Middelpos Agri (Pty) Ltd

Posbus 59
Riebeeck West
7306

Fresh Water Report

For the new dam on

Farm 422, Riebeeck West

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

August 2019

Index

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

Fact Sheet

Farm No.	Farm 422, Division Tulbach
Deed No.	T73989/2007
Date of Registration	2007/07/09
Surface area:	472.6363ha
Cadaster	C04600000000042200000
Owner:	Middelpos Trust
Trust No.	IT1241/1993
Operator	Middelpos Agri (Pty) Ltd
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1 Introduction

Mr Stephanus du Toit is a trustee of the Middelpos Family Trust. The trust is the registered owner of Farm 422, Division Tulbagh, in the Riebeek West district of the Western Cape. Mr du Toit built a small farm dam in a mostly dry drainage line. A substantial volume of water can flow down the drainage line during the annual winter rains. Mr du Toit needs the new farm dam for watering his livestock.

Of importance is that Farm 422 already has been allocated an existing legal water use out of the adjacent Berg River.

The top end of the dam is adjacent to a minor road ("ondergeskikte pad"). This is a dirt road that gives access to a number of farms in the district. When the drainage line is in flood, the road is under water, with the result that vehicles are getting stuck, which in turn resulted in some members of the farming community lodging objections. This resulted in an official S24G pre-compliance notice, as well as a compliance notice from the DEA&DP's legal compliance division.

Although this legal action was taken as a result of public complaints, DEA&DP took action because of the moving of a volume of material for the building of the dam wall exceeding legal limits and for obstructing a water course. Likewise, the DWS is most likely to instil similar legal action.

On 24 July 2019 Mr Bernard de Witt of Enviro Africa, along with Dr Dirk van Driel of WATSAN Africa visited the site of the dam and met with Mr du Toit, upon which Mr du Toit inquired if official approval from the DWS for the dam could be a possibility and if there was a change to keep the dam, instead of the dam being removed, along with the rehabilitation of the area, as required in the compliance notice. This possibility was contemplated, as well as the granting of official approval from the DEA&DP, after having paid the obligatory administrative fine. Subsequently a meeting was held on 29 July 2019 with officials in the DEA&DP Cape Town offices, where it was decided that approval of the dam can possibly be approved after Mr du Toit has fulfilled all of the legal requirements.

The possibility is also investigated if the minor road could be moved, away from the flooded area, perhaps right across the new dam wall, with culverts over the new dam's spillway.

This report attempts to satisfy both the requirements of the DEA&DP in terms of the NEMA and the DWS in terms of the NWA for keeping the dam.

The NEMA requires an Environmental Impact Assessment (EIA), along with mitigation measures, for the farm dam, retrospectively. This then is the required report to motivate the classes that have been allocated to the various aspects of the EIA. The mitigation measures are described as well.

The DWS demands a Fresh Water Report for the Water Use License, along the format and the various aspects that has been developed after many such reports over a number of years, as well as the Risk Matrix as published on the DWS webpage. This report motivates the values that have been allocated for the Risk Matrix.

2 Climate Riebeeck Kasteel

The closest locality to Farm 422 for which climatological data is available on the internet is the town of Riebeek Kasteel (Figure 1).

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

Riebeeck-Kasteel normally receives about 479mm of rain per year and because it receives most of its rainfall during winter it has a Mediterranean climate. The chart below (lower left) shows the average rainfall values for Riebeeck-Kasteel per month. It receives the lowest rainfall (7mm) in February and the highest (92mm) in June. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Riebeeck-Kasteel range from 16.9°C in July to 29.8°C in February. The region is the coldest during July when the mercury drops to 6°C on average during the night.

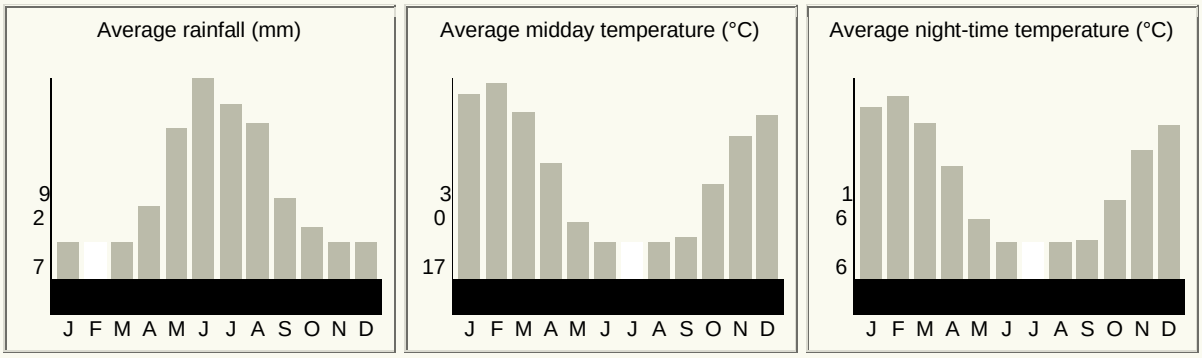


Figure 1 Climate Riebeeck Kasteel

The summers are hot and dry, with strong desiccating winds. The rainfall is too low to sustain agriculture during summer, for which irrigation out of the Berg River is required.

3 Quaternary Catchment

Farm 422 is in the G10F quaternary catchment

4 Vegetation

The original vegetation on Farm 422 was Swartland Shale Renosterveld, according to the SANBI webpage. This vegetation type is critically endangered, with 90% of it lost, mainly because of agriculture and some of it because of urban development. The 26% conservation target is now unattainable.

