWATER TREATMENT WORKS FOR AUGRABIES VILLAGE ON THE REMAINDER OF ERVEN 169 AND 387, AUGRABIES

Notice is hereby given of the intention to submit an application, and the public participation process in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended ("NEMA") and Environmental Impact Assessment ("EIA") Regulations, 2014 (as amended) as well as a Water Use Licence Application in terms of the National Water Act, 1998 (Act No. 36 of 1998) ("NWA").

The proposed Augrabies Village Wastewater Treatment Works ("WWTW") and associated infrastructure on the Remainder of Erven 169 and 387, Augrabies includes the following activities listed in terms of the EIA Regulations of 2014 (as amended):*

- Government Notice R327 (Listing Notice 1): **Activity No. 12, 27, 28 and 31**
- Government Notice R324 (Listing Notice 3): **Activity No. 12, 14**

Application in terms of the **National Water Act includes** Sections 21 (c), (e), (f), (g) and (i)*
**Please note that the listed activities above may change during the application. Registered I&APs will be notified of any changes.*

Project Location and Description:
The proposed site, *i.e.*, the Remainder of Erven 169 and 387, Augrabies, is a vacant area located next to the intersection of Malva and Angeler Streets in Augrabies.
The site coordinates are 28° 40' 22.86"S; 20° 25' 53.41"E

Public Participation:
Interested and Affected Parties ("I&APs") are hereby notified of the intention to lodge an EIA application for the above-mentioned development proposal and are invited to register in writing as a stakeholder in terms of the EIA Regulations of 2014 (as amended). You are also requested to pass this information on to any person that you think should be notified. All comments on the EIA application to be lodged for the proposed WWTW should be provided to EnviroAfrica NC cc on or before **23 May 2025** and all comments on the water use licence application to be lodged for the proposed WWTW should be provided on or before **23 June 2025.**

Please note that only **Registered I&APs** will be notified of the availability of reports for public viewing, the outcome of the application, the reasons for the decision and that an appeal may be lodged against the decision.

By registering as an I&AP, you give EnviroAfrica NC the permission to circulate your name and contact details to the relevant parties in a manner compliant with the Protection of Personal Information (POPI) Act No. 4 of 2013 (as amended), unless it is specifically stated otherwise in writing to EnviroAfrica NC.

Note: A full list of registered I&APs as well as all correspondence with I&APs will be submitted to the competent authority.

Please use the following contact details when submitting all information and comments:
Consultant: EnviroAfrica NC cc
E-mail: admin@enviroafrica.co.za , Mail: P.O. Box 5367, Helderberg, 7135 , Enquiries: Tel: 021 8511616

PROPOSED WASTEWATER TREATMENT WORKS FOR AUGRABIES VILLAGE ON THE REMAINDER OF ERVEN 169 AND 387, AUGRABIES

Figure 1 Public Participation

2 Location

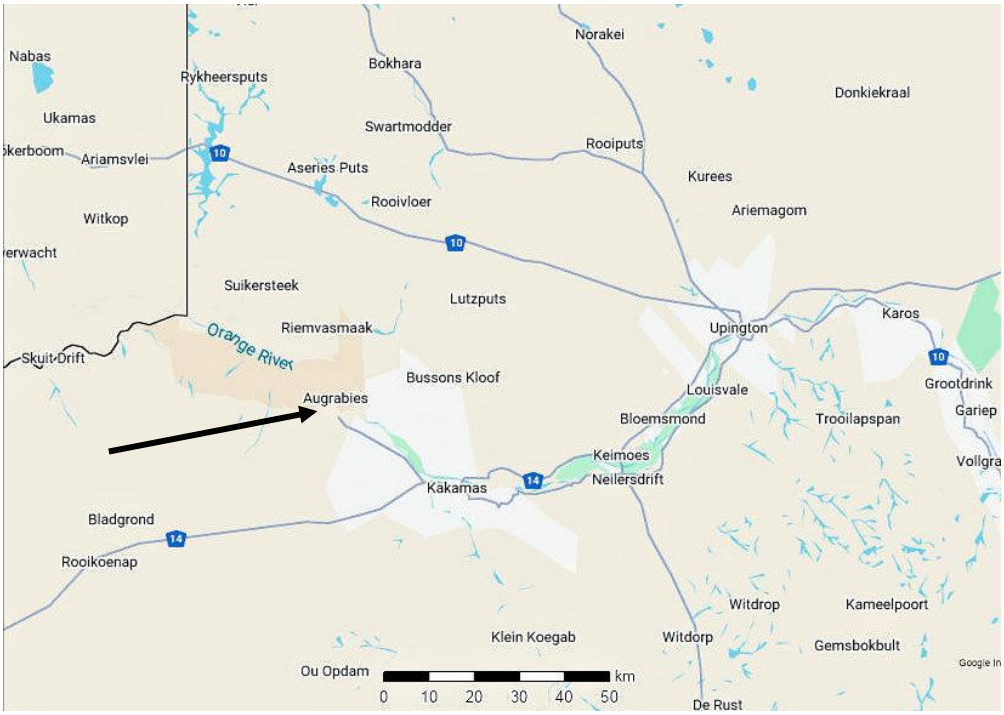


Figure 2 Augrabies WWTWs location

Augrabies is 22.5km to the northwest of Kakamas. Take the N14 out of Kakamas to the west, turn off to the right to Augrabies.

The coordinates are as follows

28°40'23.90"S and 20°25'53.32"E

3 Quaternary Catchment

Augrabies is in the D81A quaternary D81A catchment

4 Legal Framework

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

S19 *The owner of land… on which….any activity is performed….which causes pollution or is likely to cause pollution…… must take all reasonable measures to prevent such pollution….*

The release of treated sewage effluent into the Orange River is perceived as such an activity.

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

The proposed development is spanning the banks of a drainage line. The drainage lines would be altered, should the proposed activity go ahead.

S21 (e) *Engaging in a controlled activity as identified in S37(1)*

The irrigation of treated sewage effluent onto a sports field, as is currently contemplated, is a declared activity.

S21 (f) *Discharging waste of water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit*.

The release of treated sewage effluent into a water resource such as the Orange River is such an activity.

S21 (g) *Disposing of waste in such a way that it may detrimentally impact on a water resource.*

Treated sewage effluent and sludge emanating from WWTWs are regarded as waste that may impact detrimentally on water resources.

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

The proposed development will alter the characteristics of the drainage lines in the upper reaches of the affected sub-catchments.

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 32m of a water course without the consent of the Department of Environmental Affairs and its provincial representatives. The proposed development is in a drainage line, which fully qualifies as a water course. Consequently, this regulation is relevant to this application.

5 Kakamas Climate

https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/kakamas_south-africa_993014

Kakamas is the closest town to Augrabied for which on line climate data is available.

Kakamas is in South Africa's arid region, semi-desert, bordering onto the Kalahari desert to the north.

Kakamas normally receives about 62mm of rain per year, with most rainfall occurring mainly during summer (Figure 3). The summers are exceedingly hot, with maximum temperatures well into the 40's. Overnight temperatures in winter can drop below zero. This is a harsh desert-like climate with extreme temperatures and very little rain.

Kakamas is arid. During 4 months of the year, it may not rain at all. Rainfall is erratic, intense with violent electric thunderstorms and sudden downpours. During these very scarce rainfall events, drainage lines may convey water. The flow may be strong, of short duration, a day or even less, with a fierce erosion potential. The drainage lines must have been formed over millennia since historical times.

The contribution of the drainage lines to the flow in the Orange River is negligible.

