VAN DER MERWE LANDGOED

Trading as

NADERSTAAN & TURKSVY BOERDERY

WATER USE LICENSE APPLICATION
FOR THE ESTABLISHMENT OF A NEW VINEYARD AND AN IRRIGATION HOLDING DAM ON TURKSVY FARM, UPINGTON

FRESH WATER REPORT V2.3

A REQUIREMENT IN TERMS OF SECTION 21 OF THE NATIONAL WATER ACT
JANUARY 2021

Index

List of Figures

List of Tables

Abbreviations

Critical Biodiversity Area	CBA
Department of Water and Sanitation	DWA
Ecological Importance	EI
Ecological Sensitivity	ES
Ecological Support Area	ESA
Environmental Impact Assessment	EIA
Electronic Water Use License Application (on-line)	eWULAA
Government Notice	GN
Hectares	ha
Legal water Use	LWU
Metres Above Sea Level	masl
National Environmental Management Act (107 of 1998)	NEMA
National Freshwater Environment Priority Area	NFEPA
National Water Act (36 of 1998)	NWA
Present Ecological State	PES
South Africa National Biodiversity Institute	SANBI
Section of an Act of Parliament	S
Water Use License Application	WULA

1 Introduction

Mr David van der Merwe is the owner of the Van der Merwe Landgoed trading as the "Naderstaan en Turksvy Boerdery". Mr van der Merwe intends to upgrade the irrigation infrastructure on the Turksvy Farm, which is located just to the south of Upington on the Orange River in the Northern Cape. According to plan another block of vineyard will be added to the existing farming operation.

In terms of contemporary environmental legislation, an EIA is required for the planned development. Mr van der Merwe has appointed Enviro Africa of Somerset West to carry out the required EIA.

Along with the EIA, a WULA is required as well. This WULA is required in terms of S21 (c) and (i) of the NWA. Because water is going to be stored in a holding dam, official approval is required in terns of S21(b) of the NWA. Subsequently Enviro Africa appointed Dr Dirk van Driel of WATSAN Africa of Cape Town to conduct the WULA.

For the WULA, a Fresh Water Report is required, along with a Risk Matrix. These components of the WULA must contain the prescribed body of information that will allow for informed decision-making by DWS officials.

A holding dam is planned for the irrigation of vineyards. This dam is to be filled from an irrigation canal. For this purpose, a furrow or a pipeline will have to be constructed from the irrigation canal to the proposed holding dam.

The application will be lodged on the eWULAA system of the DWS. Again, this is a specialised process that requires a specific proficiency. Hence Mrs Hester Lyons Pr. Eng. Tech. has been appointed to deal with this part of the WULA. Again, this Fresh Water Report must contain adequate information that will enable her to complete the task.

2 Legal Framework

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

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

The proposed 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.

S21 (b) *Storing water*

A holding dam for irrigation is planned for Tuksvy Farm

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. The development is adjacent to drainage lines, which are defined as legitimate water resources.

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 adjacent to drainage lines. Consequently, this regulation is relevant to this application.

This Fresh Water Report is exclusively focussed in S21 (c) and (i) of the NWA. This WULA has been extended to include the storing of water. For this holding dam, a Should it ever become necessary to extend a WULA to the taking of water from a separate report is required in terms of S21(b) of the NWA., focussed on the specific requirements of these two sub-sections of the NWA.

3 Upington Climate

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

Upington normally receives about 94mm of rain per year, with most rainfall occurring mainly during autumn. The chart below (Figure 1, lower left) shows the average rainfall values for Upington per month. It receives the lowest rainfall (0mm) in June and the highest (29mm) in March. The monthly distribution of average daily maximum temperatures (centre chart below) shows that the average midday temperatures for Upington range from 19.8°C in June to 33°C in January. The region is the coldest during July when the mercury drops to 2.8°C on average during the night.

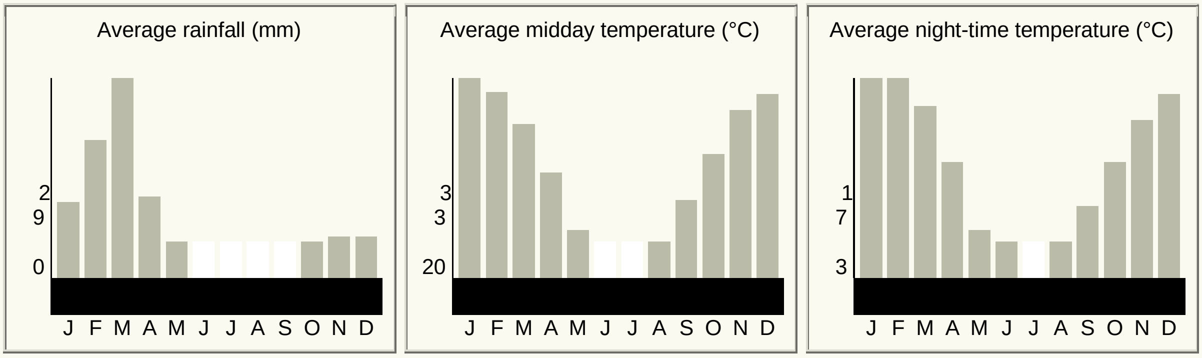


Figure 1 Upington Climate

With such a low rainfall, this area can be described as arid.

The evaporation rate is more than 2500mm per year. This is 27 times more than the annual precipitation.

http://www.dwaf.gov.za/orange/Low_Orange/upington.aspx

Agriculture is entirely dependant on irrigation out of the Orange River. Agriculture is the region's main economic activity.

4 Vegetation

The vegetation on the SANBI BGIS webpage is identified as Bushmanland Arid Grassland. None of this is listed as endangered in any way. This is not a CBA.

The Orange River is listed as an NFEPA. A small ephemeral pan in the relevant sub-catchment is listed as well.

5 Quaternary Catchment

Turksvy Boerdery is in the D73F quaternary catchment, according to the data on the DWS webpage.

