NAMA KHOI MUNICIPALITY

# WATER USE LICENSE APPLICATION
# FRESH WATER REPORT
# PROPOSED RECONSTRUCTION OF THE WASTEWATER TREATMENT WORKS
# KAMIESKROON

A requirement in terms of Section 21 (c) and (i) of the
National Water Act (36 of 1998)
April 2020

EnviroAfrica
Environmental Management and Impact Assessment
Omgewingsbestuur en Impakbeoordeling

bvi 50 YEAR CELEBRATION EST 1967-2017
ENGINEERING • PROCUREMENT • MANAGEMENT

WATSAN Africa

## Index

## Abbreviations

| | |
|---|---|
| Critical Biodiversity Area | CBA |
| Department of Environmental Affairs | DEA |
| Department of Environmental Affairs and Nature Conservation | DENC |
| Department of Mineral Resources | DMR |
| Department of Water and Sanitation | DWA |
| Ecological Importance | EI |
| Ecological Sensitivity | ES |
| Ecological Support Area | ESA |
| Environmental Management Plan | EMP |
| Environmental Impact Assessment | EIA |
| Electronic Water Use License Application (on-line) | eWULAA |
| Government Notice | GN |
| Metres Above Sea Level | masl |
| National Environmental Management Act (107 of 1998) | NEMA |
| National Freshwater Environment Priority Area | NFEPA |
| National Water Act (36 of 1998) | NWA |
| Mean Annual Runoff | MAR |
| Present Ecological State | PES |
| Section of an Act | S |
| South Africa National Biodiversity Institute | SANBI |
| Water Use License Application | WULA |
| Wastewater Treatment Works | WWTWs |

**List of Figures**



**List of Tables**

# 1 Introduction

Kamieskroon is located on the N7 trunk road in the Northern Cape, 65km south of Springbok and 45km north of Garies.

Wastewater from Kamieskroon is currently treated in an inadequate anaerobic pond system that is in need of upgrading and improvement.

The civil engineering consultancy BVi wrote the following motivation for the DWS:

"*The ponds overflows in the winter season when evaporation is low and the walls are breaking at times causing effluent water to run into streams and eventually ending up in nearby river streams. The effluent water is thus contaminating the groundwater system of the area. Many farmers downstream of the river are dependent on boreholes and wells to provide them with drinking water as well as water for their livestock.*

*"The project will acquire the construction of:*

- *Construction of Oxidation ponds, with evaporation ponds.*
- *The construction of new in- and outlet structures to at the ponds.*
- *Installation of HDPE lining to waterproof the ponds.*
- *Installation of adequate security fencing around the ponds."*

Following this motivation, the Nama Khoi Municipality appointed BVi to construct the new WWTWs.

For the construction of the new WWTWs, an EIA is required, in terms of NEMA. BVi appointed Enviro Africa of Somerset West to carry out the EIA.

The current WWTW is located close to a drainage line. Even though mostly dry, with water only during heavy rains, the drainage line is still considered to be a legitimate water resource, in terms of the NWA and its regulations. Hence an WULA is required in terms of S21 (c) and (i) of the NWA. Enviro Africa, in turn, appointed Dr Dirk van Driel of Watsan Africa in Cape Town to produce the Fresh Water Report and to deal with the WULA.

The Fresh Water Report must provide adequate information to enable decision-makers to come to informed conclusions pertaining to the official approval of the upgrading of the WWTWs. The Fresh Water Report has developed into a format over a multitude of reports and over a number of years to answer to these minimum requirements. The Fresh Water Report must contain a completed Risk Matrix. The Risk Matrix is available on the official DWS webpage.

## 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 upgrade of the pipeline would be across water courses. The flow may be impeded.

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

The proposed pipeline upgrade may alter the characteristics of the water course.

Government Notice 267 of 24 March 2017

Government Notice 1180 of 2002. *Risk Matrix.*

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

Government Notice 509 of 26 August 2016

An extensive set of regulations that apply to any development in a water course is listed in this government notice in terms of Section 24 of the NWA. No development take place within the 1:100 year-flood line without the consent of the DWS. If the 1:100-year flood line flood line is not known, no development may take place within a 100m from a water course without the consent of the DWS. Likewise, no development may take place within 500m of a wetland without the consent of the DWS.

This report deals with S21 (c) and (i) of the NWA.

National Environmental Management Act (107 of 1998)

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

## 3 Quaternary Catchment

The Kommagas River is in the F30C quaternary catchment.

## 4 Conservation Status

Only part of the Buffels River is classified as a NFEPA on the SANBI BGIS webpage. The Haas River, the tributary of concern for this report, is not listed. There are no CBAs anywhere near the WWTWs.

## 5 Vegetation Type

The vegetation in and around the Kamieskroon WWTW is listed as Namakwaland Hardeveld (Figure 1), which is a part of the Namakwaland Scrubland, which in turn is part of the over-arching division of the Succulent Karoo, according to Mucina and Rutherford (2006). It is not listed as endangered in any way. Much of the vegetation is typically the seasonal annuals that emerge in abundance during the winter rains, as well as geophytes that emerge after the rain.

**Figure 1** Hardeveld

## 6 Current Infrastructure


**Figure 2** Current Infrastructure

The current infrastructure consists of six ponds (Figure 2). The biggest one is the primary anaerobic pond with the inlet structure (Figure 3). The effluent gravitates through the successive ponds. The last ones were only partly filled during the site visit. The very last pond was dry.

The general impression was that at low flow conditions, the system works, but would probably be inadequate if the flow increases, as the pond were small, not properly constructed, like shallow scrapes in the ground, but the last ponds had high embankments at the downhill side.

**Figure 3** Kamieskroon WWTW

## 7 The Project

A screenshot was taken from the original BVi PDF file (Figure 4). From this it is clear that the six original ponds will be integrated into a cohesive and functional WWTW, with a pipeline leading towards four maturation ponds further down the incline next to the drainage line. This design would answer to the demands of a contemporary anaerobic pond system for the effective treatment of domestic wastewater.