The economy is entirely dependent on water abstraction from the Orange River. Successful farming depends on precise irrigation systems. It is therefore obligatory that the treated sewage effluent from the proposed new WWTWs be used for irrigation. It should not be merely let out into the Orange River.

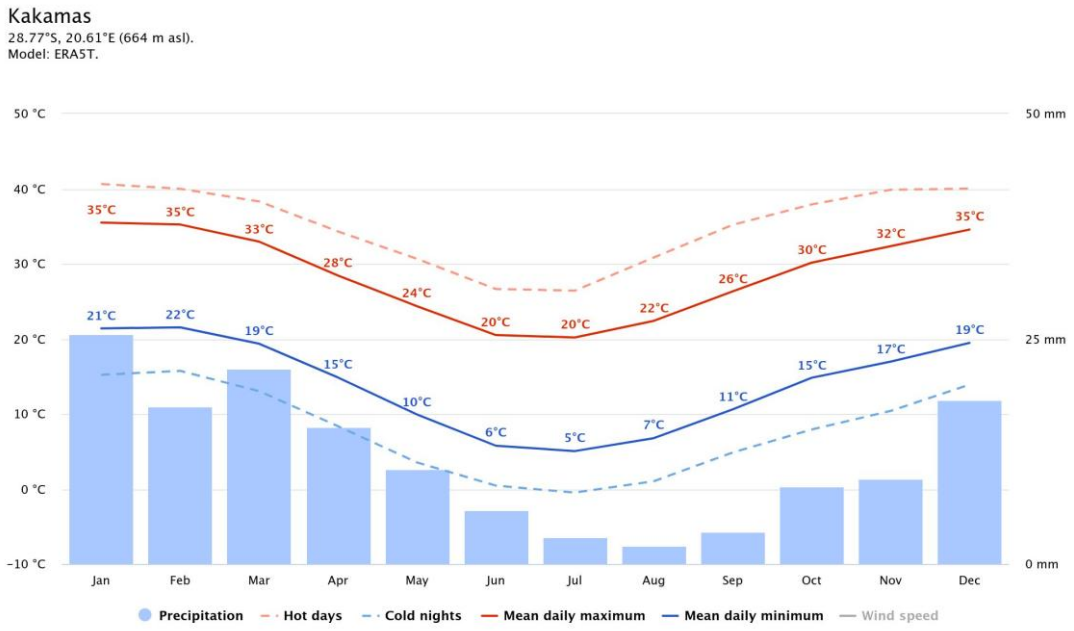


Figure 3 Kakamas Climate

6 The Project

Figure 4 WWTWs Lay-Out (Meiring, 2022)

The proposed WWTWs will consist of the following:

1 x Inlet Works
2 x Aerated Facultative Ponds
2 x Aerobic Maturation Ponds
1 x Chlorine Contact Tank

The proposed WWTWs must have a design capacity of 500m^3 a day.

No conduits or pipes are indicated for the conveyance of raw sewage and treated sewage effluent. Sewage will arrive at the WWTWs with tanker trucks. Treated sewage effluent will be used for irrigating sports fields.

In case of emergencies, the treated effluent will have to be released down the drainage line.

7 Conservation Status

DFFE Screening Tool

The online DDFE screening tool was run for the area around the proposed WWTWs.

Table 1 Screening Tool Results

Theme	Rating
Animal species Aquatic biodiversity Avian Plant species. Terrestrial biodiversity	High Low Not mentioned Medium Low

Aquatic biodiversity Theme

Even though the ecological sensitivity is rated as low, a Freshwater Report and possible WULA is still required because of the demands of GN509. Moreover, the proposed WWTWs is in the flow path of a south flowing drainage line towards the Orange River, a conduit that may contain treated sewage effluent, even though only during emergency conditions.

The Orange River is listed as a NFEPA.

Animal species theme

Two bird species are listed:

Lanner falcon *Falco biarmicus*
Ludwig's bustard *Neotis ludwigii*

The lanner falcon is a cosmopolitan species. On a regional level, its habitat may be shrinking, but internationally it is rated as least concern.

Ludwig's bustard is prone to flying into overhead electricity cables. The propose WWTWs won't have such high structures that may pose a threat to these birds.

Plant species theme

One unnamed numbered species is listed of which the name may not be published for conservation reasons.

The vegetation types likely to be encountered is Lower Griep Broken Veld (Least Concern), Kalahari Karroid Shrubland (Least Concern) and along the Orange River Lower Gariep Alluvial Vegetation, which is endangered because of the large-scale viticulture.

Terrestrial biodiversity theme

It was listed as not sensitive, not important. For a patch of degraded land surrounded by vineyards and degraded by urban development this listing is probably applicable.

8 Drainage Lines

The landscape around much of the Lower Orange River and the Hartbees 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 24).

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.

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.

Around the Orange River, the Hartbees 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.

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

Drainage line wash fields

Smaller drainage lines all over the landscape are marked by lines of driedoring (*Rhigozum trichotonum*) rather than red iron oxide depositions. These woody and thorny bushes find more soil moisture along the drainage lines than elsewhere, hence the denser stand. These small lines are visible on Google Earth images. This landform can be described as drainage line wash fields.

Sheet wash plains

These drainage lines connect to one another in a 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, migrates sideways, left and right, the flow slows down, deposits its sediment load to create sandy or gravely sheet wash plains. Sediment transportation and deposition are clearly visible.

Where larger drainage lines fuse in this manner lower down sub-catchments, much larger sheet wash plains are evident.

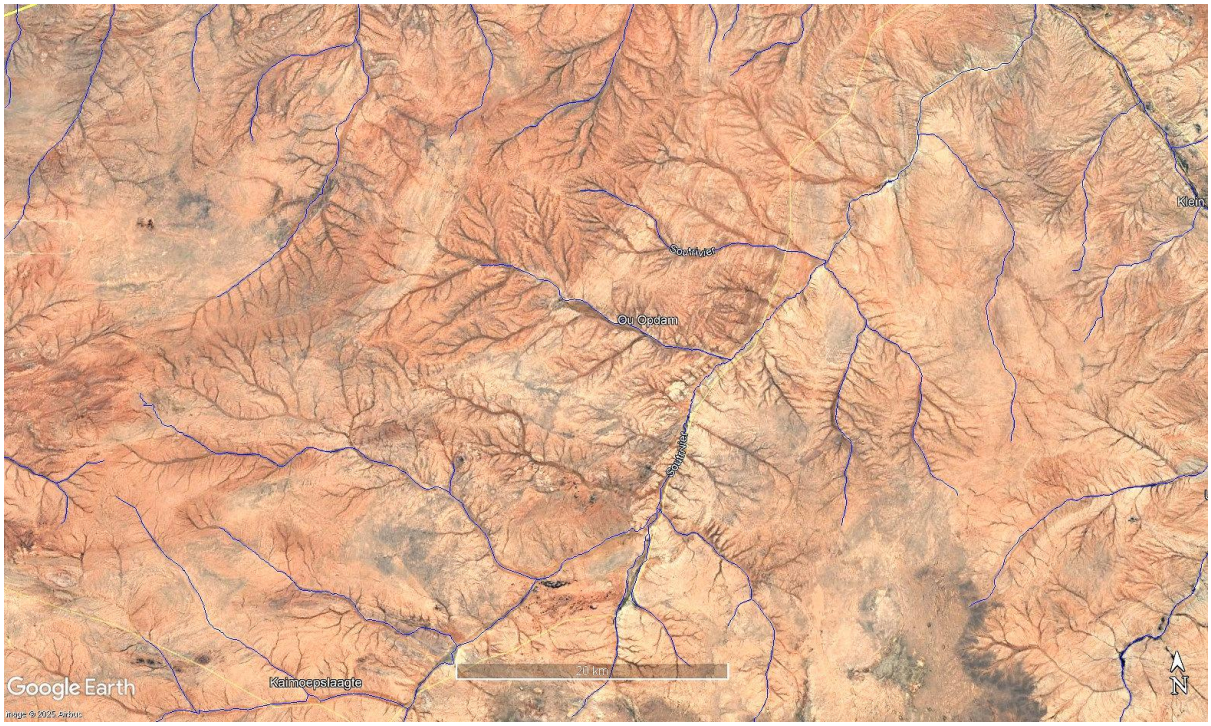


Figure 5 Drainage Lines

Smaller drainage lines all over the landscape are marked by lines of driedoring (*Rhigozum trichotonum*) rather than red iron oxide depositions. These woody and thorny bushes find more soil moisture along the drainage lines than elsewhere, hence the denser stand. These small lines are visible on Google Earth images. This landform can be described as drainage line wash fields.

