

# AGTERFONTEIN BOERDERY (PTY) LTD



## PORTION 33 OF FARM RIETVALLEY 367, CERES

Enlargement of the

### DRIEFONTEIN DAM

#### TECHNICAL REPORT V2.1

#### WATER USE LICENSE APPLICATION

#### Risk Matrix

In terms of Section 21 of the National Water Act (36 of 1998)

March 2018



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WATSAN *Africa*



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## 1 Introduction

Portion 33 of the Farm Rietvalley 367, Ceres is located of the R46 trunk road approximately 9km east of the town of Ceres, as the crow flies.

The following excerpt is from the Notice of Intent for the pending Environmental Impact Assessment:

“Agriculture forms the backbone of the Cape Winelands District economy. The Agricultural Sector contributes to 24% of the formal employment opportunities, which makes the sector essential to the livelihoods of the residents.

Agterfontein Trust proposed the enlargement of the existing Driefontein Dam on Rietvalley Farm, of which an existing water use license exists. The existing dam did not provide enough storage capacity on the farm for winter listed water. The proposed enlargement of the Driefontein Dam would allow for the storage of winter listed water for summer irrigation. Providing a more efficient use of an already existing water use. There is thus no need to apply for a new water use license. No new water will be extracted but if enlargement is granted the dam will have the capacity to store an additional 82 000m<sup>3</sup> of water per year.

10 000m<sup>3</sup> of ground will be removed from the bottom of the dam to be used to enlarge the dam wall. The current concrete spillway will be removed and a new one will be constructed on the exact predetermined elevation to precisely provide for the design capacity of the enlarged dam.

The applicant, Mr David G Malherbe of Agterfontein Boerdery (Pty) Ltd appointed Enviro Africa of Somerset West to conduct the legally required Environmental Impact Assessment.

Likewise, Dr Dirk van Driel of WATSAN Africa was appointed to complete the Risk Matrix, as is required for the Water Use License Application (WULA) with the national Department of Water and Sanitation (DWS) in terms of the National Water Act (NWA, 36 of 1998). The Risk Assessment is not a stand-alone document. The scores that are allocated should be properly motivated. This is usually done by means of a Technical Report, previously known as the Fresh Water Report.

This Technical Report serves as an input to the WULA, which is to be formally submitted by Sarel Bester Ingenieurs of Ceres on behalf of the applicant. Hence this Technical Report is rather concise and limited, since it only pertains to the Risk Matrix.

## 2 Legal Framework

The proposed dam wall construction “triggers” sections of the National Water Act. These are the following:

### S21 (b). *Storing of water.*

This report deals with S21 (c) and (i) impacts. The S 21(b) aspect is being dealt with in the appropriate WULA forms.

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

The proposed elevation of the dam wall would have a permanent effect on the flow of the stream.

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

The proposed elevated dam wall will permanently change the characteristics of the stream.

