Fresh Water Report

Proposed enlargement of the dam

Farm Zwartfontein 792, Malmesbury Version 2.1

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

June 2020

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Abbreviations

Average Score Per Taxon	ASPT
Critical Biodiversity Area	CBA
Department of Environmental Affairs	DEA
Department of Environmental Affairs and Development Planning	DEA&DP
Department of Water and Sanitation	DWA
Ecological Importance	EI
Ecological Sensitivity	ES
Environmental Impact Assessment	EIA
Government Notice	GN
Metres Above Sea Level	masl
National Environmental Management Act (107 of 1998)	NEMA
National Water Act (36 of 1998)	NWA
Present Ecological State	PES
South Africa National Biodiversity Institute	SANBI
South African Scoring System Version 5	SASS5
Water Use License Application	WULA

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1 Introduction

According to the UFF webpage (https://uff.co.za/) the following:

"UFF is the exclusive agri-investment partner to the Old Mutual Investment Group."

Its *modus operandi* includes the following:

"……*to acquire farmland and select or recommend a skilled operator for that farm, as well as facilitating finance for development. Productivity on the farm is improved and the farm is leased to the appointed operator…..*"

Zwartfontein along the Berg River on the dirt road to the north of Wellington on the way to Hermon in the Western Cape is one such farm. The farm is still under development, with new orchards and vineyards being established. Likewise, the water and irrigation infrastructure are being enlarged and upgraded. To meet future water needs for irrigation of crops, the farm dam is to be enlarged.

During the site visit it was abundantly evident that Zwartfontein Farm is a state-of-the-art undertaking, using the very latest farming techniques and practices as implement by most competent people who are adamant to deliver top quality farm produce to the most discerning consumer.

UFF has appointed Enviro Africa to conduct the legally required EIA for the envisaged enlargement of the Zwartfontein farm dam.

The construction of a larger dam will probably have an impact on the aquatic environment and will have to be addressed if approval for the larger dam is to be granted by the South African environmental authority, in this event DEA&DP, the Western Cape Provincial representative of the DEA.

To assess possible impacts on the aquatic environment, Enviro Africa, in turn, has appointed Dr Dirk van Driel of WATSAN Africa.

The Zwartfontein farming venture currently classified as an "Existing Legal Water Use" by the DWS. Hence there is no need to apply for more abstraction of water from the Berg River to fill the bigger dam. The construction of the new dam "triggers" a number of "activities" in terms of the NEMA and its regulations. For this reason a "Fresh Water Report" is required.

It was thought best to follow the same outline and profile that is required for a Fresh Water Report for WULA's. This is a recognised and tested format, which provides the best and most answers to questions raised by the DEA. At the same time it would provide the information required by the DWS for an informed decision, should it be required.

The Zwartfontein Dam is considered to be an instream dam.

2 Quaternary Catchment

Zwartfontein is in the G10D quaternary catchment

3 Vegetation

According to the SANBI webpage, the Zwartfontein Farm is located on Swartland Schale Renosterveld, which is listed as endangered. Conservation authorities will take this in serious consideration in their decision-making processes.

4 The Project

The Fresh Water Report was compiled according to the initial informantion received from the Zwartfontein management:

"*The proposed development entails the increase in height of the existing Zwartfontein dam wall with 2.3m. The existing dam wall height is ±11.7m and with the increase the maximum dam wall height will be 14m.*

The increase if the dam wall height will result in an increase of the dam's total footprint from 4.2ha to 5.8ha (1.6ha increase). The current dam capacity is at 150 000m³ and will be increased to 268 000m³ (118 000m³ increase).

Irrigation pipelines as well as the pipeline feeding water from the Berg River to the dam is already in place. Water is being pumped from the Berg River and is an existing water use right. Please refer to the letter from the Berg River Irrigation Board."

On 4 June 2020, new information was received:

- *The existing dam wall will be raised by 8.5m in height;*
- *The dam surface water area of the existing Zwartfontein dam is 3.6 ha;*
- *The surface water area of the expanded Zwartfontein dam would be 10.9 ha; and*
- *The total dam development footprint (including the dam wall, access road, water inlet, etc.) will be approximately 14.5 ha.*
- *The final dam wall height is going to be 22.5m*
- *The total storage capacity is going to be 915 000m³*

This almost doubled the wet footprint. A request was lodged to update the Fresh Water Report to include these new dam dimensions.

After careful consideration, it was concluded that the new, larger dimensions of the proposed dam are not about to change any outcomes of the prescribed evaluation such as the Impact Assessment and the Risk Matrix. It will, however, put more emphasis on the Mitigating Measures, which will be addressed in the Fresh Water Report.