9 Biomonitoring the Lower Orange River

9.1 Methodology

The biomonitoring was carried out according to the description of Dickens & Graham (2002).

Biomonitoring was carried out on the Lower Orange River during site visits for successive WULAs. So far 14 samples have been analyzed at 13 localities (Table 2). The site furthest east was at Hopetown and furthest west at Augrabies, with Upington in the middle. Thirteen of these localities are located upstream of the Augrabies Falls. One sample was analyzed at Styerkraal just east of the border post of Onseepkans downstream of the Augrabies Falls.

The river is braided, featuring numerous streams and islands. The river sports many rapids and riffles but also pool-like features where the river is broad and flowing slower.

The bottom is mainly muddy, with some large rocky outcrops in the middle of the river.

9.2 Impacts on the Lower Orange River

The river is extensively used for agriculture, with its banks transformed into vineyards. A multitude of large electric water pumps have been placed in the river to abstract large volumes of water for irrigation. Abstraction significantly lowers the flow in the river.

Flood protection berms were built along most of the river's banks. The Department of Water Affairs built these berms, which have been part of the landscape for decades. The berms keep flood water out of adjacent agricultural land and has denaturalised the riparian zone.

The single most impact on the Orange River are the two large dams, the Gariep Dam and the Vanderkloof Dam. The river flow was adjusted to a more consistent regime, unlike the previous varied flow with high peak flow and low drought flows.

The Lower Orange River is lined with a dense system of mostly dry drainage lines. These drainage lines only flow during and shortly after heavy rains. Their contribution to the flow of the Orange River is insignificant. Most of the flow comes from the Lesotho Highlands and some from the Vaal River. However, many of these drainage lines were transformed into engineered agricultural return flow furrows that carries the excess of over irrigation back to the Orange River. Agricultural return flow adds much to the nutrient load of the Orange River because runoff contains fertilizer. Nitrogen is added in large quantities. Since phosphorus readily binds to the soil, not much phosphorus is added.

Return flow can contain a heavy silt load, thereby elevating turbidity in the river.

Pesticides in agricultural runoff are suspected to significantly lower the SASS5 score in biomonitoring results.

The banks of the Orange River in the area are densely overgrown with Spaanse Riet (*Arundo donax*). This is classified as an aggressive and exotic invasive plant, which effectively prevents access to the river. The reeds result in a homogeneous aquatic habitat. This lack of variation supresses the SASS5 score, with only a limited number of aquatic macroinvertebrate species present in this habitat.

9.3 Lower Orange River Biomonitoring Results

The biomonitoring results have been captured in Table 2 and depicted in Figure 6.

The classes from A to F in Figure 20 has been assigned for mature rivers on flood plains such as the Lower Orange River.

Only 2 of the samples were classified a good and relatively unimpacted (Class A). Five were in Class B and C, which can be regarded as acceptable under the circumstances of an impacted river reach. These classes can possible be labelled as the ideal, a compromise between agriculture and aquatic ecological functioning.

Four samples were poor (Classes E and F), an undesirable situation.

The one sample downstream of the Augrabies Falls was extremely poor.

9.4 Limitations

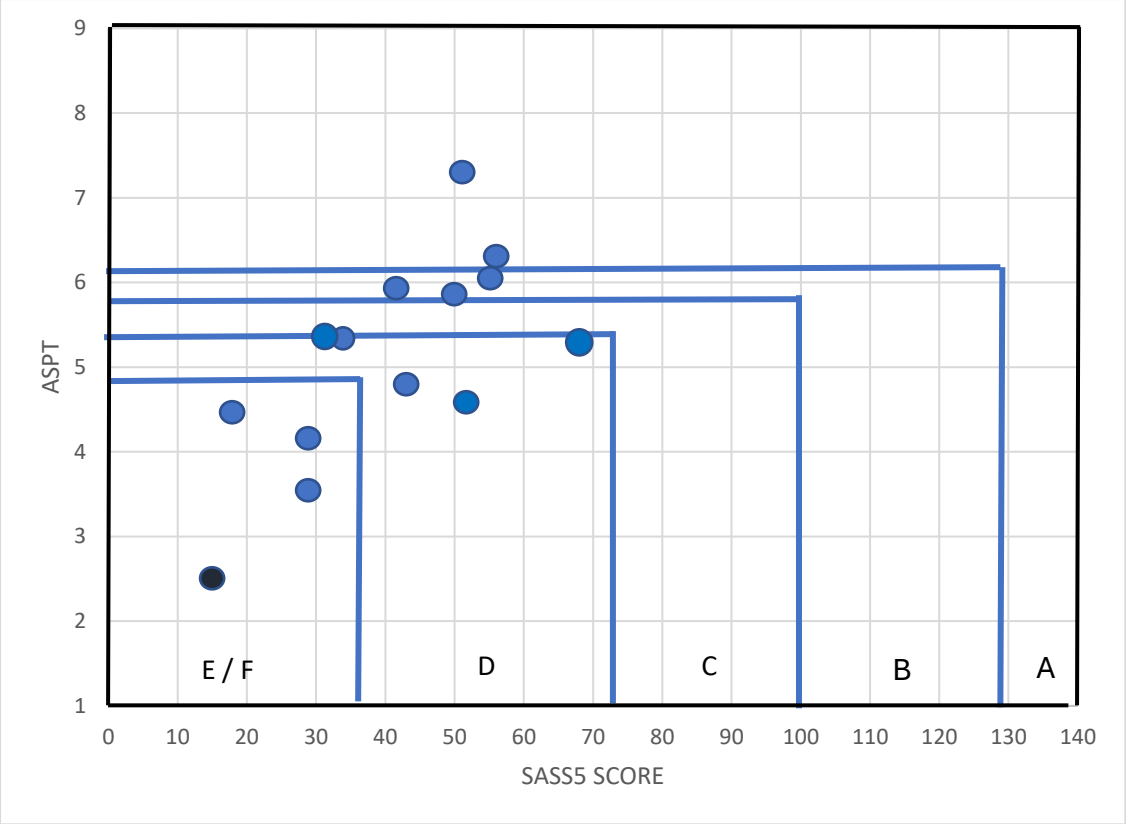
The Department of Water and Sanitation (DWS) implements a systematic and scheduled biomonitoring program across the nation, including the Lower Orange River. This gives, no doubt, a much better indication of the state of the river than self-collected data. Because this data is not available to the consulting fraternity, self-collected data such as that of Figure 25 must suffice.

Moreover, during the site visit for the Kakamas WWTWs, sampling in the Orange River was not possible because of the strong flow, but more because of the very high sediment load.