Government Notice 267 of 24 March 2017

Government Notice 1180 of 2002. *Risk Matrix.*

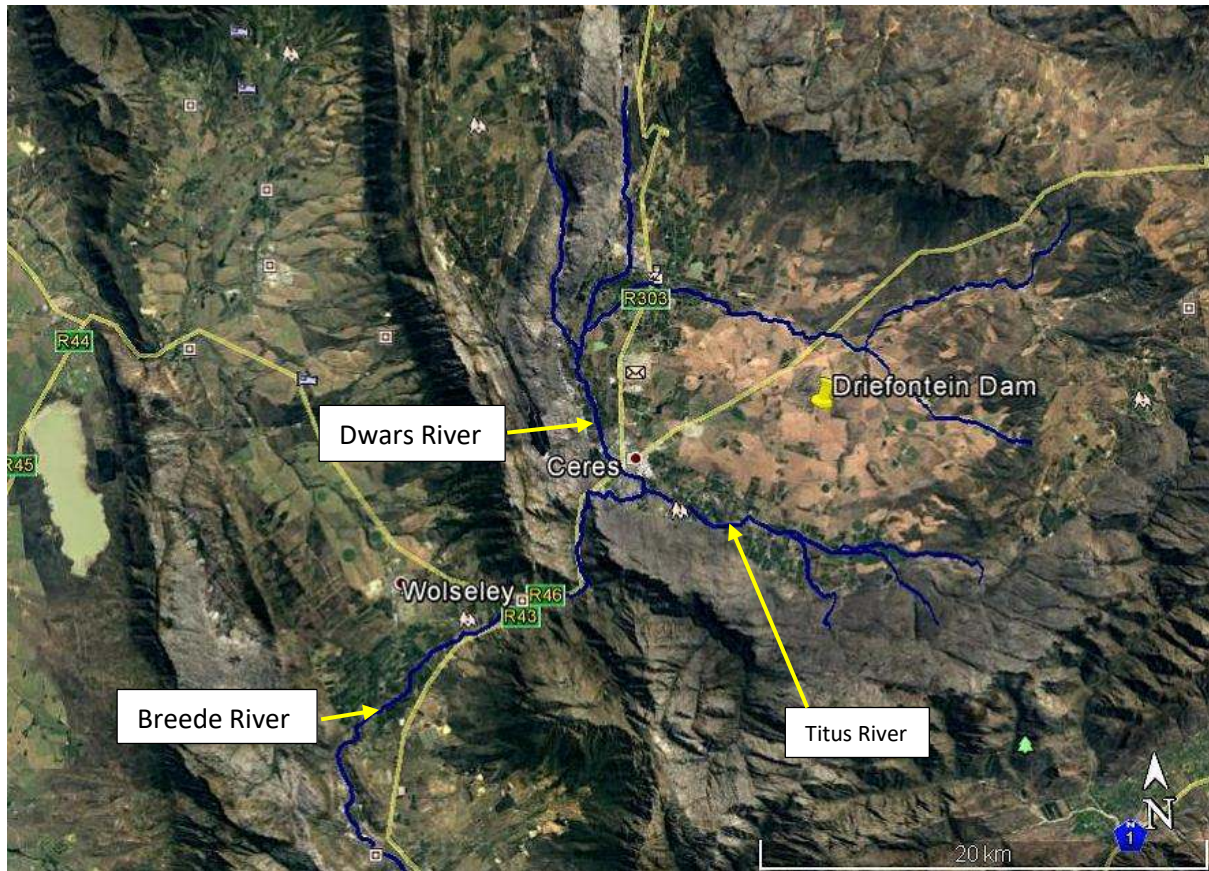
The Risk Matrix as published on the DWS official webpage must be completed and submitted along with the Water Use Licence Application (WULA). The outcome of this risk assessment determines if a letter of consent, a General Authorization or a License is required.

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. These will have a profound bearing on the elevation of the dam wall.



### 3 Regional Setting



**Figure 1** Driefontein Dam Regional Setting

The coastal plains along the Atlantic seaboard of the Western Cape are demarcated by mountain ranges that stretch from south to north. At the towns of Ceres and Wolseley the mountains abruptly turn towards the east (Figure 1). It is in this mountainous elbow where the Ceres Valley is located, a depression in the mountains to which access is gained through steep mountain passes.

The Titus River marks the southern boundary of the Valley. It joins the Dwars River in the town of Ceres, to further downstream break through the mountain in a deep ravine as the Breede River.

Figure 1 is rather schematic and simplified, as there are many more smaller rivers that have not been indicated.