5 Legal Framework

The construction of the farm dam "triggered" sections of the National Water Act. These were the following:

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

The farm dam is spanning the banks of a drainage line. The dam altered the drainage line.

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

The dam has altered 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 32m 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.

6 Locality

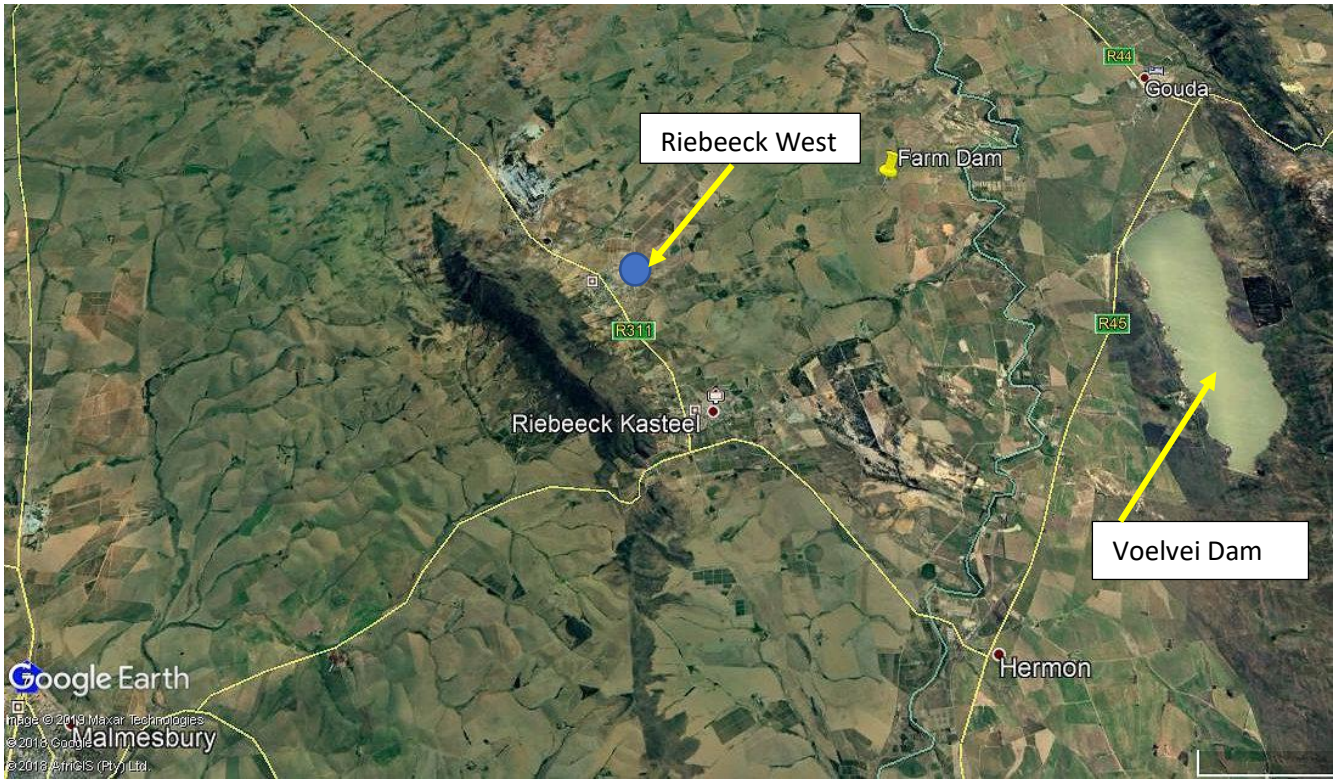


Figure 2 Locality

The new farm dam is located on Farm 422, approximately 8 km to the north east of Riebeeck West, approximately halfway to the hamlet of Gouda, as the crow flies (Figure 2). It can be reached from Station Road in Riebeeck West.

The dam's coordinates are as follows:

33°19'26.76"S
18°57'12.73"E

7 Sub-Catchment

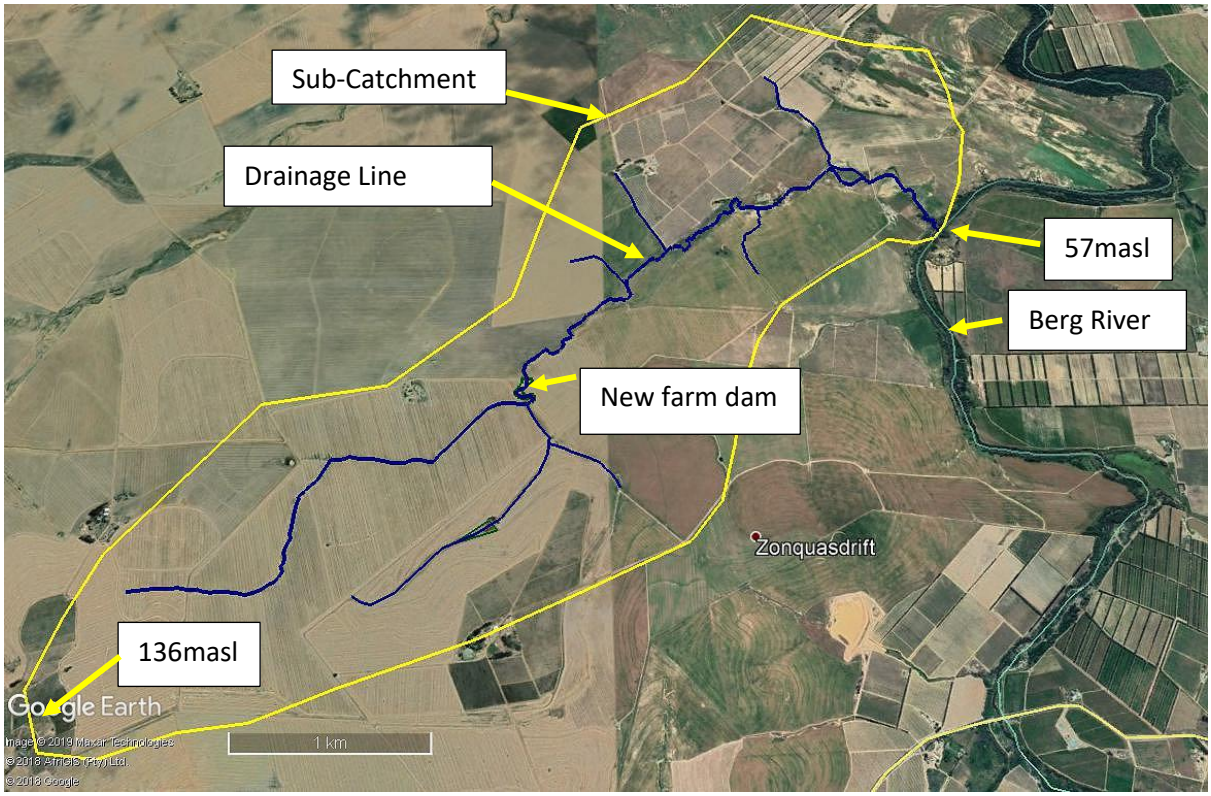


Figure 3 Sub-Catchment

The dam has been built on a small mostly dry drainage line, a very small tributary of the Berg River (Figure 3). The drainage line is only 15.3km long, following the water course along its undulating path through the hills and the wheat fields.

The sub-catchment, from its highest point at 136masl to its confluence with the Berg River at 57masl, is only 11.3 km, in a straight line as the crow flies. This amounts to a gentle slope of 0.7 horizontal metres per 100 vertical metres.

The sub-catchment covers an area of 992 hectares. This was simply measured by connecting the highest points around the drainage lines with the polygon function of Google Earth.

Most of the sub-catchment is made up of wheat fields, right up to the edge of the drainage line. Winter rains are collected in the contours that drain the wheat fields. In fact, these manicured contours in the wheat fields characterise the sub-catchment and serve as conduits along which runoff is directed into the drainage line. The drainage line is bone dry most of the year and only comes down in force with storm water during and shortly after winter rains, as was the case on 12 July during the site visit (Figure 4). This drainage line was photographed just upstream from the farm road next to the dam and was the main inflow into the dam. There were other inflows as well, all temporary streams because of the recent rain. During the site visit on 24 July, the

drainage line was entirely flooded (Figure 5). This clearly illustrates the variance in flow, between no flow in summer to a substantial flow during winter rains.

Figure 4 Runoff in drainage lines 12 July 2019

Figure 5 Drainage Line 24 July 2019

There is a small existing farm dam upstream of the new farm dam. There are not any dams or retaining structures downstream of the new farm dam to the confluence with the Berg River.

8 The New Dam

Figure 6 The New Dam

The new dam is rather small, with a surface area of less than a hectare, as measured with Google Earth's polygon function (Figure 7).

The dam wall is approximately 70 m long, 8m wide and 1.8m high.

9 Dam Wall

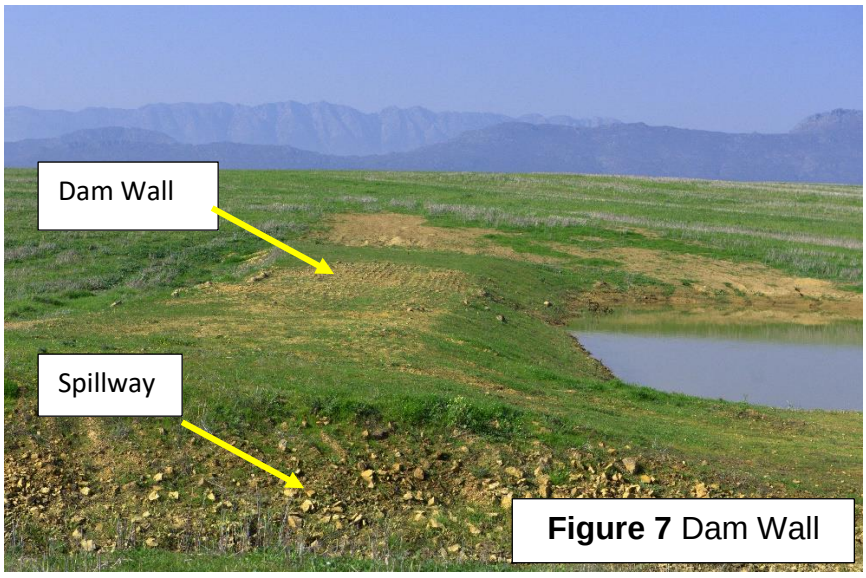


Figure 7 Dam Wall

The dam wall was properly constructed with the indentations of a large compacter still visible on the surface (Figure 7).

10 Spillway

Apart from the pipes through the dam wall (Figure 8), a large spillway has been constructed around the dam wall. The trench of the spillway (Figure 9) is through and onto the bedrock. It does not have any concrete or other constructed features.

Figure 8 Pipes

Figure 9 Spillway

The spillway was photographed on 24 July when the drainage lines were in flood and the spillway coming down strongly. It did not seem as if the flood eroded the spillway or has had any deleterious effects.