The lower Orange River in the Kakamas area is generally in Class C, measurably impacted, but with most of the ecological functioning still intact. More sampling is required to come to a trustworthy conclusion.

Table 2 Biomonitoring in the Lower Orange River

Locality	Coordinates	Date	SASS5	No Taxa	ASPT
Augrabies Lair trust	28°38’41.53S 20°26’08.49E	5/09/17	18	4	4.5
Augrabies Lair Trust	28°38’41.53S 20°26’08.49E	5/10/17	43	9	4.8
Groblershoop	28°52’31.80S 21°59’13.49E	14/8/18	41	7	5.9
Kakamas Triple D	28°45’08.37S 20°35’06.16E	15/8/18	50	9	5.6
Hopetown Sewer	29°36’05.07S 24°06’05.00E	7/10/18	29	7	4.1
Hopetown Sewer	29°36’08.06S 24°21’06.16E	7/10/18	29	8	3.6
Keimoes Housing	28°42’37.12S 20°55’07.81E	8/02/19	51	7	7.3
Upington Erf 323	28°27’11.91S 21°16’14.02E	12/2/19	56	9	6.2
Upington Affinity	28°27’11.91S 21°16’14.02E	20/5/19	54	9	6
Styerkraal	28°27’25.28S 21°15’01.87E	21/5/19	15	6	2.5
Grootdrink Bridge	28°17’15.30S 21°03’50.87E	17/5/20	34	7	5.3
Turksvy Dam	28°27’09.21S 21°17’20.72E	17/5/21	69	13	5.3
Belurana Upington	28°27’49.79S 21°14’32.67E	15/12/21	51	11	4.6
Bakenrant	28°38’35.84S 20°26’07.96E	30/9/22	33	6	5.5



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

Figure 6 Lower Orange River Biomonitoring results

10 The Drainage Line and its Sub-Catchment

Figure 7 Sub-Catchment

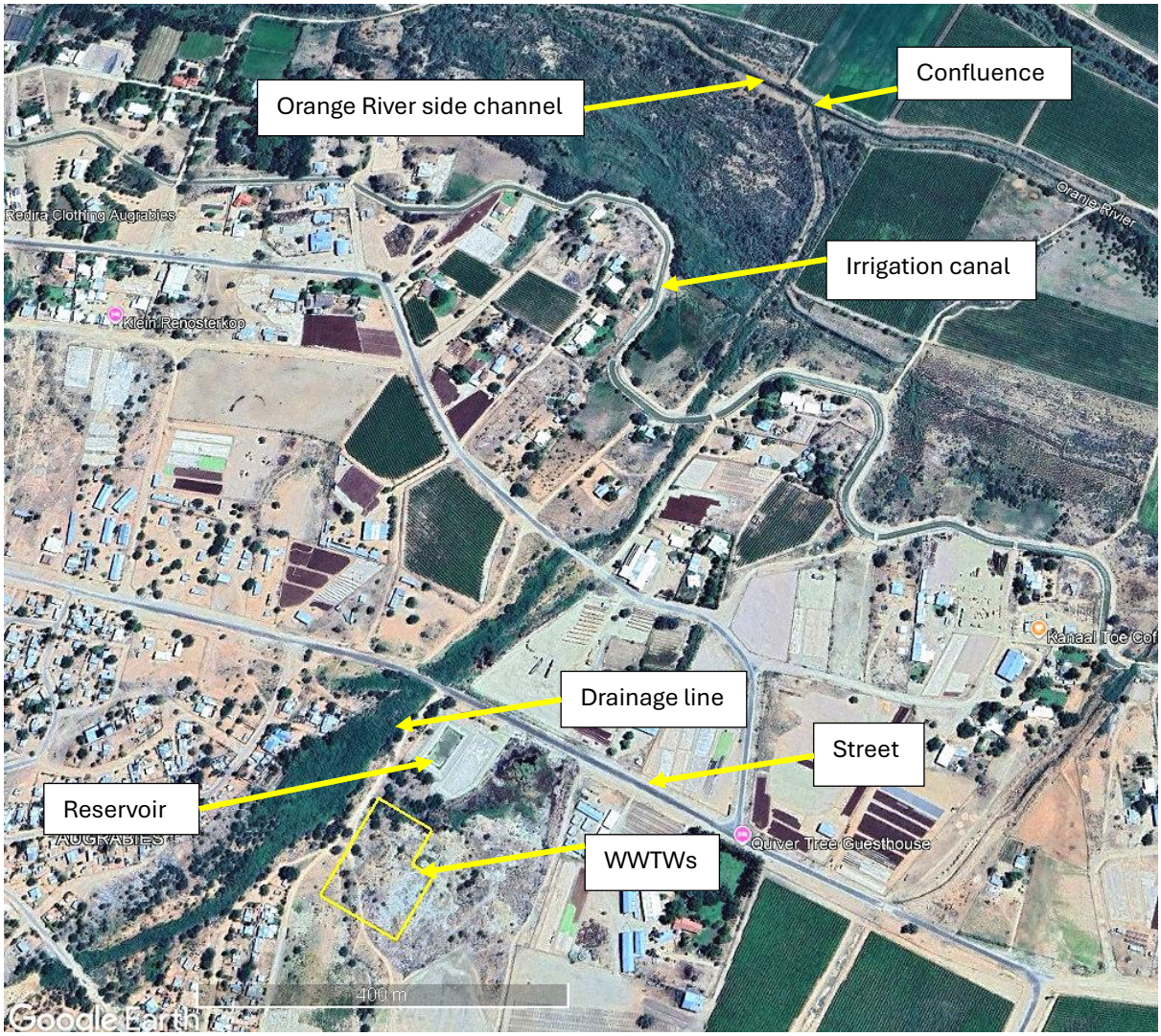


Figure 8 Drainage line's downstream reach

The proposed WWTWs will be constructed in the downstream reach of a drainage line with a catchment area of 7700ha (Figure 7). The sub-catchment is 19.8km long and 5.7km wide at its widest point. The sub-catchment is flanked by much larger sub-catchments on either side, some of which are many thousands of hectares.

The highest point of the sub-catchment is at 842masl and at its confluence with a side cannel of the Orange River, the elevation is 636masl. This translates into an average slope of 1 vertical meter in every 100 horizontal metres. This is a very gentle slope, giving rise to slow runoff velocities and a low erosion potential. The middle reach has extensive sheet wash plains.

The proposed site for the WWTWs (Figure 8) is marked by a set of concrete-lined reservoirs (Figure 9). The WWTWs is planned alongside and to the south of these reservoirs. It does not seem as if these reservoirs are currently in use.

The drainage line passes the proposed site on the west (Figure 8). The drainage line here is overgrown with reeds (Figure 9). To the east of the site, next to the reservoir, overgrown with reeds (Figure 11), runoff backs up against a street (Figure 12) that passes from east to west to the north of the reservoir. It is doubtful if this water is a result from rain in this arid area. It is rather from agricultural return flow out of the upstream vineyards. Hence the heavy growth of reeds, from water containing nutrients, fertiliser.

Upstream from the site, the drainage line is heavily overgrown with reeds, with swarthaak (*Senegalia mellifera*) trees and some invasive *Prosopis* trees.

Moving downstream, the drainage line is in an earthen canal to it confluence with a side channel of the braided Orange River (Figure 13).

The drainage line passes underneath the irrigation canal through a set of culverts (Figure 14).

The drainage line passes through the Augrabies neighbourhood, with its economic and sub-economic housing (Figure 15). Next to the designated site is a cemetery (Figure 16).