5 Zwartfontein Location

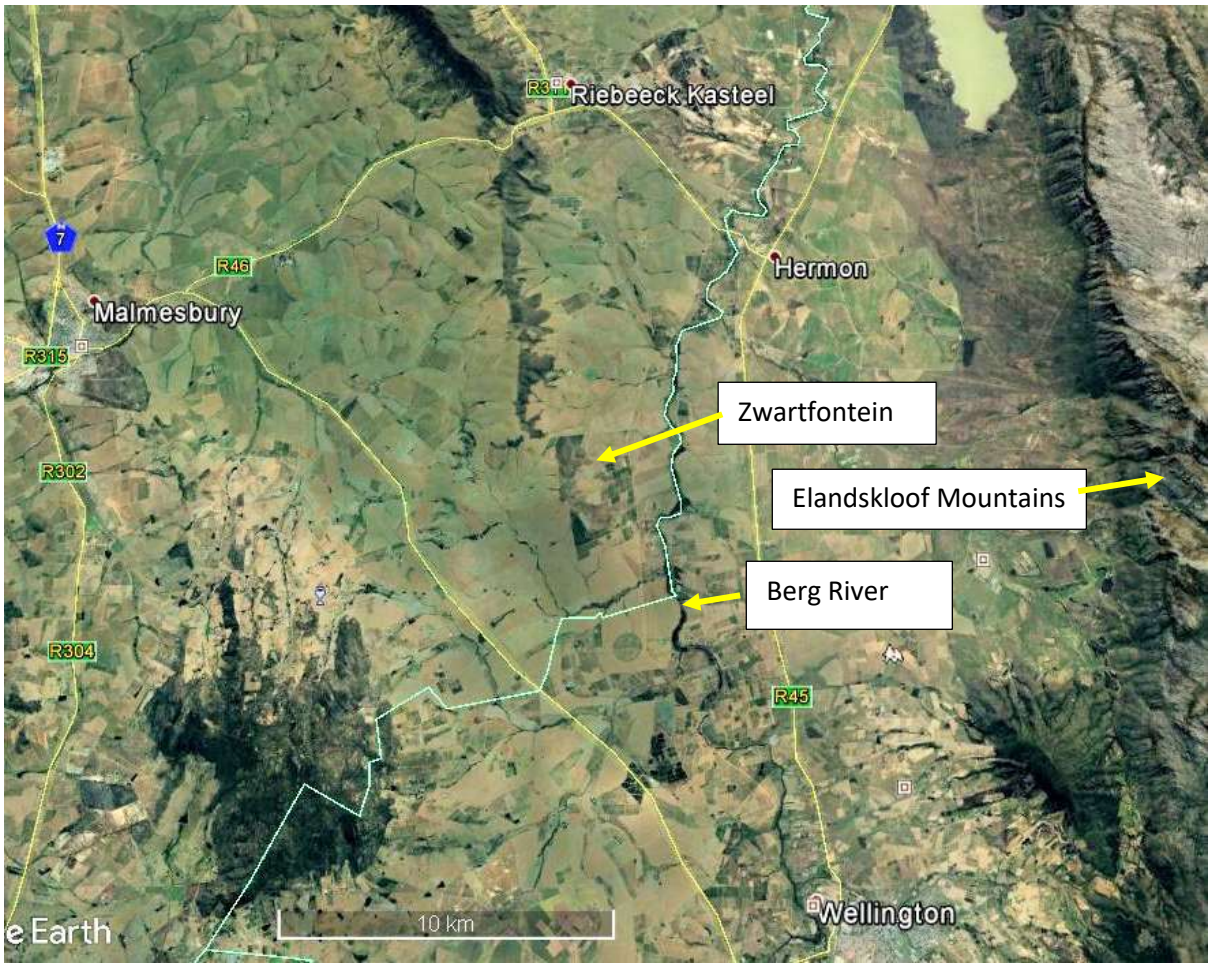


Figure 1 Zwartfontein location

The location of the Zwartfontein farm dam is shown in Figure 1. It is some 14km south of Riebeeckasteel and 18km south west of Malmesbury.

The Berg River separates the farm from the Elandskloof Mountains.

Every available patch of land in the district is utilized for farming. The largest area is under wheat. The district is noted for its wine production, while there is a good deal under fruit trees as well.

This is a rolling, undulation landscape of low hills, interrupted by the Cape Folded Mountains.

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

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

Some part of the proposed development will alter the characteristics of the banks of the drainage line.

Government Notice 267 of 24 March 2017

Government Notice 1180 of 2002. *Risk Matrix.*

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

Government Notice 509 of 26 August 2016

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

Likewise, the development triggers a part of the National Environmental Management Act, NEMA, 107 of 1998).

The EIA Regulations of 2014 No.1 Activity 12 states that no development may take place within 32 m of a water course without the consent of the Department of Environmental Affairs and its provincial representatives. A part of the development is in the river and the river bed. Consequently, this regulation is relevant to this application.

This Fresh Water Report is exclusively focussed in S21 (c) and (i) of the NWA. Should it ever become necessary to extend a WULA to the taking of water from a resource in terms of S21 (a) or the storing of water in the enlarged dam in terms of S21(b), a

separate report is required, focussed on the specific requirements of these two sub-sections of the NWA. Under the current circumstances, this is not called for.

7 Hermon Climate

http://www.saexplorer.co.za/south-africa/climate/hermon_climate.asp

The hamlet of Hermon on the banks of the Berg River is less than 10km away from Zwartfontein.

Hermon normally receives about 471mm of rain per year and because it receives most of its rainfall during winter it has a Mediterranean climate. The chart below (Figure 2, lower left) shows the average rainfall values for Hermon per month. It receives the lowest rainfall (9mm) in January and the highest (84mm) in June. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Hermon range from 17.3°C in July to 30.2°C in February. The region is the coldest during July when the mercury drops to 6°C on average during the night. Consult the chart below (lower right) for an indication of the monthly variation of average minimum daily temperatures.

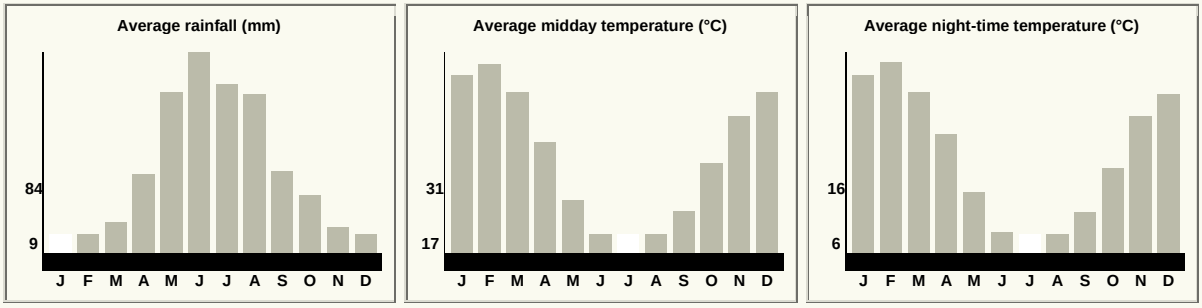


Figure 2 Hermon Climate

The rainfall is too little to sustain the Zwartfontein fruit farming venture. The farming industry heavily depends on the Berg River's water for irrigation. Because of the absence of rain during mid-summer when water is most needed, water is taken from the river during the rainy winter months and then stored in dams for irrigation later on when it becomes really dry later on in summer.

8 Sub-Catchment

The sub-catchment in which the dam is located is one of many along the Berg River in among the vineyards and the wheat fields (Figure 3). It is only 3.8km long and 2.3 km wide. It covers a surface area of 663 hectares. Only 130ha are above the farm dam to form the catchment area of the dam up the hill.

The highest point of the catchment is 270masl, up on a hill (Figure 3). The lowest point is at its point of discharge in the Berg River at 73masl. The slope is rather steep at 5.2m vertical in every 100 horizontal metres. This steep slope gives rise to fast moving water during high rainfall events and a high erosion potential.