11 The Minor Road

Figure 10 Minor Road

The minor road giving access to several farms was thoroughly flooded during the site visit on 24 July, following heavy rains (Figure 10). This gave rise to public complaints and eventually the S24G compliance notice.

However, just downstream and adjacent to the pool on the road, storm water was flowing fast down hill towards the dam, as is indicated by the riffles on Figure 9. This left the impression, by visual estimation, that the dam's surface was at least a metre lower than the pool on the road. It seemed as if the dam was not the cause of the flooding and that the dam did not push over the road when full, as was insinuated by the public complaints. This, evidently was a problem that existed even before the dam was built. Neighbourly disputes often give rise to the lodging of complaints, irrespective of the complaints being valid or legitimate.

The site was again visited on 24 August 2019. At the time the dam was almost empty, with the water let out by the foot valve in the dam wall (Figure 11). The water over the farm road, at the time, had not subsided, with running water covering the surface. This

indicated that the dam was not the cause for the flooding of the road. Therefore, the complaints to the authorities were unfounded.

Nevertheless, the compliance notice was not issued because of the flooding of the road, but because a dam was constructed, possibly illegally and without the consent of the relevant authorities.

Figure 11 Empty Dam

12 Berg River Biomonitoring Sampling Point

It is customary for a WULA to assess the state-of-the-river as close as possible downstream of a possible impact, in this case the Farm 422 Dam.

Accessibility to the Berg River here is challenging as the river's banks are high and steep. After the recent flood the muddy slopes were extremely slippery. With the river flowing more than $1ms^{-1}$, sampling proved to be dangerous.

The closest point for sampling was 820m downstream of the confluence of the Farm 422 drainage line with the Berg River, following the curve of the river (Figure 12). This was 3.4km away from the farm dam, as the crow flies.

The coordinates of the sampling point were as follows:

33°18'47.59"S
18°59'14.95"E

The river here was some 30m wide (Figure 13), turbid and flowing strongly. It was densely overgrown with a mature stand of *Eucalyptus* trees. The aquatic habitat was monotonous, with all of it a muddy bottom, with no stones-in-current of bedrock. The only hard substance was fallen blue gum trees. The only submerged vegetation was the roots of trees that were denuded by the flood.

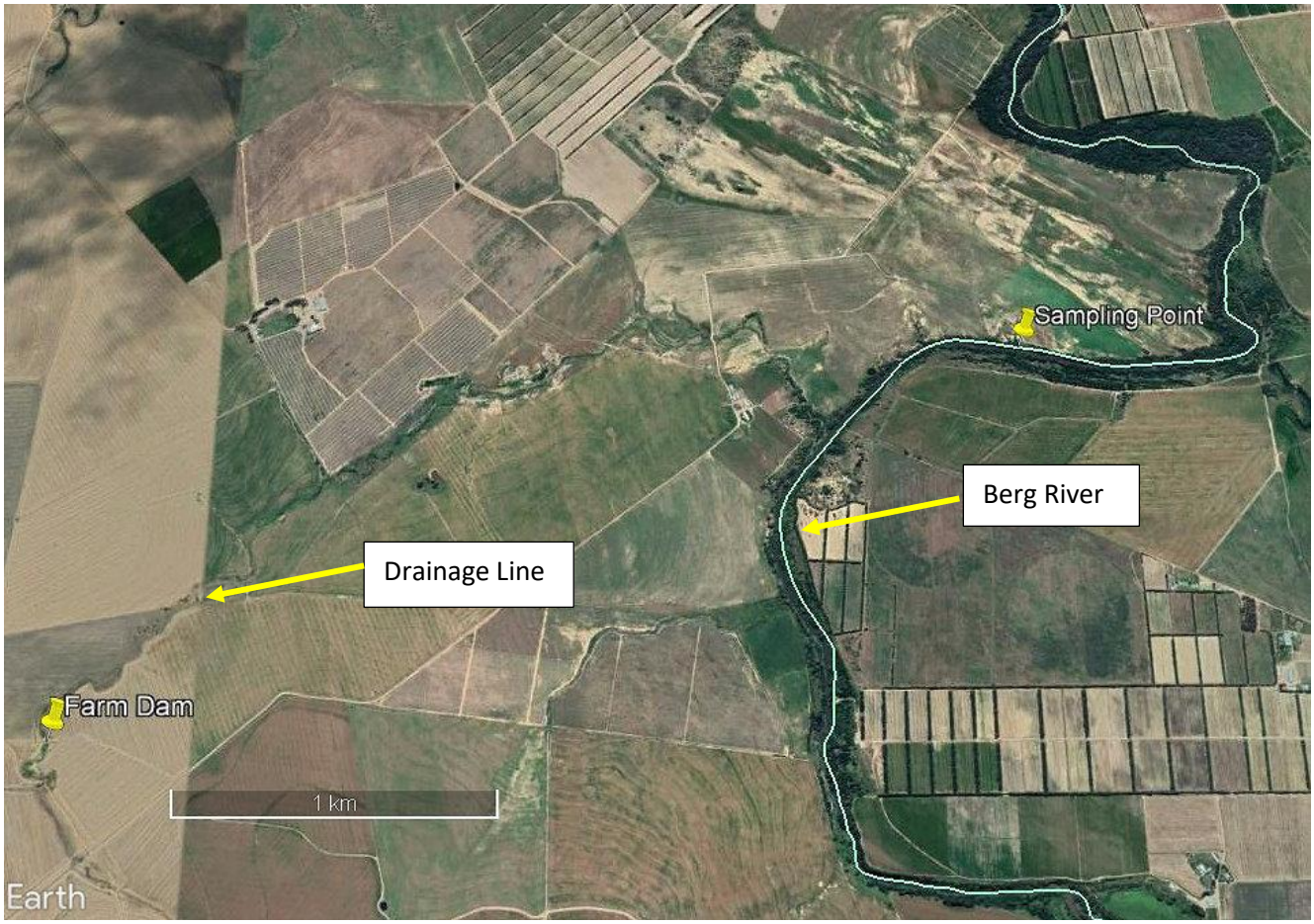


Figure 12 Locality Sampling Point

Figure 13 Sampling Point

13 Biomonitoring Results

Biomonitoring was carried out in the Berg River according to the methodology as described by Dickens and Graham (2002).