**Figure 4** Screenshot of the new WWTW Layout

## 8 Buffels River Catchment

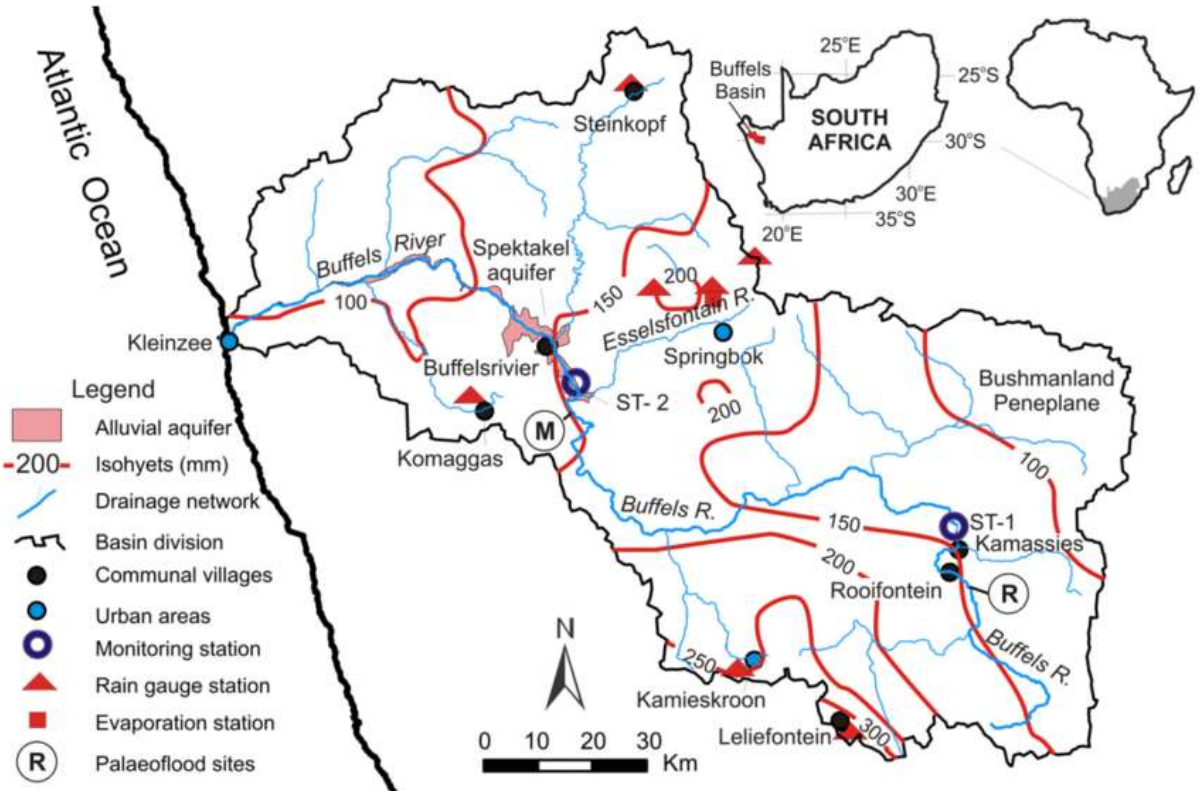


**Figure 5** Buffels River Catchment (Benito *et al*, 2011)

The Buffels River and its catchment is located in the arid north west of South Africa along the Atlantic sea board (Figure 5 and Appendix). Benito *et al* (2011) provides much insight into the catchment's characteristics. The river is only approximately 175km long, following the curve of the river, from its beginning in the mountainous terrain of northern Namakwaland to its mostly closed mouth at the ocean.

The catchment area is 9460km$^2$ in size.

The Kamies Mountains south of Springbok has a peak of approximately 1700masl and another of 1500masl, with the higher ridges up to 1300masl. Komaggas is at 476masl.

The MAR is only 10.7million m$^3$, which is little considering the catchment area.

From what is reported in the literature, mostly based on anecdotal evidence, there is water in the river once in 3 to 5 years. It is hard to estimate the frequency of episodic floods. It seems that there has been one flood of note during the past 27 years.

Yet, the mobilisation and deposition of sediments are evident over the length of the river. The middle reaches downstream of the Spektakelberg are approximately 600m wide, with a braided riverbed and continuous sand banks.

The presence of shallow ground water in the Buffels River and its upper tributaries is indicated by a mature stand of mainly sweet thorn trees *Vachellia karoo*, opposed to the barren surrounding landscape. These trees derive their water supply from the underlying ground water.

The Spektakelberg aquifer (Figure 2) located under the river bed is an important feature of the catchment, as it renders ground water to the towns, villages and mines in the area. Closer to the ocean is the Kleinzee aquifer. These aquifers are perpetually replenished by the ground water that migrates along the river bed.

The water surface area estuary is only 1.3ha, which is very small and is not even recognised as a valid estuary by some authors (Fielding, 2016). It is mostly closed to the ocean and only opens up during very large flood events, which are infrequent. The sand berm that separates the estuary from the ocean is 100m wide and even wider and forms a part of the shoreline dune field.

## 9 The Haas River Sub-Catchment upstream of Kamieskroon WWTW.


**Figure 6** Haas River

The upgraded WWTW is located next to a drainage line. This drainage line flows into the Haas River (Figure 6), a tributary of the Buffels River.

The Haas River (Figure 7) is 18.6km long from its confluence with the Buffels River along its longest route up the mountains. The WWTW is located 12.5km away from the confluence.

The highest point in the sub-catchment is at 1285masl. The mountainous ridge that runs from north to south along the eastern boundary of the sub-catchment is generally above 1000 masl and mostly at 1100masl. The Kamieskroon WWTW is located at 714masl.