6 Location

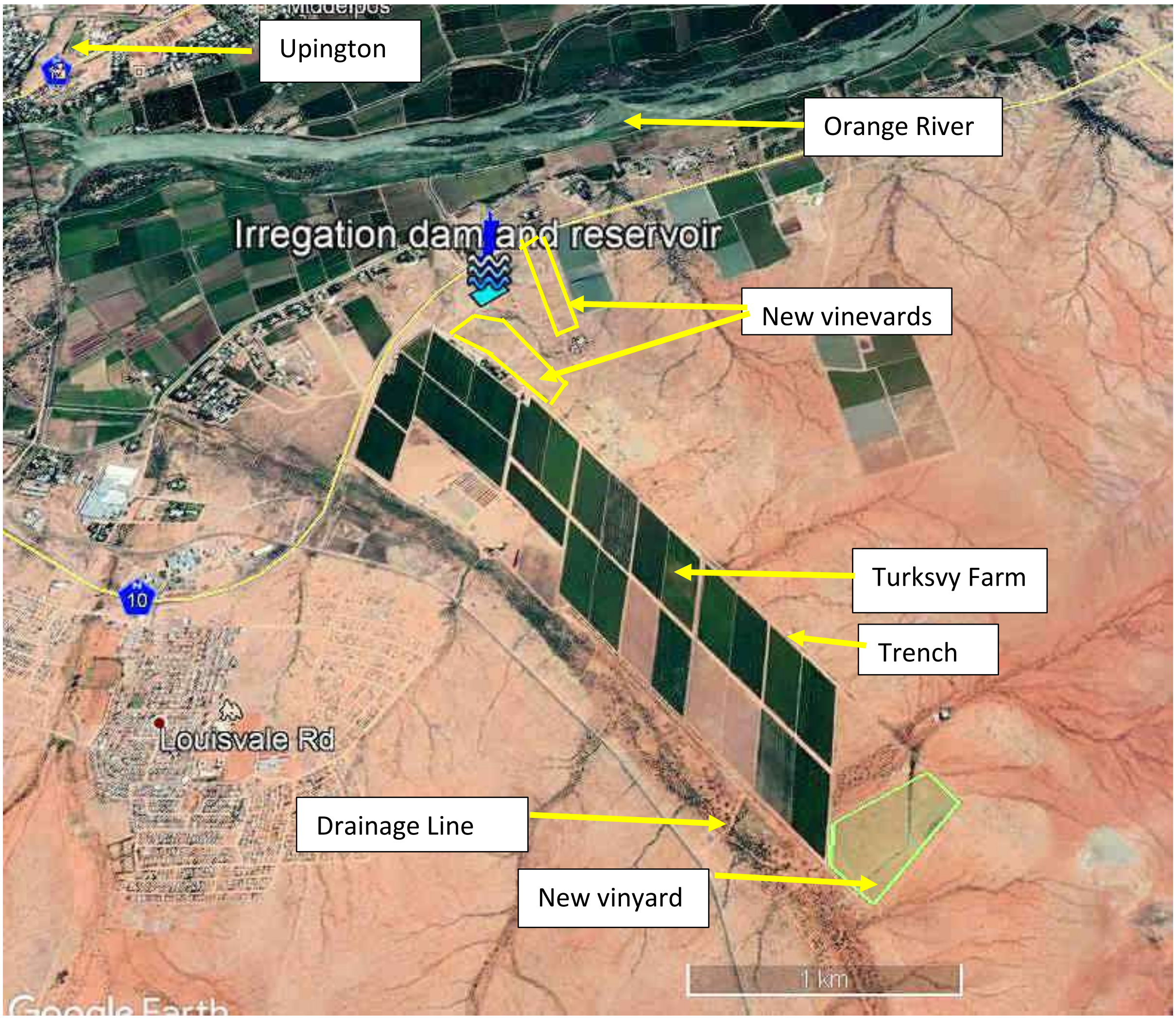


Figure 2 Turksvy Farm

Turksvy Farm is located to the south of Upington and the Orange River and adjacent and to the east of Louisvale in the Northern Cape (Figure 2). The N10 trunk road separates Turksvy Farm from the vineyard-lines Orange River.

The property is approximately 200 hectares, of which 150 hectares are under vineyards.

It is located next to a mostly dry drainage line.

7 The Project

A new vineyard of approximately 9 hectares is to be added to the existing vineyards (Figure 2).

In January 2021 another map was received that indicates that two more blocks of vineyard are going to be added, one of 7 hectares and another of 10 hectares (Figure 2). These are indicated on the next-door property.

The 9 hectares do not represent an extension of the existing LWU for the Turksvy Farm property. The irrigation water for this new vineyard has already been allocated. It is not known if the additional 17 hectares are included.

A new irrigation dam is to be constructed (Figure 2). This dam is to be constructed on the next-door property. According to Mr van der Merwe, the property has been purchased and added on to the current farming operation. From this new holding dam, water for irrigation will be let into the existing irrigation system.

Currently water for the Turksvy farming operation is pumped from the irrigation canal. This state-owned canal stretches along the Orange River reach and is an essential part of the region's large-scale farming operation. The water that Turksvy Farm takes from the canal is currently replaced, in accordance with a current contract with the DWS, with water that is pumped out of the Orange River. Turksvy Farm must pump water out of the Orange River into the irrigation canal.

According to an understanding with the DWS, water will no longer be pumped out of the Orange River into the canal. Instead, water will only be taken from the canal via a newly constructed furrow along which water will gravitate into the new holding dam on the next-door property. The existing pump on the Orange River Bank will be decommissioned.

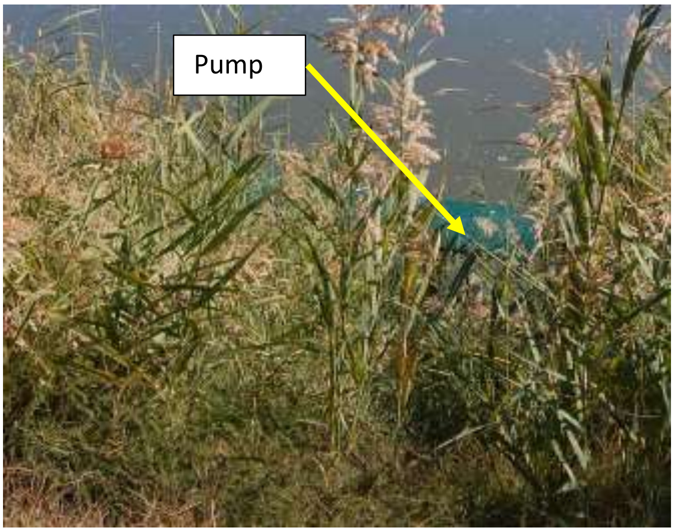


Figure 3 Pump hidden behind the reeds.

The pump in the Orange River is kept afloat on a moored raft. It is visible while standing on the river bank, albeit obscured by a thick stance of reeds. One has to look carefully to Figure 3 to make out the pump among the reeds.