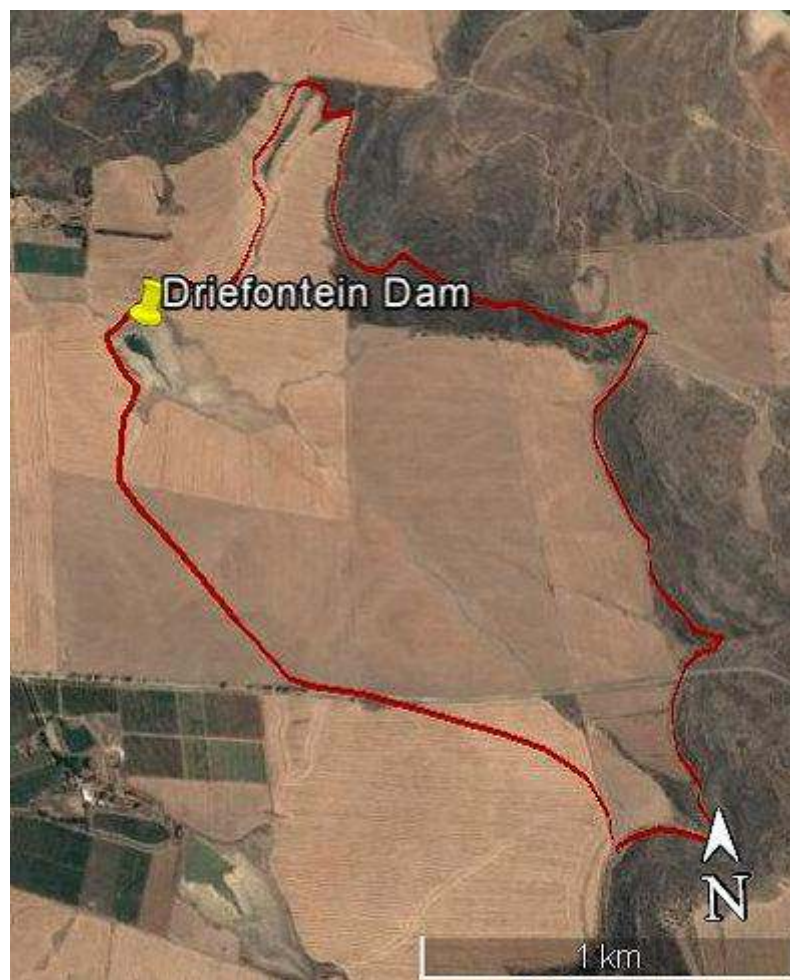
#### 4 Driefontein Dam Catchment

Of importance is that the Driefontein Dam, which is located approximately in the middle of the valley, is not naturally connected to any of the rivers that flow out of the surrounding mountains. It has, however, a small catchment of its own (Figure 2).

Originally this catchment was twice as large as it is today, as it has been divided in two portions by a canal from the Warm Bokkeveld Irrigation Scheme. The irrigation canals form the boundary of the sub-catchment on the western and northern sides.

Some of the vital numbers of this small sub-catchment are as follows:

Surface area	2.2 km
Annual rainfall	470mm
Annual runoff	230 000 m <sup>3</sup>



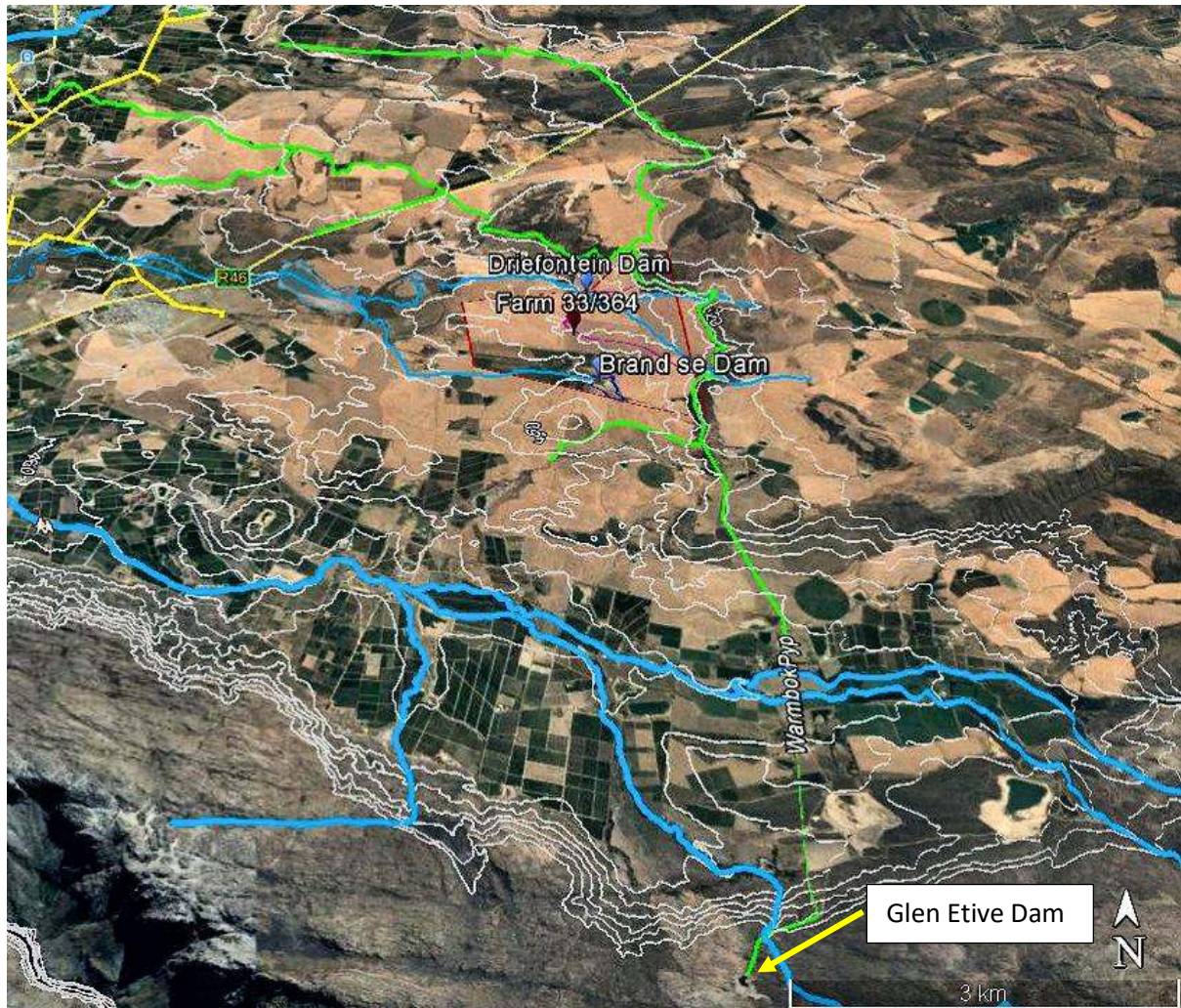
**Figure 2** Driefontein Dam Catchment Area

It is more than obvious that the runoff from the catchment is too little to fill the Driefontein Dam.



## 5 Warm Bokkeveld Irrigation Scheme

There are several irrigation schemes in the Ceres Valley, each with a water offtake from a river.



**Figure 3** Warm Bokkeveld Irrigation Scheme (Sarel Bester Ingenieurs)

The Warm Bokkeveld Scheme starts with the Glen Etive Dam (Figure 3) up against the northern slope of the mountain. Water is conveyed through a pipe northward into the Ceres Valley across the Titus River. From here water is further conveyed through a series of irrigation canals right across to the other side of the valley (yellow lines, Figure 3).

Some 20 farming units benefit from this water. No less than 965 hectares are irrigated out of this scheme. At an irrigation rate of  $8000 \text{ m}^3$  per hectare per annum, it follows that the Warm Bokkeveld scheme delivers  $7.7 \text{ million m}^3$  of water per annum.

The Glen Etive Dam (Figure 3) delivers water for 168 days per year. For the rest of the time the pipe is dry. This is because of the seasonal rainfall.

Farming is focussed in an increasing degree to permanent crops such as fruit that requires most water in summer. Hence it is important to store water in farm dams, as most of the runoff is in winter.

The scheme maximally delivers 7.7million m<sup>3</sup> per year. This is an existing legal water use. The farmer units benefitting from this scheme haven formally enlisted to use this water for the irrigation of crops.

Any water in excess than this figure passes the Glen Etive Dam and flow down the mountain stream into the Titus River.

It is most important to consider that all water that is released from the Glen Etive Dam is used for farming. None of it is allowed to flow back into any of the rivers. If any water flows past one farm because of a lack of storing capacity, the next downstream farmer would certainly use it to the benefit of his crops.