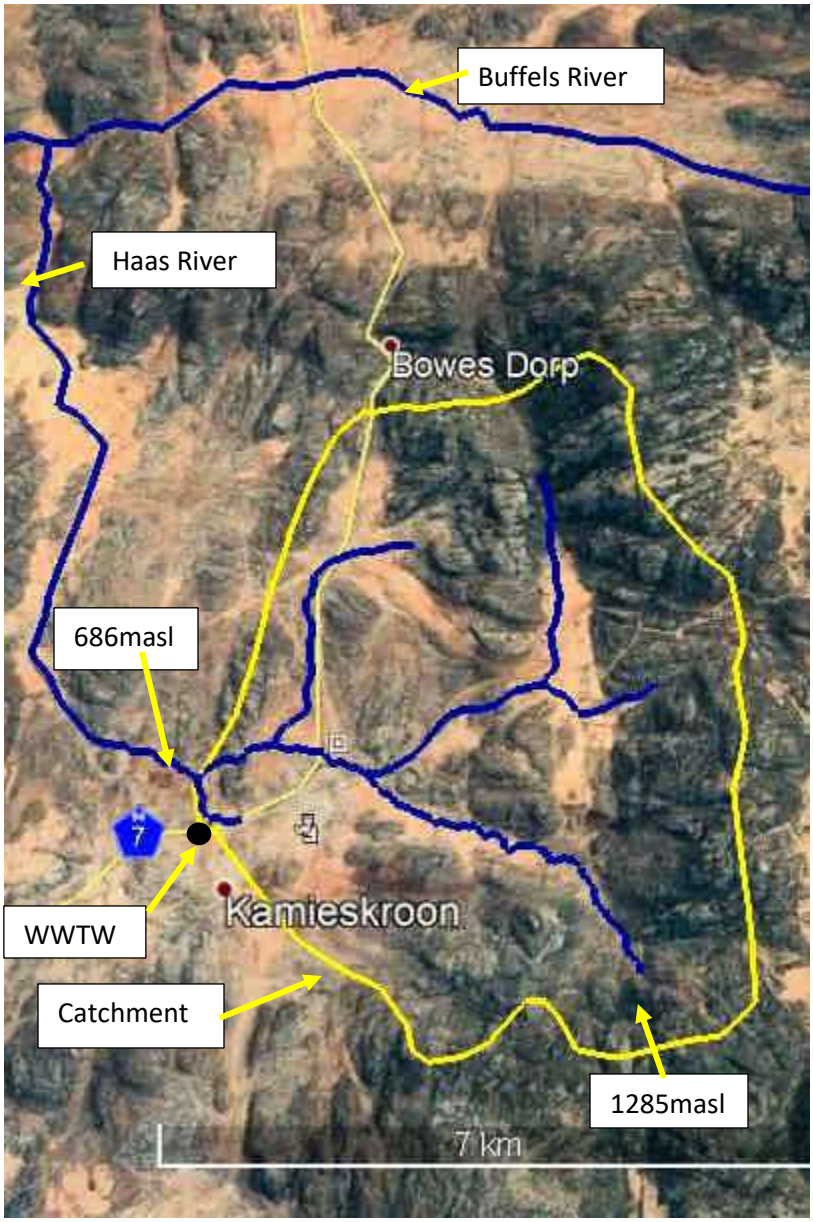


**Figure 7** Haas River Sub-Catchment

The WULA requires that a Risk Matrix has to be completed, which in turn requires that the risk of the new ponds either be washed away during a very big flood, or be overtopped and flooded during such a large rainfall event be determined. Floods not seem likely, looking at the dry drainage line. Floods are erratic, infrequent but can be of huge magnitude, if indeed they do happen. When they do, they can cause huge disruptions, looking at the sediment translocation in the river bed.

WULA's typically do not have large budgets to make provision for hydrological modelling that is required to come to a credible estimation of the flow and water levels down the drainage lines during floods, according to which the changes of flood damage and flooding can be assessed. The best that can be done under the circumstances is a very crude, first estimate with a low measure of accuracy and credibility.

The decision-making authorities may demand a better estimation, with the huge cost of modelling that will have to be footed by the people of Kamieskroon. These are mostly low-income people who cannot afford the costs. Hence, we will have to do, for the time being, with this first round estimation.

The first step towards the risk estimation is to estimate the surface area of the sub-catchment above the WWTWs, with the available means. This can be done by connecting the highest points around the Haas River, using Google Earth's polygon function.

The size of the sub-catchment comes to 4500 hectares. It has a circumference of 27.5km.

## 10 Rainfall

The rainfall varies from 150mm per year at Kamieskroon to only 92mm at Kleinzee, with Komaggas in between at 112mm. The rainfall is higher on the peaks and ridges of the Kamies Mountains and it becomes less at the lower altitudes towards the ocean. Rainfall is mainly in the winter as it is in these climates, which are classified as Mediterranean.

This is a low rainfall, with semi-desert to desert conditions. People are dependent on ground water, as surface water under these dry conditions is few and far between.

## 11 Runoff

The peak runoff must be estimated during flood conditions in order to assess the risk to the new part of the WWTWs.

**Table 1** Daily peak Runoff

| Rainfall mm | Runoff $m^3$ x1000/ day | Runoff per hour $m^3/h$ | Runoff minus loss $m^3/h$ |
|---|---|---|---|
| 10 | 0.45 | 18750 | 11250 |
| 20 | 0.90 | 26250 | 22500 |
| 30 | 1.35 | 56250 | 33750 |
| 40 | 1.80 | 75000 | 45000 |
| 50 | 2.25 | 93750 | 56250 |
| 60 | 3.75 | 156250 | 93250 |

With a rainfall of only 150mm per year at Kamieskroon, it is unlikely that an average rainfall of 30mm or higher a day over the entire catchment would ever realise. However, the rainfall on the higher mountain ranges can be much higher, which could push the daily rainfall over the entire catchment higher.

In the second column of Table 1, the runoff for the entire catchment is calculated for daily rainfall figures of 10mm to 60mm per day. From this the hourly flow is calculated by dividing by 24 hours. It is assumed that 40% of the runoff would penetrate into the sandy ground and would never reach the exit of the sub-catchment below the WWTWs, so that is subtracted from the hourly flow rate. It is assumed that this would be the volume that would pass in an hour at Point A (Figure 8) downstream of the WWTWs.