The pump is electrically driven from a transformer on the river bank (Figure 4). The pole on which the transformer rests does not have the usual sign plate with a number.

Figure 4 Transformer

The point where the water is dropped into the irrigation canal is shown in Figure 5.

Figure 5 Point of discharge

The point where water is taken out of the canal is shown in Figure 6.

The pump to take water out of the canal is located in a pumphouse on the bank of the canal (Figure 6). Its electrical supply is from a transformer on the poles of which the numbers are shown in Figure 7. The water from the pumphouse is delivered into Turksvy Farm's irrigation system (Figure 8).

Once the new furrow has been constructed, this pump and its transformer will be decommissioned.

Figure 6 Abstraction point

Figure 7 Numbers on pole

Figure 8 Irrigation system (part).

Figure 9 Proposed point of new furrow abstraction

The new furrow will be constructed on or near the following point on the canal:

28°27'35.08"S
21°16'51.96"E

The canal at this point is shown in Figure 9.

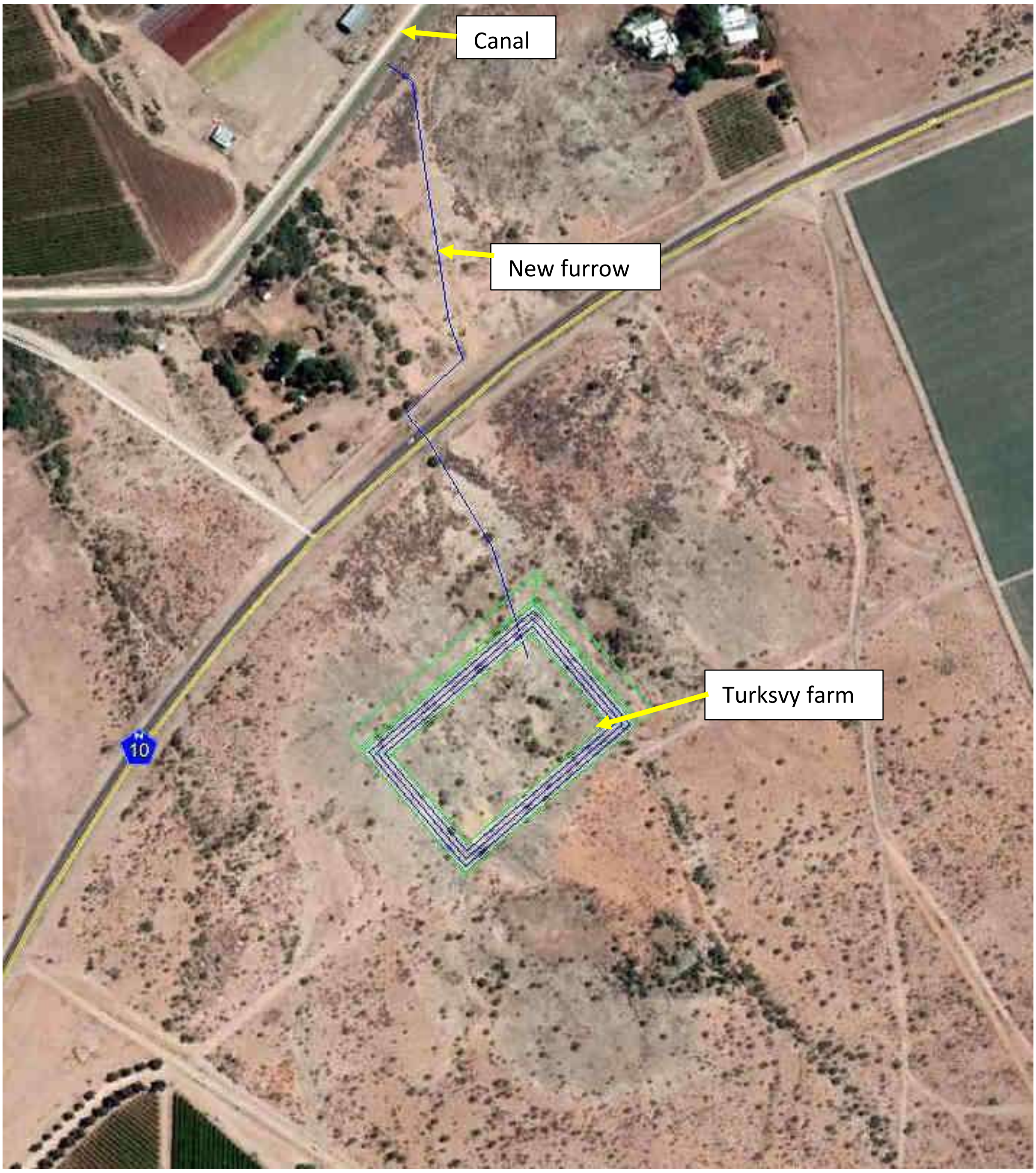


Figure 10 New holding dam and furrow

The position of the new holding dam and the new furrow is shown in Figure 10.

The design may be changed from an open furrow to a proper pipeline. It will pass underneath the N10 trunk road through an existing culvert. This is usual practice, as many pipelines pass through culverts in the region.

8 Storm water management

A trench has been constructed all along the north eastern boundary of Turksvy Farm (Figure 11 and 12). This trench act as a cut-off for storm water out of the catchment.