## 6 Driefontein Dam

**Table 1** Vital Statistics Driefontein Dam

Aspect	Current	Phase 1	Phase 2
Length of the dam wall m	300	390	431
Hieght m	7.4	8.95	9.55
Surface area ha	10.51	14.2	16.0
Capacity m <sup>3</sup>	239 000	321 000	420 000
Increase in capacity m <sup>3</sup>		82 000	181 000

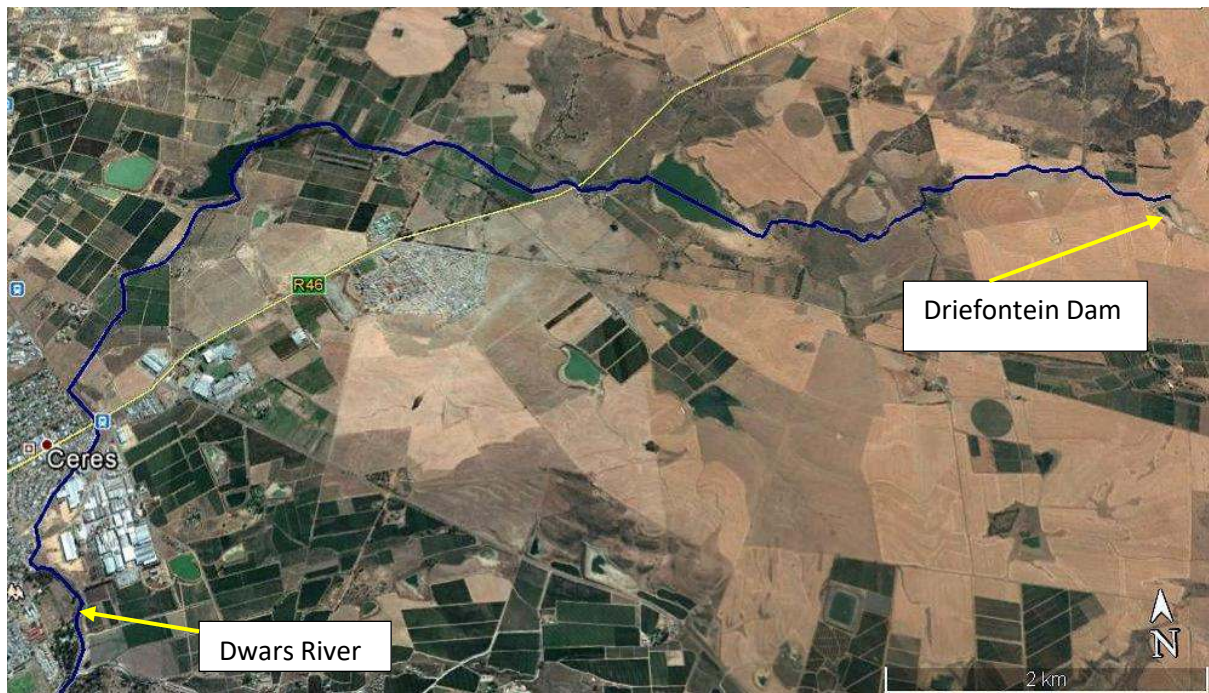
At first phase 1 was contemplated, but finally phase 2 was accepted and phase 1 scrapped.

The dam wall is to be raised with 2.15 metres to store 181 000 m<sup>3</sup> more water.

It again is most important to appreciate that this volume of water does not represent any more water that is going to be taken out of the system. This is water that has already been allocated for irrigation purposes to the Farm Agterfontein. This is an existing legal water use. This water is delivered to farming units with the canal system.

The raising of the dam wall would merely store water that is now flowing through to downstream farming operations. None of this water is currently flowing back to any river and therefore is not making any contribution to river health and the aquatic ecology. The raising of the dam wall is not about to bring any change in the *status quo*.





**Figure 4 Stream**

Where the stream leaves the Driefontein Dam (Figure 5) it is highly impacted with literally nothing left of the original qualities of a natural stream. It is an incised furrow through a ploughed-over wheat field devoid of water, aquatic habitat or riparian zone. During the site visit there were mostly exotic grasses somewhat greener than the surrounding wheat fields (Figure 6).



**Figure 5 Water course downstream of the Driefontein Dam**





**Figure 6** Stream below Driefontein Dam

The streams flowing into the Driefontein Dam are not any different (Figure 7). They are all most unnatural drainage lines through wheat fields.