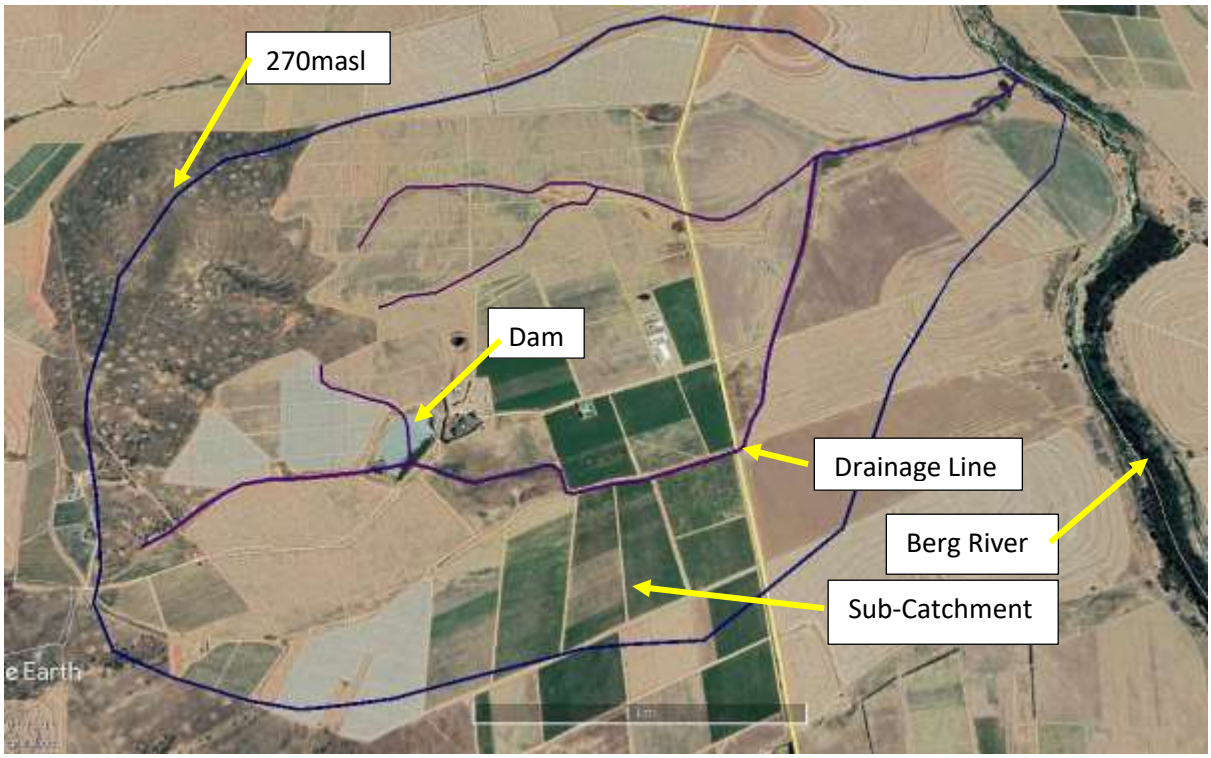


Figure 3 Sub-Catchment

9 Drainage Line

The drainage lie is 4.4 km long.

It rises on the hill above the sub-catchment (Figure 4). The drainage line upstream of the dam takes the shape of wide valleys with no discernible drainage line and with the same vegetation as elsewhere on the hill. The drainage line downstream of the dam (Figure 5) has been engineered into a straight agricultural return flow furrow all the way down to its confluence with the Berg River.

Figure 4 Hills above the dam

Figure 5 Drainage line below the dam

Figure 6 Drainage line in the vineyards

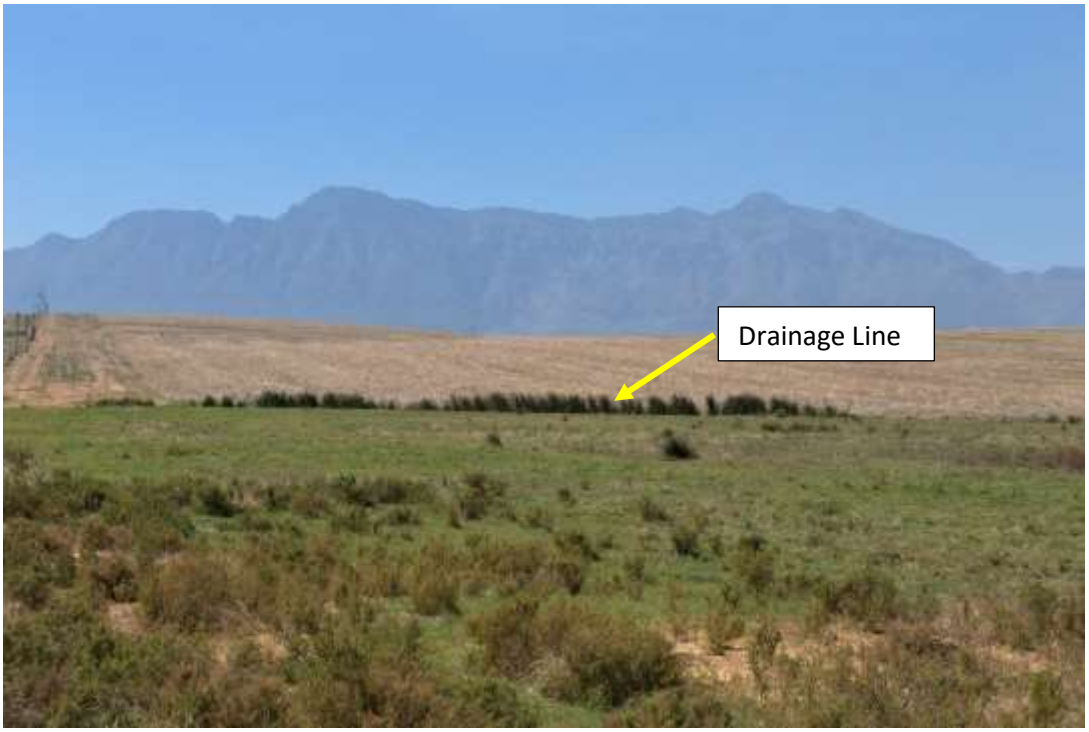


Figure 7 Diagonal drainage line

The land below and adjacent to the dam (Figure 5) has not been transformed into a vineyard and still bears some natural characteristics. The drainage line is overgrown

with reeds. At the end of this reach it makes a right angle turn, which was filled with water at the time of the site visit. This reportedly is seepage from the dam and possible agricultural return flow.

A catch pit has been constructed, together with a pump, to return most of this seepage back into the dam. The tanks containing fertiliser are positioned at the toe of the dam, together with the pumps driving the irrigation system on the farm (Figure 5).

A second reach of the drainage line (Figure 6), now a straight canal, passes through the vineyards and a third diagonally across a large wheat field (Figure 7) and into the Berg River. The entire canal was overgrown with reeds, which were thick among the vineyards and sparse over the wheat field.

10 Sampling Point

The sampling site was chosen where the pump (Figure 8) was located in the Berg River to abstract water for the farming operation.

Figure 8 Pump

The river here was shallow, less than a metre deep, some 15m wide, slow moving, pool-like. The river was narrow upstream from the pool, perhaps a metre wide and the water was moving fast, more than $1ms^{-1}$ (Figure 9).