The designated site is heavily disturbed, with quarrying and dumping (Figure 17).

Outside of town, to the south, is the largely undisturbed expanse of the Northern Cape semi-desert, with its drainage lines and sub-catchments. Approximately 15% of the sub-catchment surface area next to the Orange River is heavily impacted. The rest of the area, the larger part, is almost pristine, only crossed by a trunk road, a dirt road and what looks like a landing strip. Sheep and goats graze the sub-catchment.

Much of the town's sewage is still handled with simple pit latrines (Figure 18). Perhaps this would change for the better once the new WWTWs is constructed.

Figure 9 Reservoir

Figure 10 Overgrown drainage line

Figure 11 Reeds to the east of the site

Figure 12 Runoff backing up against the street

Figure 13 Earthen canal

Figure 14 Culverts

Figure 15 Augrabies housing

Figure 16 Cemetery

Figure 17 Disturbed site

Figure 18 Outhouse

11 Present Ecological State

The PES and EIS are protocols that have been produced by Dr Neels Kleynhans (Table 3, 4) 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.

The sub-catchment's two contrasting parts, the smaller part utterly impacted and the larger part almost pristine make it difficult to come up with a value for the entire sub-catchment. This is the best effort towards an average score, as is required for this assessment. If assessed separately, the upper sub-catchment would be in Class B and the lower sub-catchment in Class E.

Table 3 Habitat Integrity according to Kleynhans, 1999

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

Table 4 Present Ecological State

Present Ecological State of the drainage line

Instream	Score	Weight	Product	Maximum score
Water abstraction	25	14	350	350
Flow modification	18	13	234	325
Bed modification	17	13	221	325
Channel modification	17	13	221	325
Water quality	16	14	224	350
Inundation	17	10	170	250
Exotic macrophytes	20	9	180	225
Exotic fauna	15	8	120	200
Solid waste disposal	14	6	84	150
Total		100	1804	2500
% of total			72.2	
Class			C	
Riparian				
Water abstraction	25	13	325	325
Inundation	16	11	176	275
Flow modification	17	12	204	300
Water quality	16	13	208	325
Indigenous vegetation removal	19	13	247	325
Exotic vegetation encroachment	19	12	228	300
Bank erosion	21	14	252	350
Channel modification	16	12	192	300
Total			1832	2500
% of total			73.3	
Class			C	

Both parts together rendered a Class C, with some impacts but with ecosystem functioning still intact.

The proposed WWTWs won't change this situation, as it would add to the impacts in the downstream part but would have no impact on the larger upper part of the sub-catchment.

However, emergencies can have consequences, as partly treated sewage effluent can reach the side channel of the Orange River. The confluence is more than a kilometre away from the WWTWs, which limits the risks.

12 Ecological Importance

The PES and EIS are protocols that have been produced by Dr Neels Kleynhans (Table 3, 4) 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.

The sub-catchment's two contrasting parts, the smaller part utterly impacted and the larger part almost pristine make it difficult to come up with a value for the entire sub-catchment. This is the best effort towards an average score, as is required for this assessment. If assessed separately, the upper sub-catchment would be in Class B and the lower sub-catchment in Class E.

Both parts together rendered a Class C, with some impacts but with ecosystem functioning still intact.

The proposed WWTWs won't change this situation, as it would add to the impacts in the downstream part but would have no impact on the larger upper part of the sub-catchment.

However, emergencies can have consequences, as partly treated sewage effluent can reach the side channel of the Orange River. The confluence is more than a kilometre away from the WWTWs, which limits the risks.

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

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

There are no fish in the drainage line. According to this assessment, the drainage line is ecologically unimportant.

13 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.

In these arid climes vegetation is slow to grow back. It takes decades, if not a millennium. Once the drainage line ais disturbed, it will not easily recover. The drainage line is ecologically sensitive

14 EISC

Table 6 EISC

	Score
Rare and endangered species	0
Populations of unique species	0
Species / Taxon richness	2
Diversity of habitat	2
Migration Route/ Breeding and feeding site for wetland species.	3
Sensitivity to water quality changes	1
Flood storage, energy dissipation, particulate / element removal.	2
Protection status	0
Ecological integrity	3
Average	1.4
Score	Low

Score guideline:
Very High 4, High 3, Moderate 2, Low 1, None 0
Confidence Rating
Very High 4, High 3, Moderate 2, Low 1

The DWS demand that the aquatic habitat be placed in a category according to the EISC methodology (Table 6). The EISC is one of the essential items that is required for the Risk Matrix.

The EISC score is “Low”. This score can be higher for the Northern Cape’s larger drainage lines. Compared to these, this drainage line and its sub-catchment at Augrabies is still small, hence the “Low” score.

15 Numerical Significance

Decision-makers often press on a numerical score for Significance**.** The score takes into consideration both the environmental value of the site and the degree of impact.

Table 25.1, p48, Appendix provides a system for allocation values for each of the parameters Conservation Value, Extent, Duration, Severity and Likelihood about possible impacts These values are then entered into the equation on p49 to derive at a value for Significance. The value for Significance can subsequently be evaluated according to Table 25.1.2.

Table 25.1.2 provides a yardstick for decision-making to allow or disallow a development with its concomitant impact on the environment.

The scores that were given are entirely those of the specialist (Table 7), 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.

Table 7 Significance Score

Parameter	Score
Conservation value	1
Likelihood	5
Duration	5
Extent	1
Severity	5
Average	16
Significance	Low

16 Possible Impacts and Mitigating Measures

Flow modification.

If the new WWTWs treated effluent is used for irrigation, there won't be any additional flow down the drainage lines.

Permanent inundation

The drainage lines only have some flow during heavy rainfall events. They are dry for the rest of the time. The new WWTWs won't change any of this.

Water quality modification

As long as the new WWTWs treated effluent is used for the irrigation of sport fields, the drainage line won't be affected.

Sediment load modification

Soil will be loosened during the construction phase. None of this, along with sediment and debris must be allowed to move down the drainage lines along with the occasional stormwater. This is equally valid for the WWTWs and associated infrastructure.

The site and surrounding area are heavily disturbed. It is hoped that the area will be levelled and landscaped, along with the construction of the WWTWs, to reduce the sand, mud and silt ending up in the drainage line along with occasional stormwater.

Canalization

The new WWTWs will not result in any canalisation of the drainage lines. No canals will be constructed either. According to the current plan, sewage will arrive at the WWTWs in tanker trucks.

Topographic alteration

The envisaged WWTWs is not about to alter the topography of the landscape, other than the low-slung infrastructure of a typical small-scale WWTWs.

Terrestrial encroachment

Mostly dry drainage lines are terrestrial habitat. The new WWTWs will not change any of this.

Indigenous vegetation removal

There are no indigenous plants left on the site.

Invasive vegetation encroachment

There are signs on the site that *Prosopis* trees were removed and that the remaining trunks were burnt. This practice should continue, perhaps using more sophisticated methods.

Alien fauna

The upper sub-catchment is used for grazing sheep and cattle. This will carry on after the construction of the new WWTWs.

Over-utilization

The proposed WWTWs site is over-utilized, mutilated, as it is used as a quarry and dumping site. This is set to stop once the WWTWs construction starts.

Isolation / Migration

The drainage line now under consideration is isolated from the Orange River for most species by urban development and general disturbance. The WWTWs won't change any of this.

Ground water table.

It is not foreseen that the water table would be elevated as the ponds will be lined, with no leakage and infiltration into the ground. The groundwater must be monitored from a downstream borehole. Periodic sampling is mandatory, along with laboratory analysis. Analytic results must be officially and publicly available.