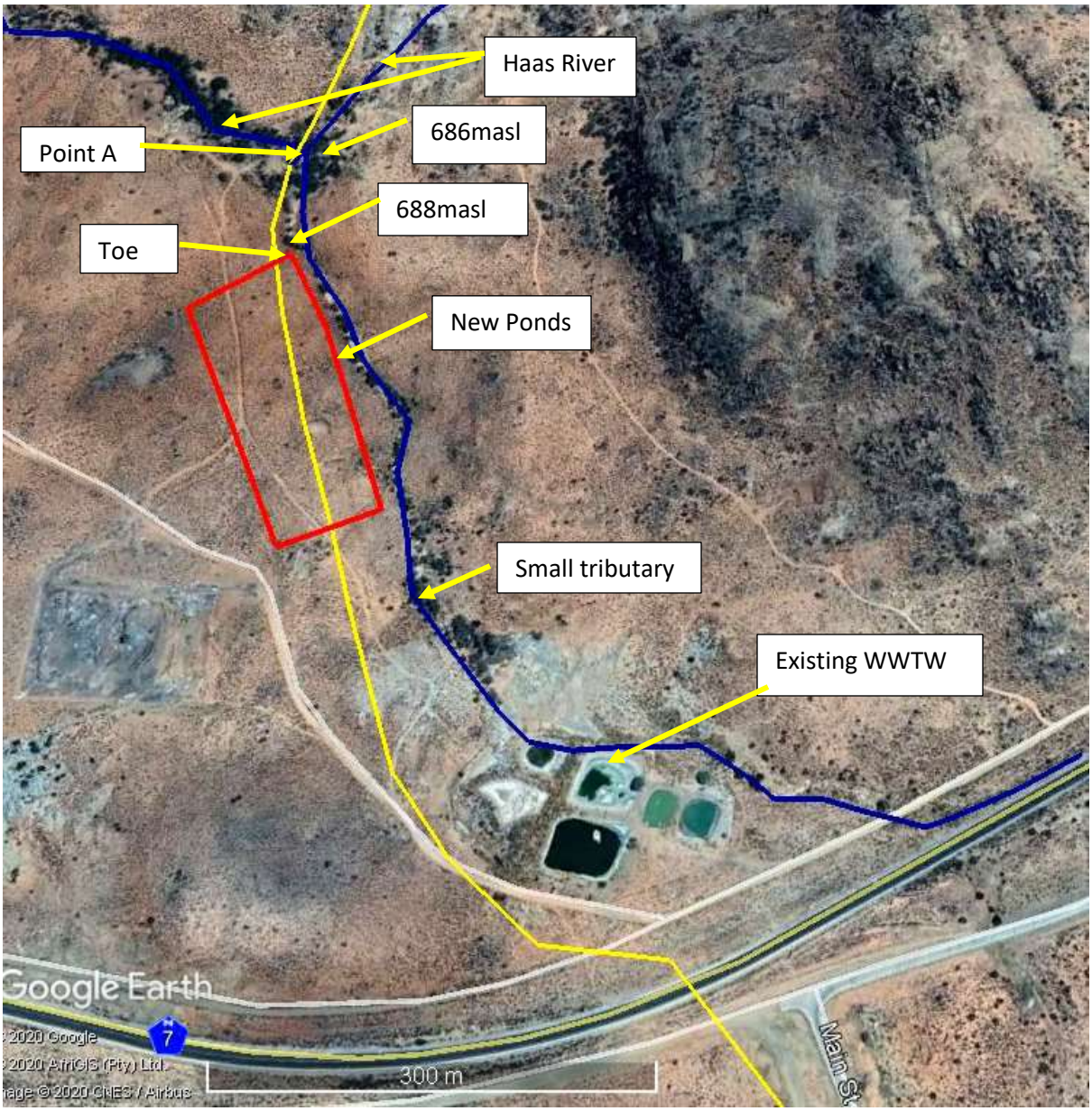


**Figure 8** Drainage line (small tributary) along the WWTWs

A small unnamed tributary (Figure 8), nothing more than a dry drainage line, runs past the existing WWTWs. It joins the Haas River 100m downstream of the proposed new extension to the WWTWs (Point A, Figure 8).

The point where the hourly runoff would pass during peak flows is at the confluence of this small tributary and the Haas River (Point A, Figure 8).

It seems unlikely that storm water from the small tributary would flood the existing or the new WWTWs. The part of the catchment is too small to gather enough water. The culvert under the N7 is blocked (Figure 9) and probably won't let enough water through during a

flood to be of any concern. The part of the catchment above the bigger culvert of probably too small as well (Figure 10). There is another box culvert (figure 11) not far to the south, entirely open and not blocked up at all, but there is no sign of a drainage line trough it and no sign of running water.

The northern-most toe of the new WWTW is only 25m away from the small tributary. What are the chances that the toe of the WWTW can wash away?

Take into account that the slope both upstream and downstream is 2 vertical metres in 100 horizontal metres. Take into account that the flood must first fill the approximate air volume of a roughly estimated 1250m$^3$ upstream of the confluence to the toe of the WWTWs.

In the absence of hydrological modelling and from experience it seems unlikely that a daily rainfall of 30mm would wet the toe of the WWTW. It is unlikely that a flood with a return frequency of once in 100 years (50mm or 60mm in 24 hours in this arid region) would wash the new WWTW away. At most it would overtop the lowest pond. With the very low level of accuracy and credibility, overtopping would probably be the most a flood would do.

**Figure 9** Blocked Culvert

**Figure 10** Another blocked culvert

**Figure 11** Box culvert

If deemed necessary, a better estimation should be done, by professional people in this field, with proper rainfall data and with know-how pertaining to the particular programming and software.

## 12 **Present Ecological State** according to Kleynhans, 1999

**Table 2** Habitat Integrity

| 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 |

### 12.1 Unnamed Drainage Line Habitat Integrity

The drainage lines that runs past the WWTWs rises on the streets of Kamieskroon and then moves through the culverts underneath the N7 trunk road. The bed and riparian zone seem to be rather natural from the culvert to a point below the WWTW, where a pile of broken rock and rubble was dumped (Figure 12). From there it widens somewhat to the junction with the Haas River. Originally, the drainage line must have started on the mountain slopes to the west of the town, but that flow is not visible anymore, as it has been disturbed by the development of the town. The flow underneath the N7 is no longer apparent, as it is blocked. Instead the drainage line stretches along the west side of the N7, where it simply stops on the incline (Figure 13). Higher up the drainage line, the riparian vegetation is no different from the surrounding veld, succulent Karoo with *Euphorbia* species, low, drought stressed bush (Figure 14).

The riparian zone looks intact, with a mature stand of thorn trees *Vachellia karoo*, as is apparent all along the Buffels River and its tributaries. The area is heavily grazed by domestic goats.