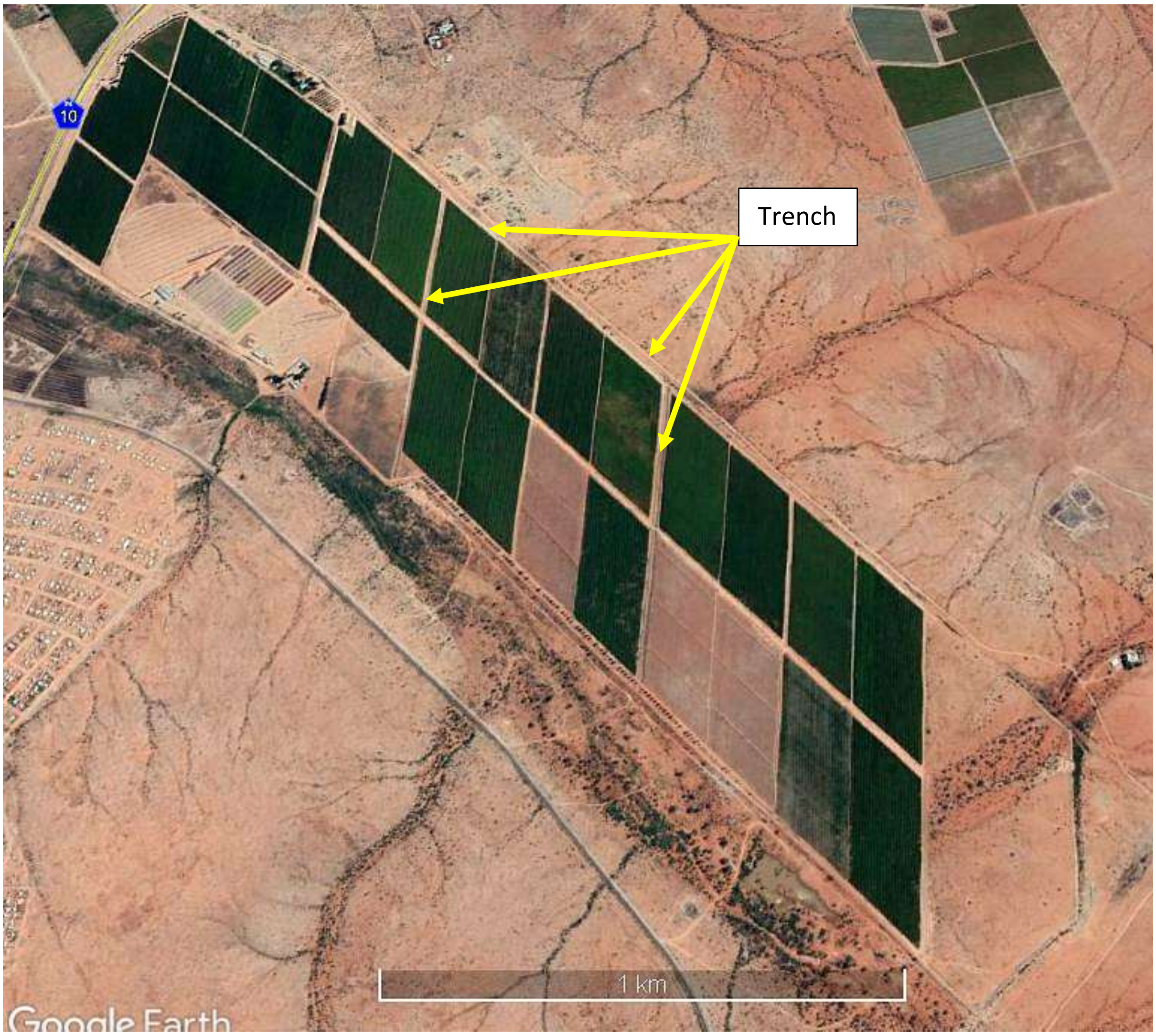


Figure 11 Trench

Figure 12 Culvert

In two places culverts (Figure 12) have been constructed out of the trench underneath the access road to the vineyards. From these culverts storm water is drained with perpendicular trenches through the vineyards to the large natural main drainage line at the south western boundary of the vineyards.

The south eastern end of the vineyards are demarcated by a berm. (Figure 13). This berm serves the same purpose as the trench, to cut off storm water out of the catchment. When constructed, the berm was meant to divert storm water around the vineyards, but this did not happen. Instead, storm water broke right through the berm to leave a wide gap (Figure 14). The current owner decided not to maintain the berm, but rather let the storm water through in its natural flow path and to contruct the new vineyards around the drainage line.

Figure 13 Berm

The drainage line that goes through the vineyard area of Turksvy Farm, next to the plot that is still to be developed, is still covered with a dense stand of natural vegetation (Figure 15 and 16), such as swarthaak *Senegalia mellifera* and kameeldoring *Vachellia erioloba.* This renders the drainage line with a particular conservation value. The preservation of this drainage line would contribute to decision-making and a positive outcome for the proposed farming opportunity.

Figure 14 Gap

Figure 15 Vegetation on the drainage line upstream of the gap

Figure 16 Vegetation on the drainage line downstream of the gap

9 The Holding Dam / Next-Door Property

The small holding dam will be constructed in a depression that is deemed to be a borrowing pit for road building. A shallow scrape has been left, with the regrowth of some vegetation (Figure 17).

Figure 17 Location of holding dam

Figure 18 is a graphical representation of the proposed holding dam. A detailed design and drawings will be submitted in a separate report.

There are faint drainage lines on the property, probably the remains of a small next-door sub-catchment. The lower end of these drainage lines has been entirely obliterated by the vineyards on the banks of the Orange River.

It is therefore doubtful if the proposed dam and its furrow or pipeline whatever is going to be finally installed, would have any more deleterious effects on the drainage lines and its riparian vegetation.