Figure 9 Upstream end of the pool

The bottom was sandy. The only stones-in-current were a few clumps of concrete that were dumped in the top end of the pool. The emerging vegetation consisted of terrestrial grass that grew over the bank into the water. This provided ample and luxurious habitat for macro-invertebrates. The submerged vegetation consisted of sparse clumps of *Ceratophylum*. The water was very clear, quite the opposite of what the turbid Berg River is like during high flow.

The riparian zone previously was overgrown with a stance of mature *Eucalyptus* trees, which were removed. Regrowth is threatening the gains that have been made with the control program and follow-up action is now required. A large portion of these trees remain (Figure 9) on the one river bank, but away from the river. Indigenous vegetation has taken root, such as the omni-present sweet thorn *Vachellia karoo*.

The river was incised, with steep banks, with the Karoo shale base exposed in places. During floods sand is deposited high up the banks. The banks are erodible, but then mobilised sediments are deposited all along (Figure 10). The riparian zone seemed most dynamic, with material eroded and deposited as floods pass through during the winter rainy season. Erodibility is enhanced by agricultural practices close to the river banks.

Aquatic life was prolific on the day of sampling, with lots of macro-invertebrates, with even more in the shallow water of the current at the top of the pool. There were many small fish, probably carp *Cyprinus carpio* and mosquito fish *Gambusia affinis*. Both are aggressive invasive species.

Figure 10 Sand deposits

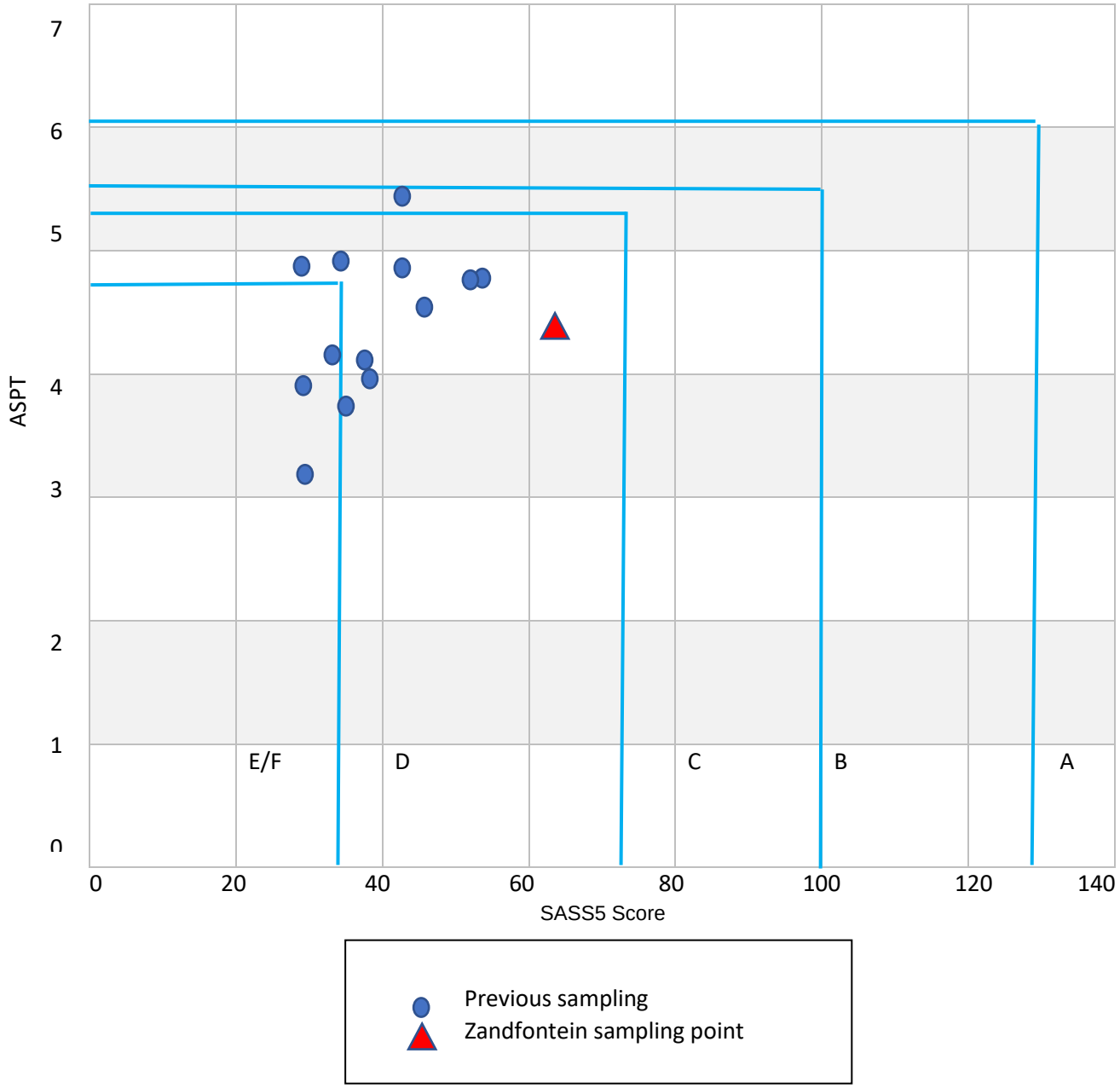
11 Biomonitoring Results

The SASS5 score (see SASS5 score sheet in the Appendix) at 65 was rather high for a mature river on a coastal plain, with a high number of taxa. However, the aquatic invertebrates were of the low-scoring type, with the result that the ASPT amounted to only 4.3. The score represented a class D (Figure 11), which signifies a “Fair” state-of-the-river.

To put the classification into perspective, from 2015 to 2017 samples were taken for a previous project at the Moredou Poultry Farm near Gouda, some 23km downstream, as the crow flies. Most of these samples resulted in a class D as well (Figure 1). The SASS5 score at Zwartfontein was generally higher than those at Moredou, but the ASPT more or less the same (Figure 1). There are more impacts downstream, such as an abattoir and a dairy farm, which could explain the lower score at Moredou, but then the entire Berg River is impacted. Upstream of Zwartfontein are numerous sources of agricultural return flow, wastewater treatment works and urban storm water.

The National River Health Program classified the Berg River downstream of Hermon classified as “D” of “Fair” as well (DWAF, 2004).

Evidently the Berg River has not deteriorated or improved since 2004 and the impacts from the Zwartfontein Farm seemingly does not alter the situation.