**Figure 7** Inflowing water course

The stream downstream and adjacent to the Driefontein Dam only flows during period of exceptionally high rainfall, when the Warm Bokkeveld Irrigation Scheme has filled up the Driefontein Dam and when there is runoff from the dam's catchment. This seldom happens, once in a couple of years. When it does, the flow lasts for a couple of days, after which it returns to its usual dry state.

Nevertheless, it seems as if the loose soils erode easily. During periods of high rain fall the stream beds are incised deeper and wider.

The stream can only return to a more natural state if the entire landscape reverts to less farming and more natural catchment. It is unlikely that this would ever happen, because of the vested agricultural interests that has been entrenched in the region's economy since the country's early history.

Some 2 km downstream is a bigger dam and upstream as well as downstream of this dam a modicum of natural aquatic habitat still exists. On the other side of the R45 the stream again is a straightened and engineered furrow following the edges of agricultural blocks. Further down is still another dam followed by a canal through the Ceres industrial area after which it joins the Dwars River.

It is quite possible that the condition of the stream improves further downstream of the Driefontein Dam. Given the budget an exhaustive study covering the length of the stream was beyond the scope of this report.

## **7 Present Ecological Status (PES)**

The PES and EIS are protocols that have been produced by Dr Neels Kleynhans 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 scores have been given to the part of the stream downstream and adjacent to the Driefontein Dam.

The instream and riparian habitat have both been critically modified by farming practices and the storage of water.



**Table 3 In-Stream Habitat Integrity**

<b>Instream</b>	<b>score</b>	<b>weight</b>	<b>Product</b>	<b>Maximum Score</b>	<b>Remark</b>
Water Abstraction	1	14	14	350	
Flow modification	2	13	26	325	
Bed modification	3	13	39	325	
Channel modification	8	13	104	325	
Water quality	5	14	70	350	
Inundation	2	10	20	250	
Exotic macrophytes	5	9	45	225	
Exotic fauna	15	8	90	200	
Solid waste disposal	15	6	60	150	
max score		100	468	2500	
% of total			18.7		
<b>Class</b>			<b>F</b>		Critically modified
<b>Riparian Zone</b>					
Water abstraction	1	13	13	325	
Inundation	2	11	22	275	
Flow modification	3	12	36	300	
Water quality	5	13	65	325	
Indigenous vegetation removal	1	13	13	325	
Exotic vegetation encroachment	2	12	24	300	
Bank erosion	1	14	14	350	
Channel modification	1	12	12	300	
		100	199	2500	
% of total			8.0		
			74.7		
<b>Class</b>			<b>F</b>		Critically modified

**Table 4** Habitat Integrity according to Kleynhans, 1999

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

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

The dam's water level fluctuates widely because the water is used for irrigation. This is a hostile environment for any of the indigenous fish species. There were none of these species and hence the dam cannot be considered as ecologically important. Neither were there any other species of whatever description that could be described as endangered or important. These were removed when the land was tilled.

The sensitivity is often described as the ability of habitat to bounce back to a condition closer to its original status if the impacts are removed. It is doubtful if highly cultivated land would ever resemble aquatic habitat within the next millennium and hence the habitat cannot be described as particularly sensitive.

**Table 5.** Ecological Importance and Sensitivity Categories (EISC) 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)

## 8 Impact Assessment

An impact assessment is required according to a predetermined methodology. This is not so much a requirement of the DWS, but rather of other environmental authorities.

The impact assessment rates the success of mitigating measures that can or should be taken during the planning, construction, operational and decommissioning phases of the project.

In the case of the Driefontein Dam and the pending increase of its storage capacity, there will not be any impact to the downstream aquatic environment. No less water would flow down the stream downstream of the dam as is currently the situation, as any water that is now not being used for irrigation is flowing down the canal and not the stream. Once the dam wall has been raised, less water would flow down the irrigation canal. The net effect on the stream's water balance is no impact at all.

The spillway (Figure 8) is to be removed. A new one will be constructed over the reconstructed dam wall. The spillway will be raised with 1m.