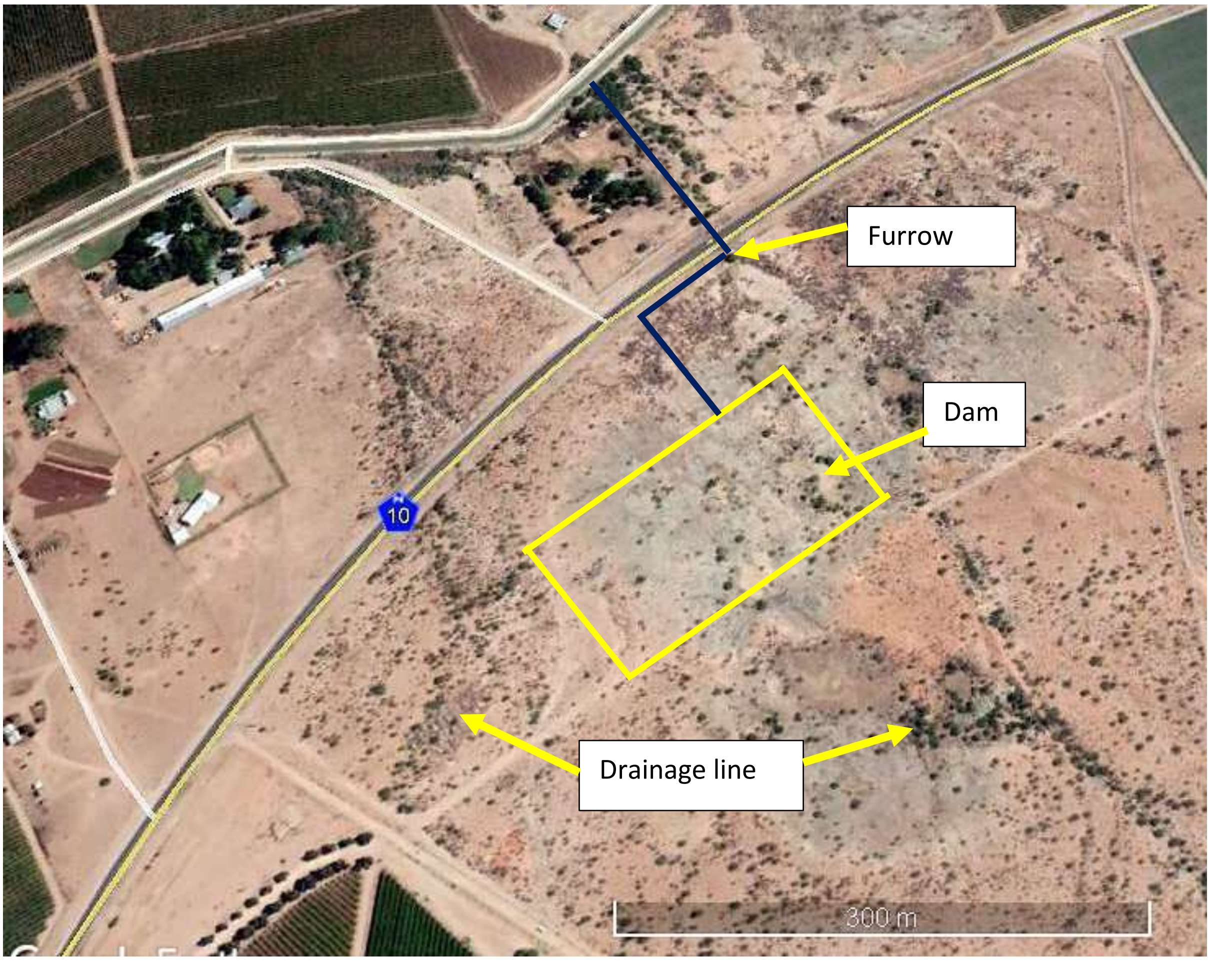


Figure 18 Holding Dam and Furrow Drainage Lines

Likewise, the new 17 hectares of vineyard on the next-door property is not about to cause more damage to an already obliterated drainage line.

10 The Sub-Catchment (Figure 19)

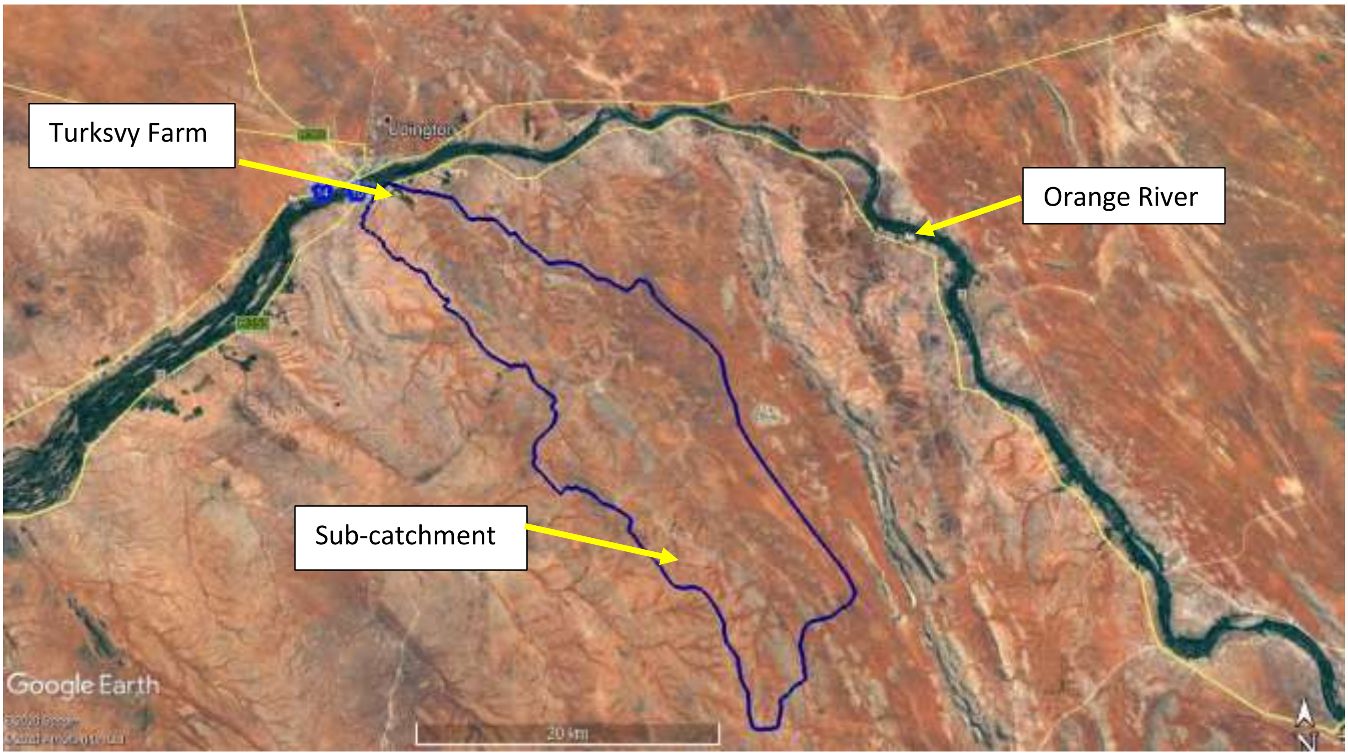


Figure 19 Sub-Catchment

The sub-catchment is 58km long and 18 km wide at its widest point. It covers an area of 56 000 hectares.

The western boundary of the sub-catchment is marked with red Kalahari sand dunes. These sands are shifting and this movement may cause that the flow changes direction, so that the flow of storm water may be towards the adjacent sub-catchment, perhaps temporary, as these environments are dynamic.

Next to the Orange River the landscape has been hugely transformed into vineyards. The drainage line here regresses into artificial drainage channels to accommodate agricultural return flow, apart from the occasional storm water. Storm water can reach the Orange River through these channels some 3.5km downstream. Perhaps some can reach the river along the railway, which is the shortest route.

Where the main drainage line from the sub-catchment passes underneath the N10 Trunk Road (Figure 20, bridge), it forms a large *Phragmitis* reed bed on both upstream and downstream of the bridge (Figure 21 and 22). Naturally, prior to human impact, this reedbed probably was absent, with a mostly dry and tree lined drainage line. The reeds established itself because of agricultural return flow and storm water as well as sewage spills out of Louisvale.