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 11 Biomonitoring

12 **Present Ecological State** (PES)

Table 1 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

The PES and EIS are protocols that have been produced by Dr Neels Kleynhans (Table 1 and 2) in 1999 of the then DWAF to assess river reaches. The PES is one of the evaluations that is prescribed for S21 (c) and (i) WULA's. The scores given are solely that of the practitioner and are based on expert opinion.

The drainage line has been classified as "E" (Table 2). This signifies that the drainage line has been significantly altered with a loss of ecological functioning. The heightening of the dam wall would not change this classification. It I not foreseen that the drainage line would further deteriorate.

The Berg River at Zwartfontein was classified as a "C" (Table 3). It has lost some ecological functioning because of water quality and invasive organisms both instream and in the riparian zone. This score is better than the "D" downstream at Moredou, where the river is heavily overgrown with eucalypts.

The better score is because of the lack of return flow at the end of the dry season, late summer. The score was elevated by the invasive vegetation campaign, during which eucalypts were removed. Carp dominated the instream habitat, with many large

specimens visible in the clear water. These fishes often surfaced to emphasize their presence.

Table 2 Present Ecological State Zwartfontein Drainage Line

Instream	Score	Weight	Product	Maximum score
Water abstraction	5	14	70	350
Flow modification	5	13	65	325
Bed modification	4	13	52	325
Channel modification	4	13	52	325
Water quality	15	14	210	350
Inundation	8	10	80	250
Exotic macrophytes	6	9	54	225
Exotic fauna	24	8	192	200
Solid waste disposal	24	6	144	150
Total		100	919	2500
% of total			36.8	
Class			E	
Riparian				
Water abstraction	5	13	65	325
Inundation	5	11	55	275
Flow modification	4	12	48	300
Water quality	15	13	195	325
Indigenous vegetation removal	4	13	52	325
Exotic vegetation encroachment	5	12	60	300
Bank erosion	22	14	308	350
Channel modification	4	12	48	300
Total			831	2500
% of total			33.2	
Class			E	

Table 3 Present Ecological Berg River at Zwartfontein

Instream	Score	Weight	Product	Maximum score
Water abstraction	15	14	210	350
Flow modification	15	13	195	325
Bed modification	15	13	195	325
Channel modification	20	13	260	325
Water quality	18	14	210	350
Inundation	15	10	234	250
Exotic macrophytes	20	9	180	225
Exotic fauna	5	8	40	200
Solid waste disposal	24	6	144	150
Total		100	1668	2500
% of total			66.7	
Class			C	
Riparian				
Water abstraction	15	13	195	325
Inundation	15	11	165	275
Flow modification	15	12	180	300
Water quality	20	13	260	325
Indigenous vegetation removal	10	13	130	325
Exotic vegetation encroachment	12	12	144	300
Bank erosion	18	14	252	350
Channel modification	15	12	180	300
Total			1506	2500
% of total			60.2	
Class			C	

13 Ecological Importance

13.1 Ecological Importance of the Berg River

The Ecological Importance (EI) is based on the presence of especially fish species that are endangered on a local, regional or national level (Table 4).

Endemic fish to the region such as the Cape galaxias *(Galaxias zebratus)* and the red fin minnow (*Pseudobarbus burgeri*) can be expected in the upper reaches of the watershed rather than at Zwartfontein. Perhaps white fish (*Barbus andrewi*) was present at some time ago. These have been decimated by the introduction of the exotic and predatory small mouth black bass (*Micropterus dolomieu*) and trout

(*Oncorhynchus mykiss*). At Zwartfontein the habitat has been taken over by carp (*Cyprinus carpio*).

Red fin minnows and white fish have both been listed by the IUCN as endangered.

With 2 species on the Red Data List, the Berg River certainly qualifies as ecologically important (Table 4). Conservation authorities therefore take a keen interest in the Berg River and as public environmental consciousness rises, the pressure for habitat rehabilitation will predictably increase.

Table 4. Ecological Importance according to endangered organisms (Kleynhans,1999).

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

13.2 Ecological Importance of the Zwartfontein Drainage Line

The drainage line is devoid of permanent water, apart from irrigation return flow. There is no fish in the drainage line, or for that matter, any other plant or animal that are endangered in any way. Perhaps there were some prior to human impact. Hence the drainage line, in its current state, cannot be considered as being ecologically important.

14 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.

14.1 Ecological Sensitivity of the Zwartfontein Drainage Line

It seems unthinkable that the Zwartfontein drainage line, as many other in the district, would ever recover, if agriculture was to cease and nature was to be left at its own devices. The current impact is of such a nature and scope that recovery seems not possible.

Looking at the surrounding renosterveld as a well-known practical example, when removed for the purpose of agriculture and then left to recover, the natural vegetation does not grow back. Cultivated areas all over the area and that have been left alone for 50 or even 100 years, have not recovered. Likewise, it can be expected that the Zwartfontein drainage line would not recover. In this sense it can be considered as sensitive.

14.2 Ecological Sensitivity of the Lower Berg River

The Berg River at Zwartfontein has absorbed numerous and deep-cutting human impacts. Yet is still functions as an aquatic ecosystem. In the highly improbable event of ceased human impact, the river here would probably bounce back to its previous glory. In this respect the river cannot be categorised as sensitive. It is dreaded among conservation minded people that, according to opinions expressed by people of the water management fraternity, the Lower Berg River might have some more capacity to absorb further impact.

It was pleasing to note the recovery of the riparian zone during the site visit. It still has a very long way to go if it were to resemble anything like the original vegetation. This would probably not happen for many decades and in this respect the riparian zone can be described as sensitive.

15 Possible Impacts

The Fresh Water Report is not only about the possibility of the extra water that could be taken from the Berg River because of the enlarged dam. It is accepted that the existing legal water use is already fully utilised for irrigation, has already been discounted by the DWS against the flow requirents of the Berg River and that extra storage capacity would not alter the situation.

Nevertheless, biomonitoring in the Berg River that was done for this application is a regular requirements for WULA's. It serves as background, should it in future transpire that incremental water quality and quantity impacts from Zwartfontein and other locations along the river become apparent.

This report is particularly about the assessment of water courses on the Zwartfontein property and the possible effects of the dam's enlargement on these water courses. With any large irrigation scheme there is always the possibility of more agricultural return flow, with its deleterious impacts.

The drainage lines have already been transformed into storm water management systems and return flow canals. The enlargement of the dam would not add to these impacts, if only the farm's management endeavours to conserve the little ecological functioning that is still left in these canals.

Farm dams are often regarded as habitat for aquatic organisms. However, water levels vary widely, from full when filled during winter to empty at the end of summer. This makes for an aggressive aquatic environment with limited ecological functioning.

With such a large turn-over of water in the dam water quality problems are less of a problem.