Table 1 Water Quality

Parameter	Value
Temperature °C pH Electrical Conductivity mSm^{-1} Dissolved Oxygen mgl^{-1}	14.9 7.7 19.2 8.2

Some water quality parameters were measured with a YSI filed instrument (Table 1).

The SASS5 score (see SASS5 score sheet in the Appendix) at 28 and the ASPT at 4 were low, even for a mature river on a coastal plain. The score represented a class E (Figure 15), which signifies a “Poor” state-of-the-river.

To put the classification into perspective, from 2015 to present, various samples were taken for previous projects. The results are shown in Figure 15, together with the score at Farm 422. The general score for the lower Berg River came to a “D”, which is one level up from that at Farm 422.

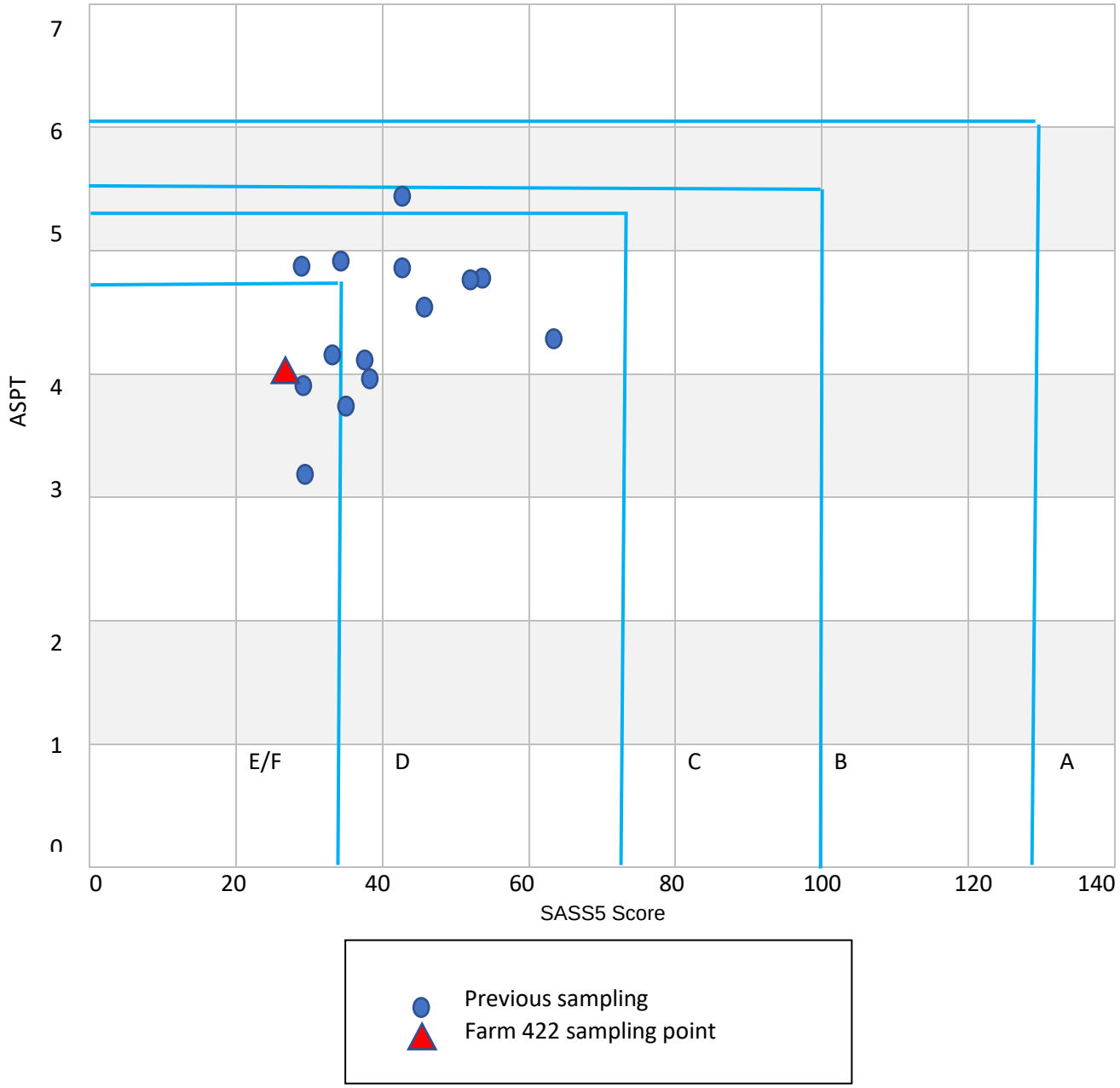
The National River Health Program classified the Berg River downstream of Hermon classified as “D” of “Fair” as well (DWAF, 2004).

The timing of the Farm 422 sampling could not have been worse, because it was at the end of winter, just after the river came down in flood. The landscape was covered with deep green wheat and with bright yellow canola, with crop spraying air planes in the sky and plenty of runoff into the river (Figure 14). This could have resulted in a lower score than the average.