Waste

Portable toilets will be serviced by a reputable company during the construction as well as the operational phase, as is standard operating procedure.

It would take a major effort to clean up litter and waste in the township and surrounds.

17 Impact Assessment

Some of the authorities, such as the DFFE and its provincial offices 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.

The methodology is set out in the Appendix.

The impact assessment follows the stages in the life cycle of a project. These stages include planning, construction, operation, decommissioning and rehabilitation.

The impact assessment follows the stages in the life cycle of a project. These stages include planning, construction, operation, decommissioning and rehabilitation.

The planning phase does not have any impact for which a Risk Matrix can be completed, as during this phase nothing is happening on the ground. It is nevertheless worth mentioning, regarding the aquatic environment, that plans must be drafted to:

- Keep debris and sediment out of the aquatic habitat during construction.
- Keep treated sewage effluent not meeting official standards out of the aquatic environment.
- To maintain stormwater management infrastructure.

These aspects must be kept onto the budget for as long as the new WWTWs is in existence.

No provision is made for the closure and rehabilitation of the site because it is expected that it will prevail in the foreseeable future and beyond.

However, when the existing WWTWs is decommissioned, a rehabilitation plan is mandatory. This is a separate project with its own documentation and official approval.

Table 8 Impact Assessment

Description of impact: Construction Phase Levelling the ground Digging of trenches for foundations Construction of the new WWTWs Cleaning up after construction **Mitigation measures** Preserve buffer zones as much as possible, leave a strip of land between the WWTWs and the drainage line Prevent loose soil and sediments from moving down the drainage line along with storm water								
Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Local	Low	Temporary	Low	Definite	Certain	Irreversible	Irreplaceable
With mitigation measures								
Negative	Local	Very low	Temporary	Very low	Definite	Sure	Irreversible	Irreplaceable

An exhaustive environmental management plan must be drafted for the new WWTWs construction. An ECO must be appointed to overlook and monitor the environmental issues during construction.

Table 8 Impact Assessment continued

Description of impact: Operational Phase Operate the WWTWs according to acceptable and published standards Maintain the WWTWs **Mitigation measures** Maintain the WWTWs Monitor effluent quality. Make analytical results public Keep surrounding environment tidy								
Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Local	Medium	Permanent	Medium	Definite	Certain	Irreversible	Irreplaceable
With mitigation measures								
Negative	Local	Low	Permanent	Low	Definite	Sure	Irreversible	Irreplaceable

Again, a proper operating plan with standard operating procedures is mandatory, according to the DWS standards and regulations. This impact assessment cannot do such a document any justice.

The educational and skill levels of staff must match the demands of a properly managed WWTWs.

The local authority must aim for a persistent annual Green Drop rating.

18 Risk Matrix

Table 9 Risk Matrix

No.	Activity	Aspect	Impact	Significance	Risk Rating
1	Construction of the new WWTWs	Levelling the ground Digging of trenches Construction of the WWTWs Cleaning up, landscaping	Sand and mud washing down the drainage line Destruction of aquatic habitat	2.4	Low
2	Operation of the WWTWs	Sewage and effluent ending up in the aquatic environment	Pollution, altering of aquatic habitat	8	Low

No	Hydrology	Water Quality	Geomorphology	Vegetation	Fauna	Overall intensity	Spatial scale	Duration
Construction 1 Drainage lines	1	2	1	1	1	4	1	1
Operation 2 Aquatic environment	2	2	0	2	0	4	1	5

No	Severity	Importance rating	Consequence	Likelihood	Significance	Risk rating	Confidence level
1	6	2	12	20	2.4	Low	High
2	10	4	40	20	8	Low	High

The purpose of the Risk Matrix is to determine if a General Authorisation of a License is applicable.

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 the Impact Assessment, with sub-activities added.

The methodology is tabled in the Appendix.

The Risk matrix indicates that a General Authorisation is the correct level of approval. A License is not called for.

19 Resource Economics

The goods and services delivered by the environment, in this case the drainage lines on the site where the Augrabies new WWTWs is envisaged, is a Resource Economics concept as adapted by Kotze *et al* (2009).

The diagram (Figure 19) 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, that of the drainage line around the proposed Augrabies WWTWs, is diminutive, signifying a limited contribution to the economy and the ecology.

The proposed Augrabies WWTWs is not about to change the resource economic footprint. However, if its leaks treated effluent, most probably an even larger *Phragmitis* reedbed would develop, to add to the nutrient trapping and carbon storage metrics.

Table 10 Goods and Services of the drainage line at the proposed Augrabies WWTWs

Goods & Services	Drainage lines combined
Flood attenuation	2
Stream flow regulation	2
Sediment trapping	2
Phosphate trapping	2
Nitrate removal	2
Toxicant removal	2
Erosion control	2
Carbon storage	2
Biodiversity maintenance	3
Water supply for human use	0
Natural resources	1
Cultivated food	1
Cultural significance	1
Tourism and recreation	1
Education and research	1