16 Mitigation Measures

The local irrigation board as well as the DWA has most likely already defined the schedule according to which water is to be taken from the Berg River. The DWA, according to its legal mandate, is already monitoring the Berg River water quality and water levels in terms of a long-standing national program. All that remains for Zwartfontein is to operate within the ambit of their water use license.

The re-growth of eucalypts on the banks of the Berg River is worrisome and it would be helpful if Zwartfontein could maintain contact with Working for Water and similar initiatives. The region would benefit greatly if landowners could contribute as well to this ongoing, worth-while and large-scale undertaking.

From time to time it may become necessary to maintain and clear the drainage lines. Although already straightened and wholly de-naturalized, it is still of concern to the DWA and other conservation authorities to protect the little ecological functioning that is still left. Maintenance should be done according to a premeditated plan, preferably in conjunction with a limnologist.

The reeds in the drainage lines serve the purpose of trapping sediments that may come out of the orchards and vineyards during high rainfall events. Therefore, the reeds should be preserved as much as possible and allowed to re-establish following maintenance.

Contemporary irrigation technology demands the measuring of soil moisture and irrigate accordingly. This would limit agricultural return flow.

The pumping of seepage and return flow back into the dam is commended and should be expanded if volumes increase.

The drainage lines above the dam are still intact, apart from the areas in the upper catchment that already has been transformed into vineyards and orchards. The natural vegetation and the drainage lines should be kept intact and not be further developed.

The dam serves as a roost for water fowl. These birds should be monitored for disease and mortalities. Mortalities should be reported to relevant authorities.

There is no need for mitigation to address the eventuality of the dam overflowing when more than full. The catchment above the dam is only 130ha. Even with a rainfall event of 60mm in a single day, when 78 000m^3 of storm water falls on the catchment, it is puny if compared to the 915 000m^3 capacity of the dam. It is unlikely that the dam would overflow because of high rainfall events.

No ecological releases from the dam are recommended. To the contrary, increased seepage from the larger dam, as well as increased agricultural return flow, should be controlled, if not prevented, to preserve as much as possible of the mostly dry state of the drainage line as it was prior to development.

17 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.

This impact assessment (Table 5) is solely directed towards the possible impacts of the proposed enlargement of the dam on the drainage line and the aquatic environment.

Table 5 Impact Assessment

Description of impact Construction of the dam wall, removal of filling material from the empty dam, placing it onto the current dam wall, compacting the material. Mud and sediments may end up in the drainage line below. **Mitigation measures** Prevent fill from leaving the construction site. Keep construction foot print as small as possible. Construct during the dry season in summer								
Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Negative	Regional	Medium	Medium	Low	Probable	Certain	Reversible	Replaceable
With mitigation measures								
Negative	Local	Low	Medium	Low	Unlikely	Sure	Reversible	Replaceable

Description of impact

Operation of the dam. Filling of the dam from the Berg River and abstraction from the dam for irrigation. Increased seepage through the dam wall and down the drainage line. Increased return flow.

Mitigation measures

Do not over-irrigate
Measure return flow
Pump return flow back into the dam

Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Regional	Medium	Long term	Medium	Probable	Certain	Reversible	Replaceable
With mitigation measures								
Negative	Local	Low	Long term	Low	Unlikely	Sure	Reversible	Replaceable

Description of impact

Maintenance of drainage line

Mitigation measures

Keep as much of the reeds as possible
Conserve of what is left of ecological functioning
Maintain according to a schedule

Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Direct	Regional	Medium	Medium	Medium	Probable	Certain	Reversible	Replaceable
With mitigation measures								
Direct	Local	Low	Medium	Low	Probable	Certain	Reversible	Replaceable

The mitigation measures are readily implementable. Mud and agri-chemicals can be prevented from moving down the drainage line and eventually in the Berg River, if care is taken and best practices are implemented

18 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.

This assessment has been designed to assist in the decision if a General Authorisation or a License is required, should the development be allowed.

The risk rating according to this assessment is generally low. This suggests that a General Authorisation should be in order.

This only applies if all of the mitigation measures are in place.

Table 6 Risk Matrix

No.	Activity	Aspect	Impact	Significance	Risk Rating
1	Construction of dam wall	Mobilisation of sediments	Sediments in drainage line and Berg River	24	Low
2	Operation enlarged dam	Agricultural return flow in drainage line and Berg River	Eutrophication	54	Low
3	Maintenance of drainage line	Remove reeds	Habitat destruction in drainage line	32.5	Low

Table 6 Continued Risk Rating

No	Flow	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Conse-quence
1 2 3	1 2 1	1 1 2	1 2 1	1 1 1	1 1.5 1.25	1 1 1	1 2 1	3 4.5 3.25

No	Frequency of activity	Frequency of impact	Legal issues	Detection	Likelihood	Significan-ce	Risk Rating
1	1	1	5	1	8	24	Low
2	2	4	5	1	12	54	Low
3	2	2	5	1	10	32.5	Low

The risks are low, given that the drainage line is already heavily impacted and that the incremental impact of the larger dam wall would not make much difference.

19 Resource Economics

The goods and services delivered by the environment, in this case the Zwartfontein drainage line, is a Resource Economics concept as adapted by Kotze *et al* (2009). The methodology was designed for the assessments of wetlands, but in the case of the drainage line the goods and services delivered are particularly applicable and important, hence it was decided to include it in the report.

The diagram (Figure 12) is an accepted manner to visually illustrate the resource economic footprint the drainage line, from the data in Table 7.

It is perhaps ironic that the environmental footprint increases as the impact rises. As the reeds in the drainage line grow more, the ability to retain floods and agricultural chemicals improves as well. Likewise, it offers a small chance to study the effect of reeds in drainage lines and its rendering of environmental services. This does not contribute anything towards the natural biodiversity.

The left-hand side of Figure 12 is deflated. The drainage line does not offer any services if it comes to water supply, food, tourism and cultural contributions. In fact, the economic resource foot print is small. The drainage line is important for sediment trapping, as it is washed off the vineyards during floods. Generally, the drainage line is not important in terms of rendered ecological services. The higher dam wall is not about to change any of this.

It seems a futile exercise to plot the economic foot print of the Berg River, as the star shape would a complete circle, with a wealth of environmental services rendered.