Figure 14 Wheat fields and canola

It cannot be said that the Diep River has deteriorated because of the poor result in only one sample. It cannot be said that the farm dam at Farm 422 could have had any impact. Most of the flow of the river is derived from the high ground of the surrounding mountains. The flow contribution from the wheat fields and other sources of agricultural pollution on the low ground is much less. During periods of high flow, agricultural pollution is diluted.

The low score is nevertheless worrisome. It signifies that biomonitoring should persist over the long term and should the biomonitoring results consistently show a down curve, mitigation measures should be implemented.



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 15 Biomonitoring

14 **Present Ecological State** (PES)

The PES and EIS are protocols that have been produced by Dr Neels Kleynhans (Table 2, 3 and 4) in 1999 of the then DWAF to assess river reaches. The scores given are solely that of the practitioner and are based on expert opinion.

Table 2 Present Ecological State of the Drainage Line

Instream	Score	Weight	Product	Maximum score
Water abstraction	22	14	308	350
Flow modification	5	13	65	325
Bed modification	5	13	65	325
Channel modification	5	13	65	325
Water quality	10	14	140	350
Inundation	5	10	50	250
Exotic macrophytes	5	9	45	225
Exotic fauna	12	8	96	200
Solid waste disposal	24	6	144	150
Total		100	972	2500
% of total			38.9	
Class			E	
Riparian				
Water abstraction	22	13	286	325
Inundation	5	11	55	275
Flow modification	4	12	48	300
Water quality	10	13	130	325
Indigenous vegetation removal	4	13	54	325
Exotic vegetation encroachment	2	12	24	300
Bank erosion	16	14	224	350
Channel modification	4	12	48	300
Total			748	2500
% of total			29.9	
Class			E	

There is little direct water abstraction in the drainage line. There is one small farm dam upstream and then there is the new farm dam. When is really rains in winter, these dams do not hold back a significant volume of water. Hence, the flow regime is not changed significantly.

The replacement of winding streams with straight flood control channels and the modification of the flood plain to manicured wheat fields have altered the runoff pattern irrevocably. A natural stream slows down the flow of water, whereas these straightened furrows let through storm water quickly, thereby elevating the peak flow and reducing the inundated period (hydroperiod).

Agricultural runoff is laced with nutrients, notably nitrates, as well as with insecticides. It can be expected that the runoff from Farm 422 carries with its load of pollutants into the Berg River.

The wheat fields serve as pastures for farm animals, which accounts for the exotic fauna.

The riparian zone was overgrown with exotic grasses (Figure 16), if not with wheat, with only a view of the original plant species left, such as flowering *Lobelia*.

The instream as well as the riparian habitat was scored an “E”, with significant loss of natural aquatic habitat.

Table 3 Habitat Integrity according to Kleynhans, 1999

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

Figure 16 Riparian zone downstream of the dam

The PES of the Lower Berg River has been determined many times over in a succession of WULA's for various developments along the river. The score that was allocated were mostly "C"'s, as was the score just downstream of the confluence of the drainage line with the Berg River. Impacts are exotic fish, invasive plants such as Eucalypts, treated sewage effluent, urban development and large-scale agriculture.

Table 4 Present Ecological Berg River

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	

15 Ecological Importance

15.1 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 Farm 422. 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 Farm 422 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 5). 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 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)

15.2 Ecological Importance of the Farm 422 Drainage Line

The drainage line is devoid of permanent water. 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.

Prior to human impact the drainage line was overgrown with renosterveld, as is evident from similar mostly dry drainage lines in the few patches of undisturbed land. Plant species associated with drainage lines indicating riparian habitat are scarce. Instead the usual renosterveld appears to be somewhat higher around the drainage lines, often the only indication of habitat variability. Even from this perspective, the drainage lines have limited ecological importance. Closer to the confluence with rivers, where the soil remains moist, a proper riparian vegetation developed.

16 Ecological Sensitivity

16.1 Ecological Sensitivity of the Farm 422 Drainage Line

It seems unthinkable that the Farm 422 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 Farm 422 drainage line would not recover. In this sense it can be considered as sensitive.

16.2 Ecological Sensitivity of the Lower Berg River

The Berg River at Farm 422 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. This is subject to the removal of alien fish. 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.

17 Possible Impacts

The new farm dam on Farm 422 holds only approximately 11250m^3 of water when full. This is the volume of water that would not end up in the Berg River during annual winter rains. This volume is negligible if compared to the mean annual runoff of the Berg River. From this perspective the impact is negligible as well. In contrast, the availability of drinking water for stock is vital to the farming operation. Nevertheless, it remains for the DWS to decide if this incremental storage will have an impact on the Berg River.

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 Farm 422 and other locations along the river become apparent.

This report is particularly about the assessment of water courses on the Farm 422 property and the possible effects of the new dam on these water courses.

The drainage lines have already been transformed into storm water management systems and return flow canals. The new 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.

18 Mitigation Measures

The local irrigation board as well as the DWS have most likely already defined the schedule according to which water is to be taken for the operation on Farm 422 from the Berg River. The DWS, 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 Farm 422 is to operate within the ambit of their existing water use license.

The re-growth of eucalypts on the banks of the Berg River is worrisome and it would be helpful if Farm 422 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 DWS 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 dam serves as a roost for water fowl. These birds should be monitored for disease and mortalities. Mortalities should be reported to relevant authorities.

The new dam wall and the spillway should be kept vegetated. Should erosion become apparent, measures should be taken, the best of which is probably ensuring a dense plant cover.