The drainage line scores a C, despite major impacts. The part below the N7 is still ecologically functional, but the part upstream on the N7 has been disrupted.

**Table 3** Kamieskroon WWTW Drainage Line Habitat Integrity

| **Instream** | **score** | **weight** | **Product** | **Maximum Score** |
|---|---|---|---|---|
| Water Abstraction | 24 | 14 | 336 | 350 |
| Flow modification | 12 | 12 | 144 | 325 |
| Bed modification | 11 | 13 | 143 | 325 |
| Channel modification | 12 | 13 | 156 | 325 |
| Water quality | 24 | 14 | 336 | 350 |
| Inundation | 15 | 10 | 150 | 250 |
| Exotic macrophytes | 24 | 9 | 216 | 225 |
| Exotic fauna | 10 | 8 | 80 | 200 |
| Solid waste disposal | 9 | 6 | 56 | 150 |
| max score | | 100 | 1617 | 2500 |
| % of total | | | 64.7 | |
| Class | | | **C** | |
| **Riperian Zone** | | | | |
| Water abstraction | 24 | 13 | 312 | 325 |
| Inundation | 12 | 11 | 121 | 275 |
| Flow modification | 12 | 12 | 144 | 300 |
| Water quality | 24 | 13 | 312 | 325 |
| Indigenous vegetation removal | 21 | 13 | 273 | 325 |
| Exotic vegetation encroachment | 24 | 12 | 288 | 300 |
| Bank erosion | 22 | 14 | 308 | 350 |
| Channel modification | 12 | 12 | 144 | 300 |
| | | 100 | 1902 | 2500 |
| % of total | | | 76.1 | |
| Class | | | **C** | |

## 12.2 Haas River Habitat Integrity

Much of the Haas River's banks have been altered into agricultural land, small patches all along the river, wherever the land is even and flat enough for development among the mountainous terrain. These are mainly wheat fields that are only vegetated during winter and mostly barren during summer. Where the banks are left undeveloped, it is covered with a mature stand of sweet thorn trees (Figure 15). Water abstraction is by means of boreholes on farms along the length of the river. The river banks are heavily grazed by farm animals.

**Figure 12** Rubble

**Table 4** Haas River Habitat Integrity

| **Instream** | **score** | **weight** | **Product** | **Maximum Score** |
|---|---|---|---|---|
| Water Abstraction | 19 | 14 | 266 | 350 |
| Flow modification | 19 | 12 | 228 | 325 |
| Bed modification | 15 | 13 | 195 | 325 |
| Channel modification | 15 | 13 | 195 | 325 |
| Water quality | 21 | 14 | 294 | 350 |
| Inundation | 20 | 10 | 200 | 250 |
| Exotic macrophytes | 23 | 9 | 207 | 225 |
| Exotic fauna | 10 | 8 | 80 | 200 |
| Solid waste disposal | 15 | 6 | 90 | 150 |
| max score | | 100 | 1755 | 2500 |
| % of total | | | 70.2 | |
| | | | | |
| Class | | | **C** | |
| | | | | |
| **Riperian Zone** | | | | |
| Water abstraction | 19 | 13 | 247 | 325 |
| Inundation | 20 | 11 | 220 | 275 |
| Flow modification | 19 | 12 | 228 | 300 |
| Water quality | 21 | 13 | 273 | 325 |
| Indigenous vegetation removal | 14 | 13 | 182 | 325 |
| Exotic vegetation encroachment | 22 | 12 | 264 | 300 |
| Bank erosion | 20 | 14 | 280 | 350 |
| Channel modification | 15 | 12 | 180 | 300 |
| | | 100 | 1874 | 2500 |
| % of total | | | 75.0 | |
| | | | | |
| Class | | | **C** | |

As in many rivers, where an overall score is required, it is challenging to classify, as the upper reaches in the mountains are mostly natural, with little impacts, while the lower reaches are developed.

The Haas River scores a C for both the instream and riparian habitat, which is consistent with that of Benito *et al* (20111) for the entire Buffels River catchment. The Haas River has been impacted, but much of its ecosystem functioning is still intact.

It is important to note that the upgrade of the WWTW is not about to change any of this. The impact could rather be positive, as there would no longer be overflows from the old works.

**Figure 13** Drainage line along the N7

**Figure 14** Unnamed drainage line

**Figure 15** Sweet Thorn Trees

## 13 Ecological Importance

The EI was developed by Dr Neels Kleynhans of the DWS.

“Ecological Importance (EI) refers to the diversity, rarity, uniqueness of habitats and biota and it reflects the importance of protecting these ecological attributes from a local, regional and international perspective.”

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

**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 is no permanent water in the Buffels River and its tributaries at the river reach in and around Buffelsrivier and Kamieskroon and hence no habitat for any fish. Therefore, the river cannot be regarded as important, according to this evaluation.

However, the river and its shallow groundwater provided tree-line habitat, which is important on a regional scale.

The upgrade of the WWTWs does not affect in any way the river’s importance.

## 14 Ecological Sensitivity

“Ecological Sensitivity (ES) refers to the ability of an ecosystem to tolerate disturbances and to recover from impacts. The more sensitive a system is, the lower the tolerance will be to various forms of alterations and disturbances. This serves as a valuable indicator

of the degree to which a water resource can be utilised without putting its ecological sustainability at risk and the level of protection the system requires."

If the Buffels River and its tributaries are left to its own devises, with current impacts removed, it would probably bounce back to a condition closer to the original. However, this would never happen. The river can get much worse if more impacts are added.

The Haas River's ES is rated as "Moderate". The unnamed drainage line at the Kamieskroon WWTWs is rated as moderate as well.

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.

## 15 Impact Assessment

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

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

The methodology is set out in the appendix. The assessment is given in Table 6.

There is a strip of land of 25m wide and wider between the reconstructed WWTW and the edge of the drainage line's riparian zone. It is going to be a challenge to keep earth moving machinery out of this strip and keep building material and rubble out of this strip and out of the drainage line, but this is what is required and should be done during the construction phase. With due diligence and best practices, it can be done. If any sediments end up in the drainage line, the building operation should be tightened up. An ECO should be appointed to oversee the operations. If these conditions are met, the impact should be low.