Table 7. Goods and Services

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

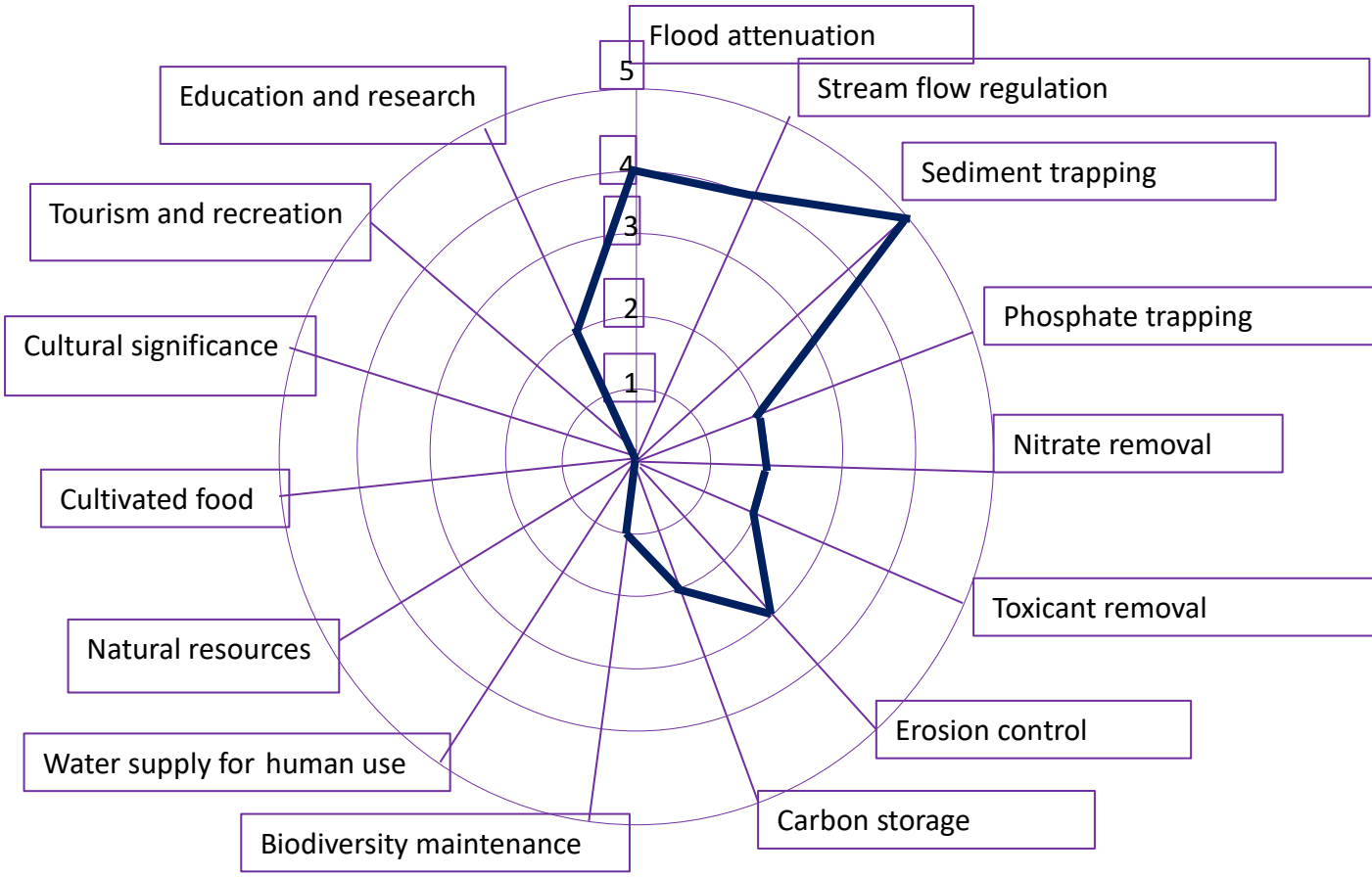


Figure 12. Resource Economics Footprint of the Drainage Line

20 Conclusions

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 (Figure 13). The WULA and the EAI must provide mitigation measured for these impacts.

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

The driver of the Zwartfontein drainage line is the seepage from the dam, that will predictably be more when the dam wall height is increased, as well as the runoff and return flow from agricultural areas. This results in a prolific growth of reeds, *Typha* in the drainage line and *Phragmitis* below the dam wall.

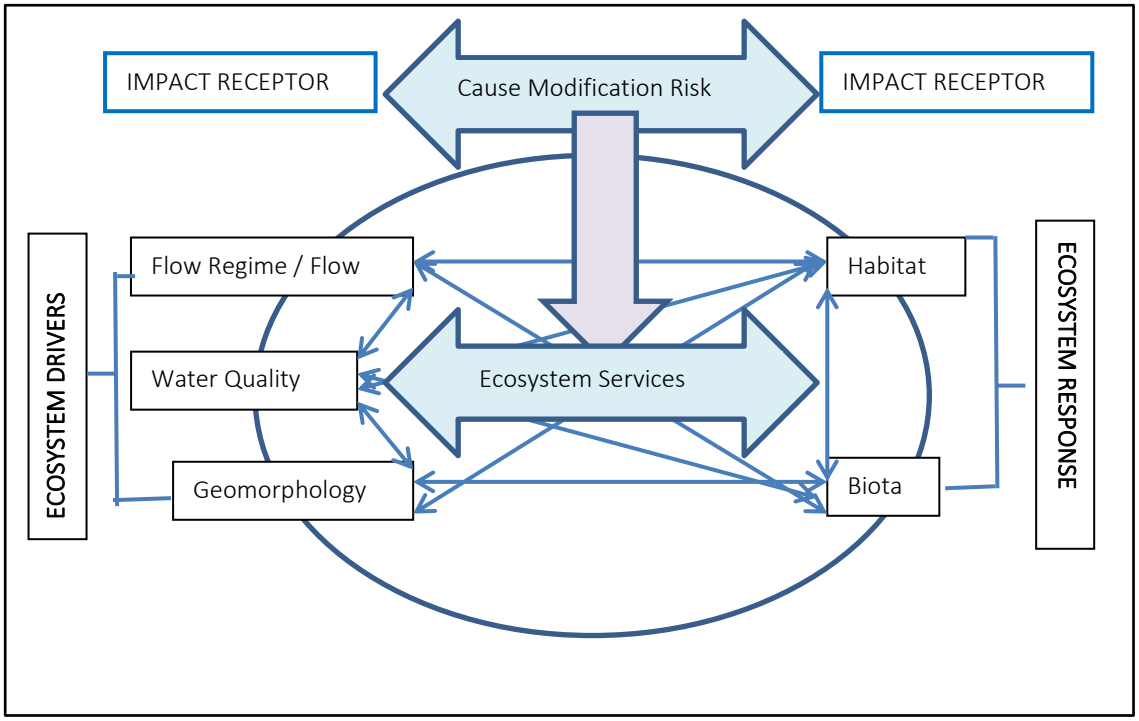


Figure 13 Minimum Requirements for a S21(c) and (i) Application

The driver of the Berg River is the flood because of the winter rains, as much as the long and very dry summer with the concomitant low flow conditions. Variability in flow is fundamental to the Berg River's ecology.