The dam and the spillway should be not any higher than the dam's full capacity, after the 181 000m<sup>3</sup> has been added to the capacity of the dam. This would ensure that if the dam is at its design capacity, it would overflow during these exceptional very high rainfall events. This water would hardly benefit the highly impacted stream adjacent and below the Driefontein Dam. It would possibly be of benefit further downstream where there may still be ecological functioning left.

During the construction phase material will be collected on the bottom of the empty dam and compacted on top of the current dam wall. During this phase a small amount



of loose dirt can end up in the stream. It is doubtful if this volume of dirt would be any more than that of a ploughed-over wheat field.

The possibility of any building rubble washing down the stream during the removal of the spillway can be prevented by applying standard work procedures, due diligence and limiting construction to the dry season.

The new spillway will be lined with natural stone rather than concrete. Again, no building material will be allowed to wash downstream under any circumstances.



**Figure 8** Spillway

From this the following mitigation measures can be identified:

- The dam should not be built any bigger than its enlarged design capacity;
- During construction its footprint should be kept as small as possible;
- All building rubble should be removed following the completion of the dam
- Building should take place during the dry summer months

**Table 6** Summary of possible impacts

Possible Impact		Extent	Duration	Intensity	Significance	Probability	Confidence
Elevation of the dam wall	Without mitigation	Regional	Medium term	Low	Medium	Low	High
	With mitigation	Local	Short term	Low	Low	Improbable	High
Removal of the spillway	Without mitigation	Regional	Medium term	Low	Medium	Low	High
	With mitigation	Local	Short term	Low	Low	Improbable	High
Construction of new spillway	Without mitigation	Regional	Medium term	Low	Medium	Low	High
	With mitigation	Local	Short term	Low	Low	Improbable	High

- Local means the stream at the site (Table 6).
- Regional means downstream of the Driefontein Dam to a locality where there is residual ecological functioning.
- Short term means the time during which the dam is constructed.
- Long term means the time following construction.
- Probability is expressed with a 5-point scale: Improbable, Low, Medium, High, Probable.
- The Confidence Level can either be low, medium or high. The same applies to Intensity and Significance. Significance is the combined effect of extent, duration and intensity.

## 9 Risk Matrix

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

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

The risk assessment is a requirement of Government Notice 509 of 2016 in terms of the National Water Act (36 of 1998).

The risks are low for all listed activities.

**Table 7** Risk Assessment

No.	Activity	Aspect	Impact	Significance	Risk Rating
1	Heighten dam wall	Compacting dirt on existing dam wall	Sand ending up in stream	24	Low
2	Demolish spillway	Rubble ending up in stream	Pollution Habitat alteration	24	Low
3	Construct new spillway	Rubble in stream	Habitat alteration	24	Low



**Table 7** Continued Risk Rating

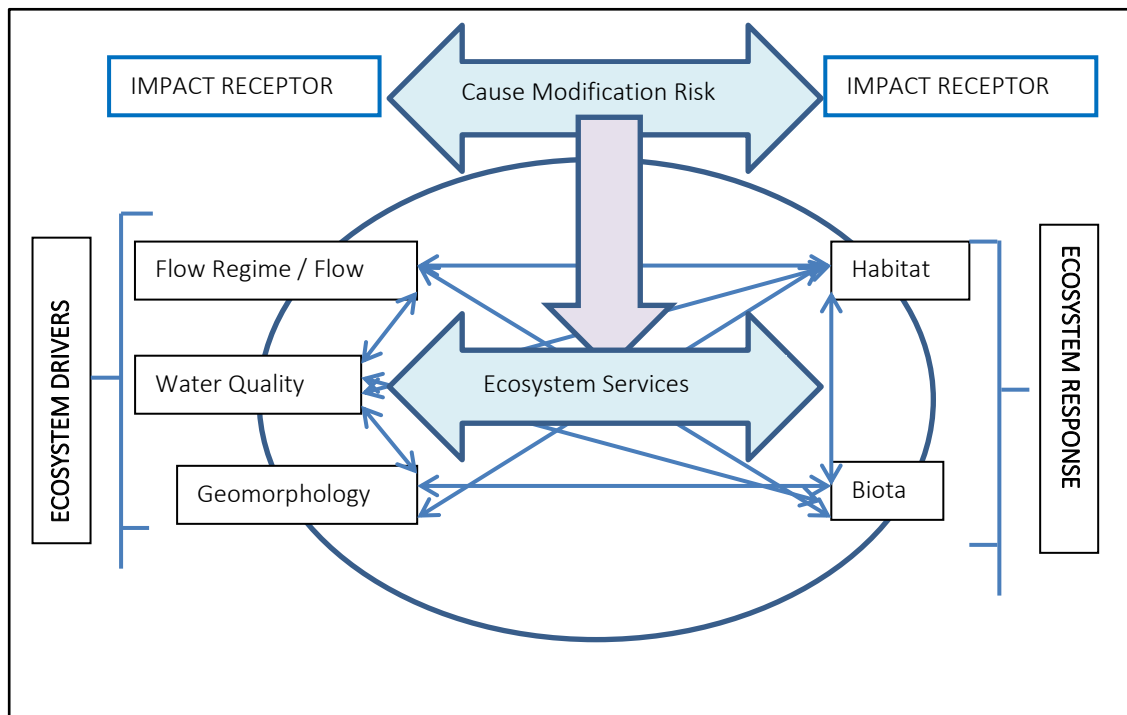
No	Flow	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence
1	1	1	1	1	1	1	1	3
2	1	1	1	1	1	1	1	3
3	1	1	1	1	1	1	1	3