0	Low
5	High

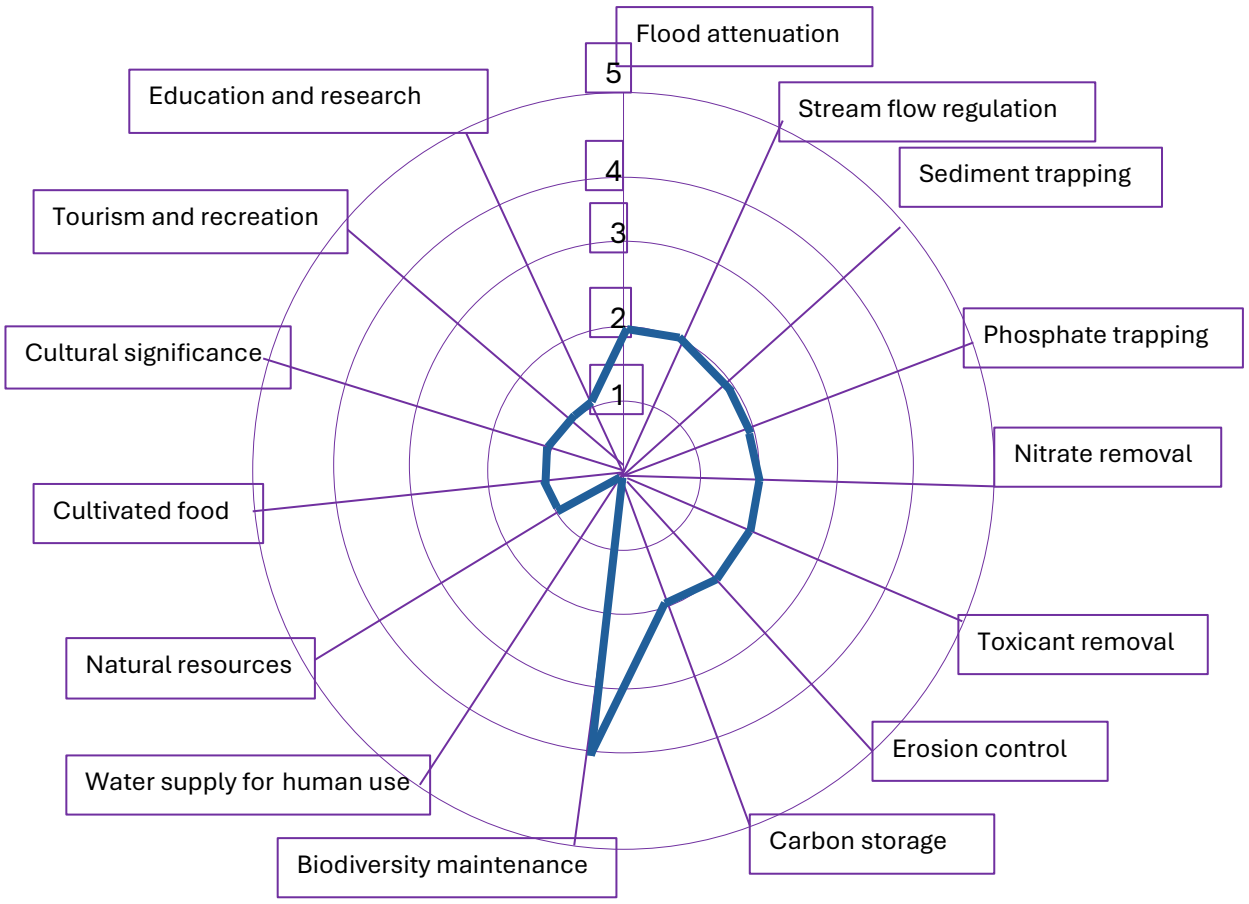


Figure 19. Resource Economics Footprint of the Drainage line at the Augrabies WWTWs

20 Summary

Table 11 Summary of Augrabies WWTWs assessments

Aspect	WWTWs site
DFFE Screening Tool	Sensitivity Low, Medium and High
Protection status	Not a CBA or ESA
Drainage line and rivers	Not NFEPA
Vegetation	Least concern
PES	C
Ecological Importance drainage line	Not important
Ecological Sensitivity	Sensitive
EISC drainage line	Low
Impact assessment	Mitigation can be implemented
Risk Matrix	General Authorization
Resource Economics drainage lines	Small Footprint

According to Table 11, the land on which the future WWTWs is to be constructed is environmentally sensitive but is not environmentally important. Its contribution to the local economy is negligible. The new WWTWs would add to the social and economic spider diagram's metrics.

21 Conclusion

An anthropogenic activity can impact on any of the ecosystem drivers or responses. This can have a knock-on effect on all the other drivers and responses. This, in turn, will predictably impact on the ecosystem services (Figure 20*). The WULA and the EAI must provide mitigation measured for these impacts.'*

Figure 20 has been adapted from DWS policy documents.

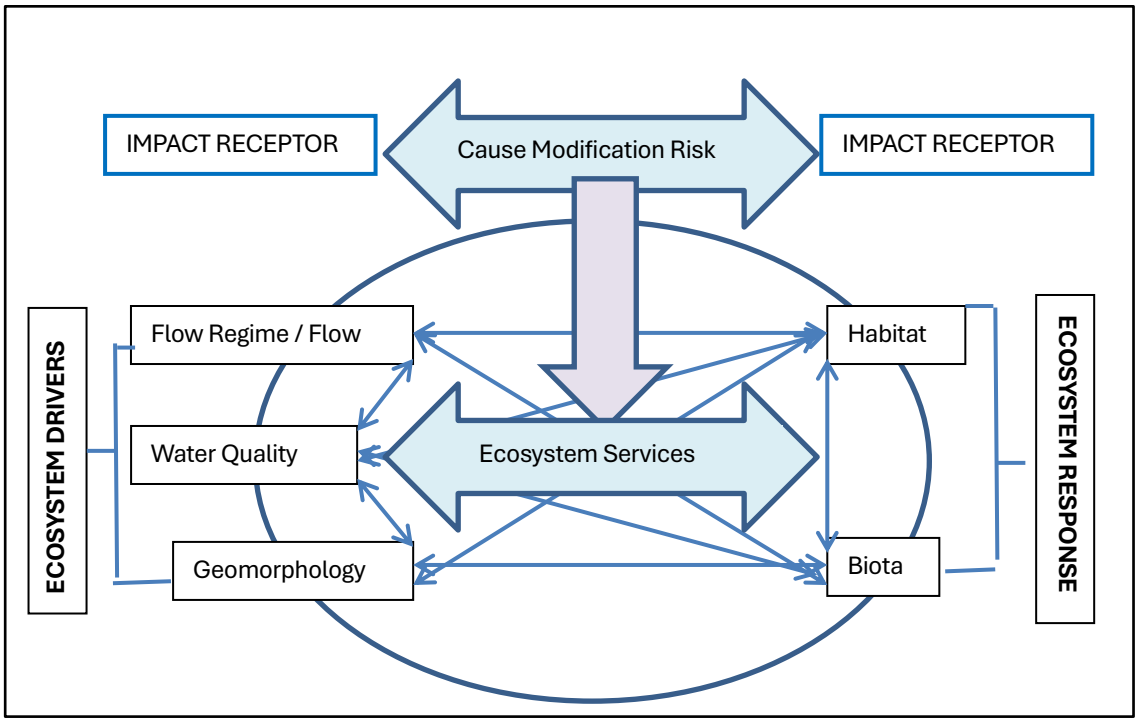


Figure 20 Minimum Requirements for a S21(c) and (i) Application

The occasional sudden and fierce electric thunderstorm drives the drainage lines of the region. The torrent of runoff scours out these drainage lines and preserves their integrity. Moreover, the shallow ground water migrating down the slopes underneath these drainage lines maintain the rows of higher vegetation that criss-crosses the landscape. This adds so terrestrial habitat variability, more than to aquatic habitat.

The droughts in between downpours as just as much as a driver. This limits the mostly sparse vegetation in the drainage lines to hardy and specialised species.

The drainage lines' contribution to the local economy and to the ecology are insignificant. A WULA and Freshwater Report is required only because of the 100m controlled zone of GR509 and not because of any mentionable ecological impacts. The report may be viewed as an administrative requirement rather than an ecological imperative. It is therefore recommended that the DWS is added to the EIA list of

interested and affected parties. The process must only be taken further if the DWS and its regional office demands a WULA after having acknowledged taking note of this Freshwater Report and its contents. Should the DWA refrain from reacting, a WULA may be omitted from the process.

In several respects, the Cillie WWTWs WULA and the Freshwater Report mirrors that of Alheit. The issues, the terrain and the outcomes are the same.

Nevertheless, if a WULA is required, a General Authorisation is the indicated level of authorisation.

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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:  11 June 2025

24 Résumé

Dr Dirk van Driel
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Water Scientist

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Experience

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 (Past Deputy Chairperson): Grotto Bay Homeowner's Association
- Past 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
- Freshwater Report, CA Bruwer Quarry, Kakamas
- Freshwater Report, Orren Managanese Mine, Swellendam
- Wetland Delineation, Klipheuvel ZCC Solar Energy
- Freshwater Report Delville Park, George
- Freshwater Report Wolseley bulk water pipeline
- Freshwater Report Urban Settlement No.1 Pababello Upington
- Freshwater Report Urban Settlement No.2 Pababello Upington
- Freshwater Report Pringle Rock Distillery, Rooiels