19 Impact Assessment

The DEA and its provincial offices prescribe an impact assessment according to a premeditated methodology as set out in the Appendix.

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 6) is solely directed towards the possible impacts of the new dam, retrospectively, on the drainage line and the aquatic environment.

Table 6 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.
Erosion of the dam wall and spillway

Mitigation measures

Maintain integrity of the dam wall and the spillway
Prevent erosion

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

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.

20 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.

This assessment has been designed to assist in the decision if a General Authorisation or a License is required, should the dam 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 7 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 of the dam	Erosion of the dam wall and spillway	Wall failure Sediments in Berg River	24	Low
3	Maintenance of drainage line	Removal of vegetation and sediments	Sediments down drainage line into the Berg River	24	Low

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	2	3
3	1	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

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

21 Resource Economics

The goods and services delivered by the environment, in this case the Farm 422 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 17) is an accepted manner to visually illustrate the resource economic footprint the drainage line, from the data in Table 8.

Table 8. Goods and Services

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

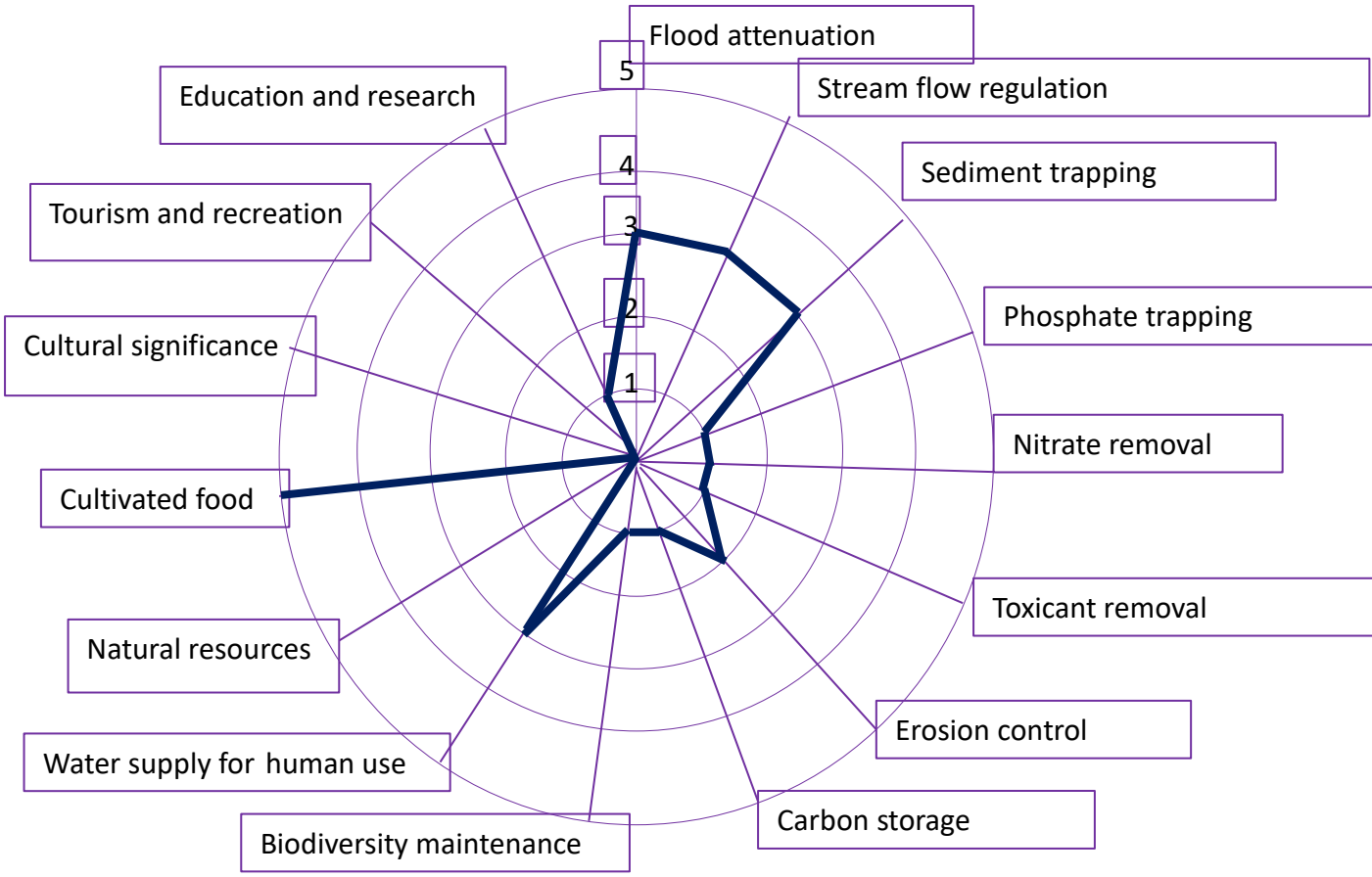


Figure 17. Resource Economics Footprint of the Drainage Line

In many instances these drainage lines are ploughed right through and planted with wheat, giving rise to a high score for cultivated food. For the rest the economic foot print of the drainage line is small, it is doubtful that the small star shape of Figure 17 would attract the attention of the decision-making authorities.

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.

22 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 18). The WULA and the EAI must provide mitigation measured for these impacts.

Figure 18 has been adapted from one of the most recent DWS policy documents.