Apart from the incremental demand for water, not only from Zwartfontein, but from many more similar establishments, it is not foreseen that the higher dam wall would have any significant impacts on the drainage line and the Berg River. The demands on the Berg River has long been discounted against the minimum flow requirements and the Ecological Reserve.

Hence it is recommended that the elevation of the dam wall is allowed, either by a letter of consent or a General Authorisation, should the DWS elect to do so, considering the fact that the current taking of water from the Berg River for the Zwartfontein Farm is considered to be an Existing Legal Water Use.

21 References

Department of Water Affairs and Forestry. 2004. State-of-the-River Report, National River Health Program. Berg River. DWAF, Pretoria.

Dickens, CWS & PM Graham. 2002. *The South African Scoring System (SASS) Version 5 Rapid Bioassessment Method for Rivers*. African Journal of Aquatic Science 27: 1–10

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

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

Skelton, P. 1993. *A Complete Guide to the Fresh Water Fishes of Southern Africa*. Tutorial Press, Harare.

22 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:  2 April 2019

23 Résumé

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Experience

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

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

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

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

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

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

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

Service Positions

- Project Leader, initiator, member and participator: Water Research Commission (WRC), Pretoria.
- Director: UNESCO West Coast Biosphere, South Africa
- Director (Deputy Chairperson): Grotto Bay 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

Reports and Water Use License Applications

- Process Review Kathu Wastewater Treatment Works
- Effluent Irrigation Report Tydstroom Abattoir Durbanville
- River Rehabilitation Report Slangkop Farm, Yzerfontein
- Fresh Water and Estuary Report Erf 77 Elands Bay
- Ground Water Revision, Moorreesburg Cemetery
- Fresh Water Report Delaire Graff Estate, Stellenbosch
- Fresh Water Report Quantum Foods (Pty) Ltd. Moredou Poultry Farm, Tulbagh
- Fresh Water Report Revision, De Hoop Development, Malmesbury
- Fresh Water Report, Idas Valley Development Erf 10866, Stellenbosch
- Wetland Delineation Idas Valley Development Erf 10866, Stellenbosch
- Fresh Water Report, Idas Valley Development Erf 11330, Stellenbosch
- Fresh Water Report, La Motte Development, Franschhoek
- Ground Water Peer Review, Elandsfontein Exploration & Mining
- Fresh Water Report Woodlands Sand Mine Malmesbury
- Fresh Water Report Brakke Kuyl Sand Mine, Cape Town
- Wetland Delineation, Ingwe Housing Development, Somerset West
- Fresh Water Report, Suurbraak Wastewater Treatment Works, Swellendam
- Wetland Delineation, Zandbergfontein Sand Mine, Robertson
- Storm Water Management Plan, Smalblaar Quarry, Rawsonville
- Storm Water Management Plan, Riverside Quarry
- Water Quality Irrigation Dams Report, Langebaan Country Estate
- Wetland Delineation Farm Eenzaamheid, Langebaan
- Wetland Delineation Erf 599, Betty's Bay
- Technical Report Bloodhound Land Speed Record, Hakskeenpan
- Technical Report Harkerville Sand Mine, Plettenberg Bay
- Technical Report Doring Rivier Sand Mine, Vanrhynsdorp
- Rehabilitation Plan Roodefontein Dam, Plettenberg Bay
- Technical Report Groenvlei Crusher, Worcester
- Technical Report Wiedouw Sand Mine, Vanrhynsdorp
- Technical Report Lair Trust Farm, Augrabies
- Technical Report Schouwtoneel Sand Mine, Vredenburg
- Technical Report Waboomsrivier Weir Wolseley
- Technical Report Doornkraal Sand Mine Malmesbury
- Technical Report Berg-en-Dal Sand Mine Malmesbury
- Wetland Demarcation, Osdrif Farm, Worcester
- Technical Report Driefontein Dam, Farm Agterfontein, Ceres
- Technical Report Oewerzicht Farm Dam, Greyton
- Technical Report Glen Lossie Sand Mine, Malmesbury
- Preliminary Report Stellenbosch Cemeteries
- Technical Report Toeka & Harmony Dams, Houdenbek Farm, Koue Bokkeveld
- Technical Report Kluitjieskraal Sand & Gravel Mine, Swellendam
- Fresh Water Report Urban Development Witteklip Vredenburg
- 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

24 Appendix

24.1 Biomonitoring Score Sheet

SASS5 Score Sheet										
Date	27 Mar 19	**Taxon**	**Weight**	**Score**	**Taxon**	**Weight**	**Score**	**Taxon**	**Weight**	**Score**
Locality	Berg River	Porifera	5		**Hemiptera**			**Diptera**		
	Zwartfontein	Coelenterata	1		Belostomatidae	3	3	Athericidae	10	
		Turbellaria	3		Corixidae	3	3	Blepharoceridae	15	
		Oligochaeta	1	1	Gerridae	5	5	Ceratopogonidae	5	
Coordinates	33°30' 06.28"	Huridinea	3	3	Hydrometridae	6		Chironomidae	2	2
	18°56'22.16"	**Crustacea**			Naucoridae	7		Culicidae	1	
		Amphipodae	13		Nepidae	3		Dixidae	10	
DO mg/l	8.7	Potamonautidae	3		Notonectidae	3	3	Empididae	6	
Temperature °C	25.0	Atyidae	8		Pleidae	4	4	Ephydridae	3	
pH	7.8	Palaemonidae	10		Veliidae	5	5	Muscidae	1	
EC mS/m	15.4	Hydracarina	8		**Megaloptera**			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	65	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	15	Perlidae	12		**Trichoptera**			Tabanidae	5	
ASPT	4,3	**Ephemeroptera**			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		**Gastropoda**		
Other Biota	Carp	Baetidae 2 sp	6		Hydropsychidae 1 sp	4		Ancylidae	6	
		Baetidae >3 sp	12	12	Hydropsychidae 2 sp	6		Bulinidae	3	
		Caenidae	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuridae	15		**Cased Caddis**			Thiaridae	3	
Comments	lots of small fish	Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
		Prosopistomatida	15		Calamoceratidae	11		**Pelecipoda**		
		Teloganodidae	12		Glossostomatidae	11		Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6				
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4	4	Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		**Coleoptera**					
		Protoneuridae	8		Dyticidae	5				
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5	5			
		Gomphidae	6	6	Haliplidae	5				
		Libellulidae	4	4	Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Score				30			28			7

24.2 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 24.2.1 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 24.2.2 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 24.2.3 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 24.2.4 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.

24.3 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