Upstream from the bridge on the left is the large Turksvy Farm vineyard. On the right is the informal settlement of Louisvale. Downstream from the bridge the agricultural development is extensive.

Figure 20 Trunk Road Bridge

Figure 21 Reedbed Upstream

There are numerous low-lying vineyards, cut-off trenches and swales along the path of the main drainage line to the Orange River. Moreover, the banks of the Orange River are so thickly overgrown with *Phragmitis* reeds and particularly the highly invasive and dominant Spaanse riet *Arundo donax* that is almost impossible establish where exactly the main drainage line impacts on the highly braided Orange River.

Figure 22 Reedbed Downstream

The upper part of the sub-catchment is largely natural (Figure 23), but closer to Louisvale it is entirely transformed into a dumping site for building rubble and other waste (Figure 24). The area is defaced by large quantities of litter. It was hard to see any conservation value in this area.

Figure 23 Upper part of sub-catchment

Figure 24 Rubble and litter

11 Risk of Flooding

The high ground at the top end of the larger catchment is at an elevation of 1020masl and at the point of discharge at the N10 road bridge it is 800 masl. The mean slope is only 0.38m in every 100 horizontal metres, which is very flat.

The velocity of storm water currents will predictably be very slow and water will be standing in the countryside. This is supported by the presence of an ephemeral pan, known as Trooilapspan, in the middle of the larger sub-catchment.

With such a large catchment area, a rainfall event of 40 mm per day would produce a runoff of more than a million cubic metres, after half of it has sunk into the ground.

With such a high evaporation rate, perhaps half of the remaining storm water would be lost as well. Probably only a quarter of the storm water would reach the end of the sub-catchment, perhaps over a period of 5 days or more.

This flow would probably be enough to scour the 150m wide drainage line and perhaps somewhat move its flow path over the easily erodible sandy substrate, but would be hardly enough to flood any of Turksvy Farm.

Yet, it was strong enough to punch a large gap right through the berm on Turksvy Farm.

This is speculative, as a proper hydrological computer-based modelling exercise using one of the recognised hydrological models in the hands of an experienced hydrologist is beyond the financial means of a regular WULA. Nevertheless, these assumptions are probably adequate to assess the environmental risks to Turksvy Farm and its proposed vineyard expansion.

12 Drainage Lines

The landscape around much of the Lower Orange River and the Sak River is dominated by a dense succession of drainage lines, each with their own sub-catchment. The drainage lines spread along the river with many smaller tributaries to cover the entire area. The iron oxides in the sands renders a red hue that is visible from space on the Google Earth images. These reds are concentrated in the drainage lines, making them even more visible (Figure 19).

The drainage lines are mostly dry, with water only during rains and perhaps shortly thereafter. During the odd thunder storm, drainage lines can come down in flood. These floods maintain the drainage line's morphological integrity, as sediments are moved and these water ways are scoured out.

Because rainfall events are far apart, the drainage lines must have been formed over millennia, even since geological times.

The vegetation in these arid parts is sparse, with a low diversity op plant species and a limited habitat variability. Drainage lines are often overgrown with a mature stand of sweet thorn *Vachellia karoo*, together with some other scrub and low trees such as *Searsia* species. In other parts the dominant tree is swarthaak *Senegalia mellifera.* This considerably adds to the habitat variability of the region. These tree lines stretch over the otherwise barren landscape and provide a linear connected habitat that would have been entirely absent if it was not for the shallow ground water in the unconfined aquifer in the drainage line's alluvium. Likewise, these tree lines provide habitat and nourishment to a variety of fauna that would have been entirely absent, was it not for the gradual migration of shallow ground water along the drainage lines.

All over the arid and semi-arid landscape of the western half of South Africa, these tree lines are considered to have a special and high conservation value.

Around the Orange River and even the Sak and Hartbees River, large-scale agriculture has changed the drainage lines into drainage channels among the vineyards and orchards. The upper reaches away from the rivers are less impacted, even near-pristine, as intense agriculture is not possible, apart from those areas where water is piped over long distances from the Orange River.

The conservation of drainage lines along the Lower Orange River deserves and demands attention by decision-making authorities, environmental practitioners, the conservation and farming community alike. As more of these drainage lines are impacted upon, and because impacts are radical by nature, because sections of drainage lines are replaced by vineyards or other forms of agriculture, or transformed into return flow infrastructure, the necessity for a widely accepted conservation policy becomes urgent as development escalates.000000

A percentage of still unimpacted drainage lines should be identified, prioritised and set aside for conservation. Only specified practices with no or limited impacts should be allowed in these sub-catchments and their drainage lines.

13 Biomonitoring the Lower Orange River

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

Biomonitoring was carried out on the Lowers Orange River during site visits for successive WULAs. So far 12 samples have been analyzed at 11 localities (Table 1). The site furthest east was at Hopetown and furthest west at Augrabies, with Upington in the middle. All of these are located upstream of the Augrabies Falls.

Another sample was analyzed at Styerkraal just east of the border post of Onseepkans downstream of the Augrabies Falls.

The river is mostly braided, with many smaller streams and with islands in the middle. The river sports many rapids and riffles, but also pool-like features where the river is broad and slower flowing.

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

14 Impacts on the Lower Orange River

The river is heavily utilized for agriculture, with the banks entirely modified into cultured vineyards. A multitude of large electric water pumps have been placed in the river for abstracting large volumes of water for irrigation. Abstraction significantly lowers the flow in the river.

Berms for the purpose of flood protection have been constructed on the banks of the river for most of its length. These berms have been constructed by the Department of Water Affairs and now have been a feature of the landscape for many decades. The berms keep flood water out of adjacent agricultural land and has denaturalised the riparian zone.

The single most impact on the Orange River are the two very large dams, The Gariep Dam and the Vanderkloof Dam. The river flow has been modified to a much more even regime, different from the varied flown with high peak flows and low drought flows.

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

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

It is suspected that pesticides in agricultural return flow have a heavy impact on biomonitoring results, significantly reducing the SASS5 score.

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

15 Lower Orange River Biomonitoring Results

The biomonitoring results have been captured in Table 1 and depicted in Figure 25.

The classes from A to F in Figure 25 has been assigned for mature rivers on flood plains such as the Lower Orange River.