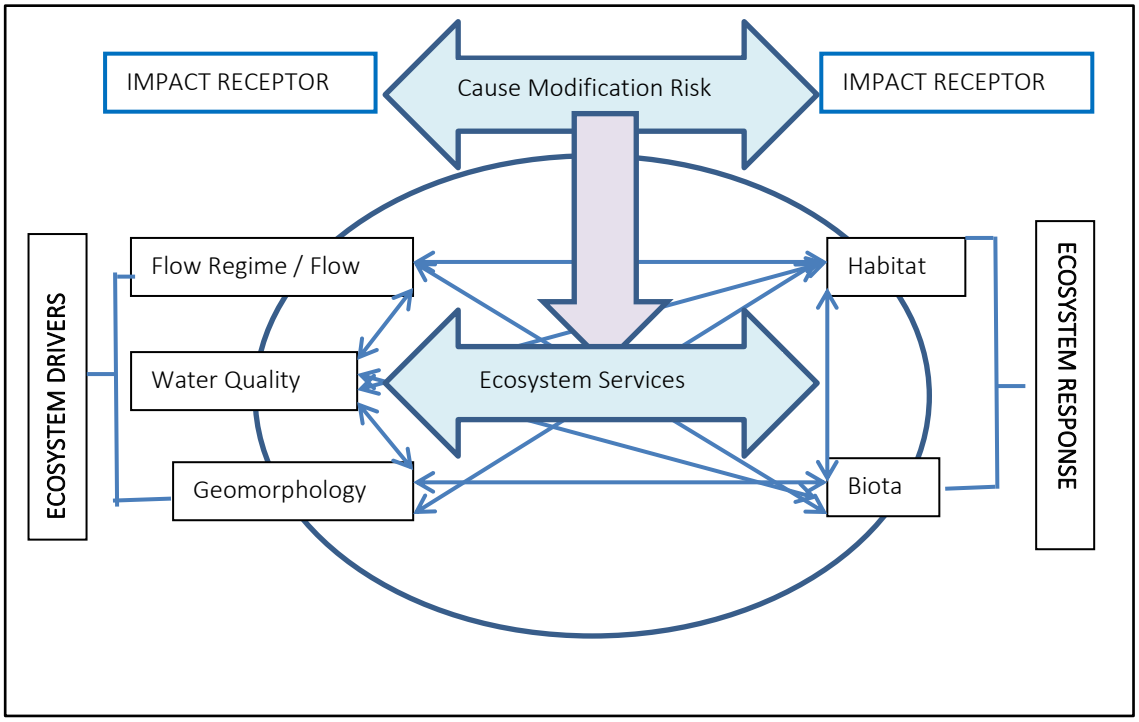


Figure 18 Minimum Requirements for a S21(c) and (i) Application

The driver of the Farm 422 drainage line is the annual winter rain, which can turn a usually dry drainage line in an arid summer landscape into a raging torrent. Agriculture is another driver. Wheat is annually sown right to the edge of drainage lines, if not right through. This determines the shape of the drainage line and limits the ecological functioning. The landscape is dominated by very dry wheat fields and an apparent absence of any aquatic habitat.

The addition of a small farm dam is not about to change any of this, apart from a small local alteration on the site of the dam. A positive spin-off perhaps is the addition of lentic aquatic habitat, albeit only until the dam dries up in late summer.

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.

The additional risks because of the dam on Farm 422 to the environment and to the Berg River are insignificant, extremely low. The new dam should be allowed on account of these findings pertaining to Section 21 (c) and (i) of the NWA with a General Authorization. A License in not required, according to the Risk Matrix.

23 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.

24 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:  24 August 2019

25 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
- Fresh Water Report Zwartfontein Farm Dam, Hermon
- Wetland Delineation Grabouw Cell Phone Tower
- Statement Delsma Farm Wetland, Hermon
- Fresh Water Report Lemoenshoek Farms Pipelines Bonnyvale
- Fresh Water Report Water Provision Pipeline Brandvlei
- Fresh Water Report Farm Shed Erf 19992 Upington

26 Appendix

26.1 Biomonitoring Results

SASS5 Score Sheet										
Date	23 Aug 19	**Taxon**	**Weight**	**Score**	**Taxon**	**Weight**	**Score**	**Taxon**	**Weight**	**Score**
Locality	Berg Rivr	Porifera	5		**Hemiptera**			**Diptera**		
	Rhenosterug	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3		Corixidae	3		Blepharoceridae	15	
		Oligochaeta	1		Gerridae	5	5	Ceratopogonidae	5	
Coordinates	33°18' 49.7"	Huridinea	3		Hydrometridae	6		Chironomidae	2	2
0	89°59'30.5"	**Crustacea**			Naucoridae	7		Culicidae	1	1
		Amphipodae	13		Nepidae	3		Dixidae	10	
DO mg/l	8.2	Potamonautidae	3		Notonectidae	3		Empididae	6	
Temperature °C	14.9	Atyidae	8		Pleidae	4	4	Ephydridae	3	
pH	7.7	Palaemonidae	10		Veliidae	5		Muscidae	1	
EC mS/m	19.2	Hydracarina	8		**Megaloptera**			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	
SASS5 Score	28	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	7	Perlidae	12		**Trichoptera**			Tabanidae	5	
ASPT	4,0	**Ephemeroptera**			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		**Gastropoda**		
Other Biota	Galaxias	Baetidae 2 sp	6	6	Hydropsychidae 1 sp	4		Ancylidae	6	
	Tadpoles	Baetidae >3 sp	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		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		Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		**Coleoptera**					
		Protoneuridae	8		Dyticidae	5				
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5				
		Gomphidae	6	6	Haliplidae	5				
		Libellulidae	4	4	Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Score				16			9			3

26.2 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 26.2.2 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 26.2.3 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 26.2.4 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.

26.3 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