- Freshwater Report De Kuilen Resort, Kamiesberg
- Wetland Delineation, Klipheuvel ZCC Solar Energy
- Freshwater Report Delville Park, George
- Freshwater Report ZCC Akkerboom electric vehicle charging station, Keimoes
- Freshwater Report ZCC Piketberg electric automobile charging station
- Freshwater Report ZCC electric truck charging station Piketberg
- Freshwater Report ZCC electric truck charging station Prince Albert Weg
- Freshwater Report Vleesbaai Wastewater Treatment Works
- Freshwater Report ZCC Brandvlei electric vehicle charging station.
- Site Sensitivity Report desalination plant Velddrif
- Technical Report desalination plant Velddrif
- Freshwater Report Abbottsdale High Voltage Power Line
- Freshwater Report Darling Solar Energy Plan
- Freshwater Report Malmesbury Klipkoppie Solar Energy Plant
- River Rehabilitation Plan Louterwater, Langkloof
- River Rehabilitation Plan Kloof Please Krakeelrivier
- Freshwater Report ZZC Potchefstroom electric automobile charging station.
- Freshwater Report ZKA Information Centre Carnavon
- Freshwater Report ZCC Estcourt electric vehicle charging station
- Freshwater Report ZCC Kohler electric vehicle charging station
- Freshwater Report ZCC Harrismith electric vehicle charging station
- Wetland demarcation, Farm Gustrouw 918, Somerset West
- Freshwater Report, New vineyard, Plot 1181, Kakamas
- Freshwater Report, Farm 91, Riversdale.
- Freshwater Report Harmony Agriculture, Koue Bokkeveld, Ceres
- Freshwater Report Toeka Agriculture, Koue Bokkeveld, Ceres
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- Wetland Demarcation Portion 81 Farm Gustrouw, Somerset West
- Freshwater Report Farm 9 George
- Freshwater Report Farm Plattekloof 90 Riversdale
- Freshwater Report Franschhoek Pedestrian Bridges
- Freshwater Report Gwaing Landfill, George
- Freshwater Report Erf 977 Val de Vie
- Fresh Water Report Eerste River Bus Depot
- Freshwater Report Farm Krugerskop onion field, Merweville
- Freshwater Report, Farm Oudebosch, Riversdale
- Freshwater Report Kakamas Wastewater Treatment Works, Kakamas
- Freshwater Report Alheit Wastewater Treatment Works, Alheit, Kakamas
- Freshwater Report Farm Hottentots Bosch 80, Riversdale
- Freshwater Report Cillie Wastewater Treatment Works, Kakamas

25 Appendix

Table 25.1 Numerical Significance

Table 25.1.1 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 25.1.2 Significance

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.

Table 25.1.3 Scoring system

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

25.2 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 25.2.1 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 25.2.2 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 25.2.3 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 25.2.4 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.

25.3 Risk Matrix Methodology

TABLE 1 – IMPORTANCE OF AFFECTED WATERCOURSE/S		
What is the overall importance of the watercourse/s, based on the criteria and guidelines provided below?*		
(If no formal assessment of EI / EIS / Wetland Importance has been completed, assign rating according to criterion below that results in the highest score)		
Low or Very Low EI / EIS / Wetland Importance rating; OR, If EI/EIS has not been determined, Low rating based on presence of: - no areas identified to be of conservation importance (i.e. OESA at most); and/or - only species/habitats of Least Concern on the IUCN Red List or on a regional/national Red List (including freshwater ecosystem types of Least Concern in terms of the NBA); and/or - only species which are common and widespread and/or habitats of low conservation interest; and/or - highly degraded habitat of extremely small size	**Low / Very low** = 2	
Medium EI / EIS / Wetland Importance rating; OR, If EI/EIS has not been determined, Moderate rating based on presence of: - CESAs; and/or - species/habitats listed as VU or NT on the IUCN Red List or on a regional/national Red List (including VU/NT freshwater ecosystem types in terms of the NBA); and/or - functionality as an important ecological corridor or buffer area	**Moderate** = 3	
High EI / EIS / Wetland Importance rating; OR, If EI/EIS has not been determined, High rating based on presence of: - CBA2; and/or - species or degraded habitats (in poor condition) listed as EN or CR on the IUCN Red List or on a regional/national Red List (including EN/CR freshwater ecosystem types in terms of the NBA)	**High** = 4	
Very high EI / EIS / Wetland Importance rating; OR, If EI/EIS has not been determined, Very high rating based on presence of: -CBA1; and/or - FEPA; and/or - species or intact habitats (in fair or good condition) listed as EN or CR on the IUCN Red List or on a regional/national Red List (including EN/CR freshwater ecosystem types in terms of the NBA); and/or - KBA or IBA or Ramsar site	**Very high** = 5	
* EI=Ecological Importance; EIS=Ecological Importance & Sensitivity; OESA=Other Ecological Support Areas; IUCN=International Union for Conservation of Nature; CESA=Critical Ecological Support Area; NBA=National Biodiversity Assessment; VU=Vulnerable; NT=Near Threatened; EN=Endangered; CR=Critically Endangered; CBA=Critical Biodiversity Area; FEPA=Freshwater Ecosystem Priority Area; KBA=Key Biodiversity Area; IBA=Important Bird Area.		

TABLE 2- INTENSITY OF IMPACT	
What is the intensity of the impact on the resource quality (hydrology, water quality, geomorphology, biota)?	
Negative Impacts	
Negligible / non-harmful; no change in PES	0
Very low / potentially harmful; negligible deterioration in PES (<5% change)	+1
Low / slightly harmful; minor deterioration in PES (<10% change)	+2
Medium / moderately harmful; moderate deterioration in PES (>10% change)	+3
High / severely harmful; large detrioration in PES (by one class or more)	+4
Very high / critically harmful; critrical deterioration in PES (to E/F or F class)	+5
Positive Impacts	
Negligible; no change in PES	0
Very low / potentially beneficial; negligible improvement in PES (<5% change)	-1
Low / slightly beneficial; minor improvement in PES (<10% change)	-2
Medium / moderately beneficial; moderate improvement in PES (>10% change)	-3
Highly beneficial; large improvement in PES (by one class or more) and/or increase in protection status	-4
Very highly beneficial; improvement to near-natural state (A or A/B class) and/or major increase in protection status	-5
NOTE: Positive Impacts must be given a negative Intensity Score	
***PES of affected watercourses must be considered when scoring Impact Intensity**	

TABLE 3 – SPATIAL SCALE (EXTENT) OF IMPACT	
How big is the area that the activity is impacting on, **relative to the size of the impacted watercourses**?	
Very small portion of watercourse/s impacted (<10% of extent)	1
Moderate portion of watercourse/s impacted (10-60% of extent)	2
Large portion of watercourse/s impacted (60-80%)	3
Most or all of watercourse/s impacted (>80%)	4
Impacts extend into watercourses located well beyond the footprint of the activities	5

TABLE 4 – DURATION OF IMPACT	
How long does the activity impact on the resource quality?	
Transient (One day to one month)	1
Short-term (a few months to 5 years) OR repeated infrequently (e.g. annually) for one day to one month	2
Medium-term (5 – 15 years)	3
Long-term (ceases with operational life)	4
Permanent	5

TABLE 5 – LIKELIHOOD OF THE IMPACT	
What is the probability that the activity will impact on the resource quality?	
Improbable / Unlikely	20%
Low probability	40%
Medium probability	60%
Highly probable	80%
Definite / Unknown	100%

TABLE 6: RISK RATING CLASSES

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 29	**(L) Low Risk OR (+) Positive (+ +) Highly positive**	Acceptable as is or or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
30 – 60	**(M) Moderate Risk**	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
61 – 100	**(H) High Risk**	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

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

TABLE 7: CALCULATIONS AND MAXIMUM VALUES	
Intensity = Maximum Intensity Score (negative value for positive impact) X 2	MAX = 10
Severity = Intensity + Spatial Scale + Duration (<Intensity - Spatial Scale - Duration> for positive impact)	MAX = 20 (MIN = -20 for +ve impacts)
Consequence = Severity X Importance rating	MAX = 100
Significance\Risk = Consequence X (Likelihood / 100)	MAX = 100