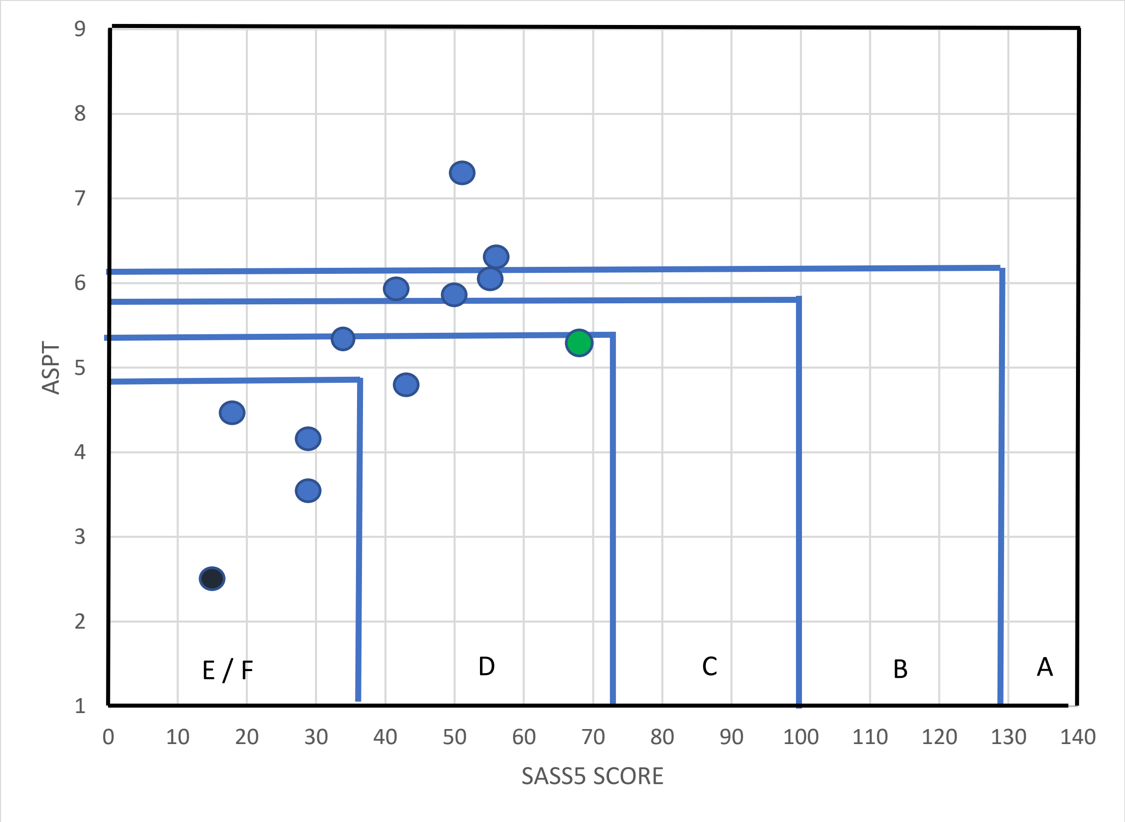
Only 2 of the samples were classified a good and relatively unimpacted (Class A). Four were in Class B and C, which can be regarded as acceptable under the circumstances of an impacted river reach. These classes can possible be labelled as the ideal, a compromise between agriculture and aquatic ecological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

Four samples were poor (Classes E and F), an undesirable state of affairs.

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

Table 1 Biomonitoring in the Lower Orange River

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



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 25 Lower Orange River Biomonitoring Results

The red dot on the graph represents the result at Turksvy Farm. All of the other dots represent previous sampling.

16 The Sampling Site

The site that was considered to be a reference point for the Turksvy Farm was in the Orange River close by on a property of which the owner was known to Mr van der Merwe. It was accessible because it was one of the very few places on the bank of the river that was kept clear and not overgrown with reeds. Sampling possibilities are limited because of the dense stand of reeds.

The river here was approximately 100m wide, pool like, flowing an approximate 5 to 10cm per second in the middle and 30 to 40 cm per second over the rapids. There were granite rocks that serves as bedrock sampling substrate. The only other habitat was muddy bottom and the reeds that were emerging vegetation. However, the exposed roots of the reeds at this locality served as additional habitat that was not available in most other parts of the river.

The river water was turbid, but not nearly as muddy as it can get.

Even though the sample produced more taxa than any previous sample, with the highest SASS5 score ever, it only scored a class D, because the organisms detected were not of the high scoring types, as is mostly the case in slow flowing reaches of mature rivers. The river here was rated as “Fair”, with some loss of ecological functioning, but with most of it still intact.

It is not expected that the new development at Turksvy Farm would change any of this, as a single plot of vineyard makes no difference to the thousands of hectares already present and because no extra water would be abstracted.

Figure 26 Sampling Site

17 Present Ecological State (PES)

Table 2 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 2 and 3) 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.

It is challenging to arrive at a realistic score for the drainage line that is 58 km long, as the crow flies, with most of it almost pristine and with the last reach before its confluence with the Orange River entirely modified into vineyards and drainage trenches. The small part of the sub-catchment in the township of Louisvale has been rated "E", highly impacted, before (Van Driel, 2019). It is obligatory to find a score that represents the entire drainage line and not only the reach at Turksvy Farm.

The prolific stand of reeds at Turksvy Farm is probably the result of agricultural return flow as well as reported sewage spills from Louisvale. These reeds have a profound effect on the flow and inundation. The lower reach is overgrown with *Prosopis* exotic invasive trees. Sheep and goats in the upper sub-catchment are reckoned as exotic fauna.

Both the instream habitat and the riparian zone score a “C”, moderately modified, with most ecological functioning still intact.

Scoring the reaches separately, the upper reach would score a “B”, only slightly impacted and the lower reach as well as the part in Louisvale, score an “E”, highly impacted. An average of “C” is probably realistic for the entire sub-catchment of 56000 hectares.

Much has been published on the ecological state of South African rivers and the Orange River is no exception. In fact, it seems somewhat arrogant to assess the Lower Orange River, even at the sampling point, with a team of one and with the financial backing of a single WULA. This is a large undertaking that is to be contemplated by a team of experts. Nevertheless, this is what the WULA requires.

The river at Upington, as elsewhere, has been impacted by major dams, large-scale water abstractions, an influx of agricultural chemicals, encroachment of reeds and exotic macrophytes, translocated and exotic fish, levees, bridges and many other infarctions.

However, the river at Upington was less impacted than further downstream, as at Kakamas. The river at Upington was stronger flowing, with much more water. The condition of the river gradually deteriorates as water abstraction and return flows increases downstream.

Hence the river was scored a C (Table 7), which signifies that it has been impacted, but despite these impacts still exhibits appreciable ecological functioning. The riparian zone scores a C as well.