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

The risks to the aquatic environment are insignificant. According to the risk matrix this activity should be allowed with a letter of consent or at most a General Authorisation.

## 10 Conclusions

Figure 3 has been adapted from one of the most recent DWS policy documents.



**Figure 9** Minimum Requirements for a S21(c) and (i) Application.

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

The conclusions can be structured along the outline that is provided by Figure 9.

The driver of the system, this is the stream just downstream of the Driefontein Dam, is the pulse of water that occurs possibly during a 1:5 year-flood. This pulse is modified by the abstraction of water through the Warm Bokkeveld Irrigation Scheme. However, this pulse is of such a magnitude that it entirely overruns the scheme and its storage capacity.

The stream below the Driefontein Dam does not benefit from these floods, because there is little if any aquatic ecological functioning left. A fast pulse of water did not create any permanency in the past to the aquatic habitat and it is doubtful if it ever will. The landscape is entirely dominated by wheat field, with little chance for the restoration of aquatic habitat.

The enlargement of the Driefontein Dam would not make any difference to this situation. This is especially true as any water over and above the current inflow volume passes in the irrigation canal and not down the stream.

Likewise, it does not make any difference to the aquatic environment if phase 1 or phase 2 is going to be implemented. The 181 000m<sup>3</sup> per year of water that is taken from the sub-catchment is a allocated fixed volume and not connected to the storage capacity of the Driefontein Dam. It is an existing legal water use. The only difference would be that the water will be used on Agterfontein, instead of downstream farmers who are now claiming this water for use on their land.

The question remains if the upper catchment produces enough runoff to provide the extra water that is needed to fill up the Farm Agterfontein's current Existing Legal Water Use (ELU). Under the current extreme drought conditions, it does not seem so. However, that is not the point that is required to be debated in this report. Only if the enlargement of the dam would have any effect on the stream just downstream of the Driefontein Dam.

Under the current irrigation system's operating rules, the heightening of the dam wall is ecologically insignificant. From this point of view the project should go ahead. A letter of consent or a General Authorisation would be in order.

## **11 Reference**

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



## 12 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, whether 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: 14 March 2018

## 13 Résumé

**Dr Dirk van Driel**  
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### Experience

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

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

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

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

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

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

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

### Service Positions

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

### Membership of Professional Societies

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

## **Recent Reports & Water Use License Applications**

- Process Review Kathu Wastewater Treatment Works
- Effluent Irrigation Report Tydstroom Abattoir Durbanville
- River Rehabilitation Report Slangkop Farm, Yzerfontein
- 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 Doornfontein Sand Mine Malmesbury
- Technical Report Berg en Dal Sand Mine Malmesbury
- Technical Report Driefontein Dam, Farm Agterfontein, Ceres