During the site visit, there was a lot of litter in the drainage line and surrounds. This is not necessarily an overflow from the adjacent solid waste disposal site. If the municipal efforts were to carry credibility, litter should be cleaned up in the waterways and not be allowed to accumulate any more.

The chances of a breakage in any of the ponds resulting in a spillage of sewage or partly treated effluent down the drainage line and the Haas River is remote. The possible environmental impact is virtually non-existent, as the combined capacity of the ponds by far outstrip the sewage production of the town.

**Table 6** Impact Assessment

**Description of impact**

**Construction**
Construct a WWTW within 32m in some places and within 100m in all places on the banks of a drainage line
Execute major earth works
Clean up and landscape the construction site

**Impact**
**Possible lose sediments washed down the drainage line and into the Haas River**

**Mitigation measures**
Limit the footprint
Level and landscape after construction
Construct during the dry summer months
Be mindful of the aquatic environment during construction and employ best practices

| Type Nature | Spatial Extent | Severity | Duration | Significance | Probability | Confidence | Reversibility | Irreplaceability |
|---|---|---|---|---|---|---|---|---|
| Without mitigation | | | | | | | | |
| Negative | Local | Medium | Medium term | Low | Definite | Certain | Reversible | Replaceable |
| With mitigation measures | | | | | | | | |
| Negative | Local | Low | Short term | Low | Definite | Sure | Reversible | Replaceable |

Actually, the upgrade of the WWTW has, if compared to the current situation, would have positive impact, as it would reduce the possibility of a spill happening to virtually zero, given that the long-term planning remains in place

**Description of impact**

**Operation**
Possible spill of partly treated effluent

**Impact**
**Pollution of aquatic habitat**
**Deleterious impact on downstream farming**

**Mitigation measures**
Maintain infrastructure at works
Timely planning for expansion of works prior to reaching design capacity

| Type Nature | Spatial Extent | Severity | Duration | Significance | Probability | Confidence | Reversibility | Irreplaceability |
|---|---|---|---|---|---|---|---|---|
| Without mitigation | | | | | | | | |
| Negative | Local | Medium | Medium term | Low | Definite | Certain | Reversible | Replaceable |
| With mitigation measures | | | | | | | | |
| Negative | Local | Low | Short term | Low | Definite | Sure | Reversible | Replaceable |

**Description of impact**

**Operational Phase**
Possibility of works washing away during sever flood

**Impact**
**Pollution of aquatic habitat**
**Deleterious impact on downstream farming**

**Mitigation measures**
Carry out proper hydraulic modelling

| Type Nature | Spatial Extent | Severity | Duration | Significance | Probability | Confidence | Reversibility | Irreplaceability |
|---|---|---|---|---|---|---|---|---|
| Without mitigation | | | | | | | | |
| Negative | Local | Medium | Medium term | Low | Definite | Low | Reversible | Replaceable |
| With mitigation measures | | | | | | | | |
| Negative | Local | Low | Short term | Low | Definite | Low | Reversible | Replaceable |

## 16 Risk Matrix

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

The Risk Matrix is a requirement of Government Notice 1180 of 2002 in terms of the National Water Act (36 of 1998).

**Table 7** Risk Matrix

| No. | Activity | Aspect | Impact | Significance | Risk Rating |
|---|---|---|---|---|---|
| 1 | Construct a WWTW<br>Execute major earth works<br>Clean up and landscape the construction site | **Lose sediments washed down the drainage line and into the Haas River** | **Aquatic habitat destruction** | 24 | Low |
| 2 | Possible spill of partly treated effluent | **Pollution** | Threat to downstream farming community. Aquatic and riparian habitat destruction | 24 | Low |
| 3 | Works washing away during severe floods | **Large volume of sediment in drainage line and Haas River** | Habitat destruction | 24 | Low |

The purpose of the Risk Matrix is to provide information with regard to the decision if a General authorization or a License is the appropriate level of authorization.

Values have been assigned assuming that the mitigation measures are in place.

The impacts are low, insignificant. On account of risk to the aquatic environment, a General Authorization would be in order. However, wastewater treatment is, in terms of S21(e) if the NWA, a controlled activity for which a License is required.

**Table 7** Continued Risk Rating

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

| No | Frequency of activity | Frequency of impact | Legal issues | Detection | Likelihood | Significan-ce | Risk Rating |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 5 | 1 | 8 | 24 | Low |
| 2 | 1 | 1 | 5 | 1 | 8 | 24 | Low |
| 3 | 1 | 1 | 5 | 1 | 8 | 24 | Low |

## 17 Resource Economics

The goods and services delivered by the environment, in this case the Buffels River and the Komaggas River, 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 these rivers, the goods and services delivered are particularly applicable and important, hence it was decided to include it in the report.

The diagram (Figure 17 and 18) is an accepted manner to visually illustrate the resource economic footprint of the drainage lines, from the data in Table 8.

A large star shape (spider diagram) is likely to attract the attention of the decision-making authorities. The Haas River's larger star shape because of its services towards flow regulation, sediment trapping and erosion control shows that it is a tributary worthy of protection. The unnamed tributary is much smaller, with less environmental services on offer. Its tree line is a contributor towards its services (Figure 16).

The upgrade of the WWTW is not about to change any of the goods and services rendered, on condition that the unnamed tributary is kept intact during the construction phase.

**Table 8**. Goods and Services

| Goods & Services | Score Haas River | Score Drainage Line |
|---|---|---|
| Flood attenuation | 5 | 4 |
| Stream flow regulation | 5 | 4 |
| Sediment trapping | 5 | 4 |
| Phosphate trapping | 3 | 2 |
| Nitrate removal | 3 | 2 |
| Toxicant removal | 3 | 2 |
| Erosion control | 5 | 4 |
| Carbon storage | 3 | 2 |
| Biodiversity maintenance | 5 | 2 |
| Water supply for human use | 1 | 0 |
| Natural resources | 1 | 0 |
| Cultivated food | 2 | 2 |
| Cultural significance | 1 | 0 |
| Tourism and recreation | 1 | 0 |
| Education and research | 1 | 0 |

| | |
|---|---|
| 0 | Low |
| 5 | High |

**Figure 16** Tree line

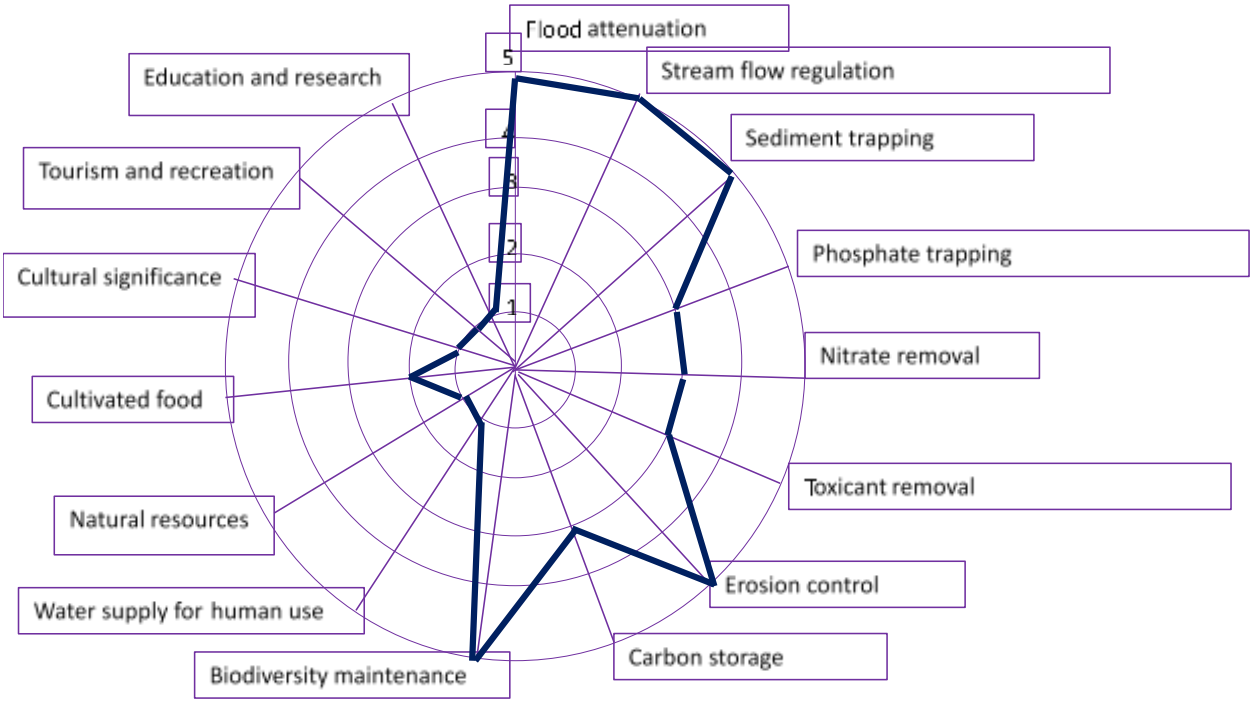


**Figure 17**. Resource Economics Footprint Haas River

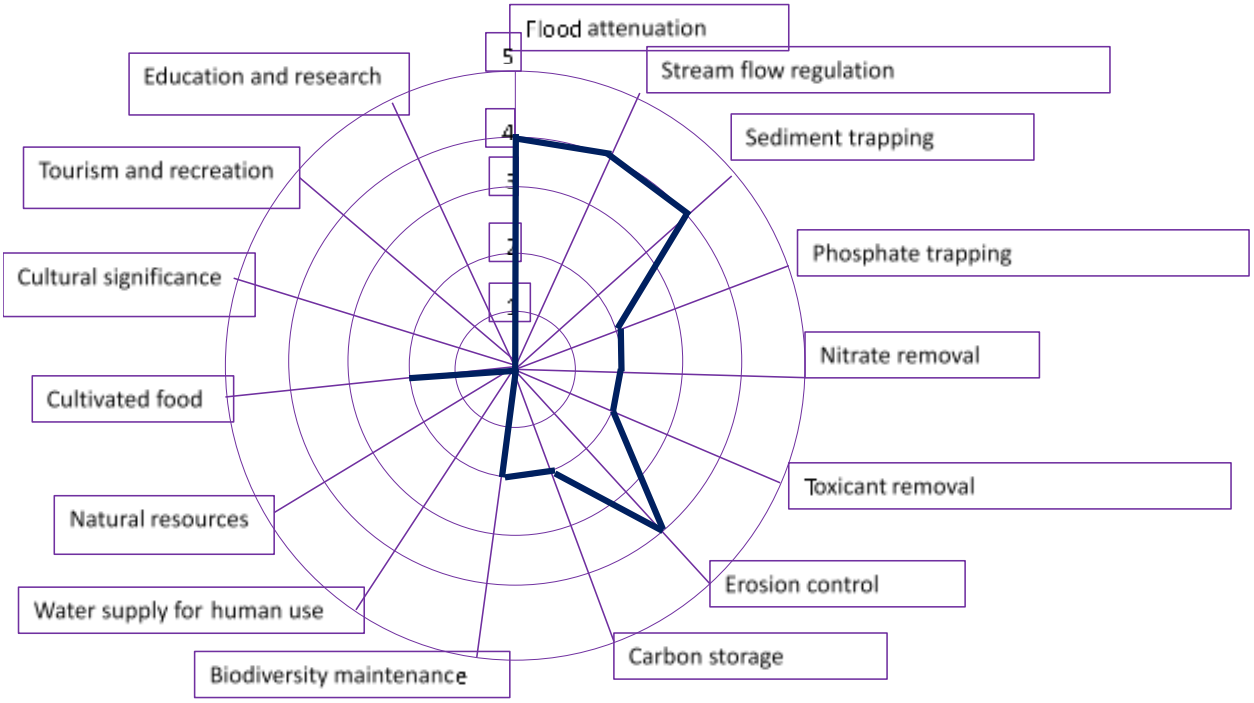


**Figure 18**. Resource Economics Footprint Drainage Line

## 18 Conclusions

Figure 19 has been adapted from one of the most recent DWS policy documents.

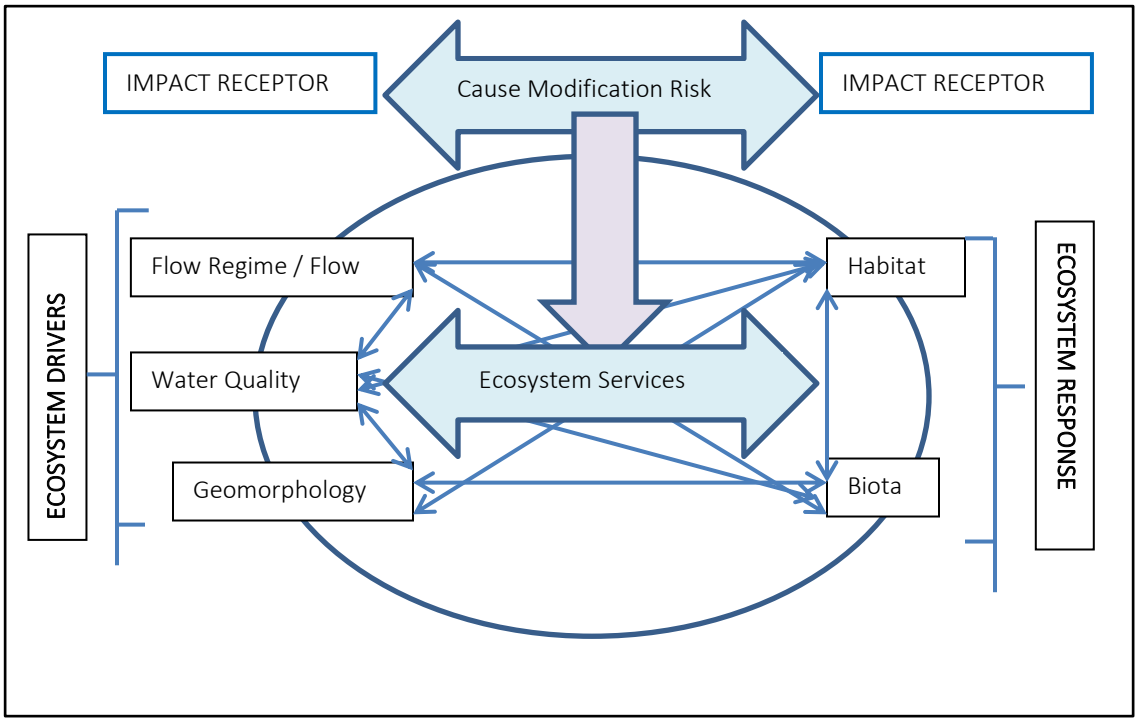


**Figure 19** Minimum Requirements for a S21(c) and (i) Application.

An anthropogenic activity can impact on any of the ecosystem drivers or responses and this can have a knock-on effect on 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 conclusions can be structured along the outline that is provided by Figure 19.

The aquatic system is driven by the seasonal rains in winter, scant as it may be, followed by the long summer drought and intense heat that limits aquatic habitat to a line of sweet thorn trees kept alive by the migration of shallow, unconfined ground water. The tree line adds significantly to the biodiversity of the area.

The renovation of the WWTW is not about to compromise the environmental goods and services rendered, under the strict condition that the unnamed drainage line is protected during the construction phase. Moreover, the risks of a spillage would be reduced to insignificant levels, once the WWTWs has been renovated, much to the advantage of the downstream farming community.

The environmental risks of the projects are negligible. The Risk Matrix indicates that a General Authorisation would be in order. However, WWTWs are controlled activities I terms of S21(e), hence a Licence will have to be issued for the project to go ahead.

## 19 References


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## 20 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: 30 April 2020

## 21 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.
- Past Director: UNESCO West Coast Biosphere, South Africa
- Past Director (Deputy Chairperson): Grotto Bay Home Owner'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
- Member Wetland Society of South Africa
- Member Botanical Society of South Africa

## 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 Waste Water 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, Muggievlag 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

# 22 Appendix

## 22.2 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 22.2.1** 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 22.2.2** 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 22.2.3** Significance Rating

| Significance Rating | Description |
|---|---|
| High | High consequence with a regional extent and long-term duration<br><br>High consequence with either a regional extent and medium-term duration or a local extent and long-term duration<br><br>Medium consequence with a regional extent and a long-term duration |
| Medium | High with a local extent and medium-term duration<br><br>High consequence with a regional extent and short-term duration or a site-specific extent and long-term duration<br><br>High consequence with either local extent and short-term duration or a site-specific extent with a medium-term duration<br><br>Medium consequence with any combination of extent and duration except site-specific and short-term or regional and long term<br><br>Low consequence with a regional extent and long-term duration |
| Low | High consequence with a site-specific extent and short-term duration<br><br>Medium consequence with a site-specific extent and short-term duration<br><br>Low consequence with any combination of extent and duration except site-specific and short-term<br><br>Very low consequence with a regional extent and long-term duration |
| Very low | Low consequence with a site-specific extent and short-term duration<br><br>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 22.2.4** 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. |

## 22.3 Risk Matrix Methodology

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

**Negative Rating**

**TABLE 1- SEVERITY**

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

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

**TABLE 2 – SPATIAL SCALE**

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

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

**TABLE 3 – DURATION**

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

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

**TABLE 4 – FREQUENCY OF THE ACTIVITY**

How often do you do the specific activity?

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

**TABLE 5 – FREQUENCY OF THE INCIDENT/IMPACT**

How often does the activity impact on the environment?

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

**TABLE 6 – LEGAL ISSUES**

How is the activity governed by legislation?

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

| TABLE 7 – DETECTION | |
|---|---|
| How quickly can the impacts/risks of the activity be observed on the environment (water resourc | |
| Immediately | |
| Without much effort | |
| Need some effort | |
| Remote and difficult to observe | |
| Covered | |
| | |

| TABLE 8: RATING CLASSES | | |
|---|---|---|
| | | |
| **RATING** | **CLASS** | **MANAGEMENT DESCRIPTION** |
| 1 – 55 | (L) Low Risk | Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded. |
| 56 – 169 | M) Moderate Risk | Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and |
| 170 – 300 | (H) High Risk | Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale |
| **A low risk class must be obtained for all activities to be considered for a GA** | | |

**TABLE 9: CALCULATIONS**

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

## 22.4 Buffels River Catchment Graphic Version