There is a good chance that other practitioners would score the river very much the same.

Importantly, the proposed developments at Turksvy Farm are not about to change the PES of the Orange River at Upington.

Table 3 Present Ecological State of the Drainage Line

	Score	Weight	Product	Maximum score
Instream				
Water abstraction	24	14	336	350
Flow modification	17	13	221	325
Bed modification	18	13	234	325
Channel modification	19	13	247	325
Water quality	17	14	238	350
Inundation	16	10	160	250
Exotic macrophytes	20	9	180	225
Exotic fauna	15	8	120	200
Solid waste disposal	14	6	84	150
Total		100	1820	2500
% of total			72.8	
Class			C	
Riparian				
Water abstraction	24	13	312	325
Inundation	16	11	176	275
Flow modification	17	12	204	300
Water quality	17	13	221	325
Indigenous vegetation removal	16	13	208	325
Exotic vegetation encroachment	15	12	180	300
Bank erosion	20	14	280	350
Channel modification	16	12	192	300
Total			1773	2500
% of total			71.0	
Class			C	

Table 4 Present Ecological State Orange River

Instream	Score	Weight	Product	Maximum score
Water abstraction	15	14	210	350
Flow modification	15	13	195	325
Bed modification	20	13	260	325
Channel modification	22	13	286	325
Water quality	15	14	210	350
Inundation	12	10	120	250
Exotic macrophytes	18	9	162	225
Exotic fauna	15	8	120	200
Solid waste disposal	20	6	120	150
Total		100	1593	2500
% of total			63.7	
Class			C	
Riparian				
Water abstraction	15	13	195	325
Inundation	14	11	154	275
Flow modification	15	12	180	300
Water quality	15	13	195	325
Indigenous vegetation removal	15	13	195	325
Exotic vegetation encroachment	15	12	180	300
Bank erosion	20	14	280	350
Channel modification	18	12	216	300
Total			1595	2500
% of total			63.8	
Class			C	

18 Ecological Importance

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

There are no fish in the drainage line, as there is no permanent water. According to this assessment, which is prescribed for WULA's, the drainage lines are not important.

No other endangered species, either plant or animal, were detected in or near the drainage line.

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)

As has been stated before, the higher vegetation in and around the drainage lines are of particular importance in these arid regions and add significantly to biodiversity. These should be considered as ecologically important.

The Orange River is most important, according to this assessment.

According to Skelton (1993) 12 species of indigenous fish occur in the Lower Orange River. Since 2011 another one was added, as well as 3 exotic species. These are the following:

Barbus trimaculatus
B paludinosus
B. hospus
Labeobarbus kimberleyensis (Near threatened)
L aenus
Labeo umbratus
L capensis
Austroglanis sclateri (Widespread elsewhere)
Clarias gariepinus
Pseudocrenilabrus philander (Threatened locally but abundant elsewhere)
Pseudobarbus quathlabae
Mesobola brevianalis (critically endangered)

Exotic and translocated fish:

Cyprinus carpio
Tilapia sparrmanii
Oreochromus mossambicus

Those in blue are endangered to a varying extent. Those indicated in red are exotic or translocated fish.

The only one that causes real concern in the largemouth yellow-fish *Labeobarbus kimberleyensis*. It is endemic to the Orange River system and hence is threatened not only on a local scale, but on a national scale as well. This puts the Lower Orange in category 4. This renders the Orange River as important.

According to the owners of the Kalahari River and Safari Co. along the northern bank of the Orange River on the Riemvasmaak Road, mature blue kurper *Oreochromus mossambicus* are regularly captured in increasing numbers. It now takes at least 4 man-days to capture a single yellow fish.

Yellow fish are generally infected with cestode bladder worms, while darters (*Anhinga rufa*) that predate on these fish are heavily infected with tape worms. It seems as if the translocated Tilapia are not affected by these parasites.

According to Mr Chris van der Post, a renown angling guide and the owner of the Gkhui Gkhui River Lodge near Hopetown, there are still many smallmouth-yellow fish around, but largemouth yellow-fish are scarce.

19 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.

19.1 Ecological Sensitivity Drainage Line

The question arises, according to the ES definition, if the drainage lines would recover to its original ecological state prior to any human impact. If the Turksvy Farm with its return flow and Louisvale, along with the many tons of rubble and trash beremoved, would the drainage line recover? The answer is probably yes, even though the drainage lines would find new routes and even though it would take many decades, perhaps more than a century, in this semi-arid region where re-growth of vegetation can take a long time. However, this is not a realistic scenario. Development is here to stay, together with its impacts. From this point of view the drainage line can be considered as ecologically sensitive.

19.2 Ecological Sensitivity Orange River

The Lower Orange River 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 the Lower Orange River might have some more capacity to absorb further impact.

20 Possible Impacts

20.1 Construction Phase

When the new vineyard is developed, loosened soil and sediments may wash into the drainage line during rainfall events. The same applies to the construction of a new access road and a drainage channel.

20.2 Operational Phase

Agricultural return flow because of over-irrigation can be a severe impact.

21 Mitigation Measures

When the new vineyard is developed, it should be done during the dry season. No more land should be disturbed than is really necessary and the foot print should not be any bigger than the design area of the vineyard. Earth moving machinery and farming implements should not be allowed outside of the designated area.

The drainage line next to the new vineyard should be preserved, with an allowance for flow from the catchment right through to the main drainage line on the other side and adjacent to Turksvy Farm, similar to the already present drainage channels through the vineyards.

Disturbed areas next to the new vineyard should be vegetated as soon as possible to prevent erosion and sediment transport.

Over-irrigation should be prevented at all costs. State-of-the-art instrumentation is available to measure soil moisture and to aid decisions regarding the correct volume of irrigated water. Apart from huge saving of costs, scientific measurement as standard operating procedures prevents agricultural return flow, the loss of fertiliser downstream and more prolific growth of reeds in the drainage line. Turksvy Farm is an extremely up-to-date enterprise and these measures have probably been internalised long ago.

22 Impact Assessment

Table 6 Impact Assessment

Description of impact Loosening of soil during construction phase, washing of soil down the drainage line and into the Orange River during a storm event **Mitigation measures** Construction only during the dry season, limit the foot print, vegetate disturbed areas.								
Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Negative	Local	Medium	Short term	Medium	Probable	Certain	Reversible	Replaceable
With mitigation measures								
Negative	Local	Low	Short term	Low	Unlikely	Sure	Reversible	Replaceable

Description of impact Operation of new vineyard **Mitigation measures** Prevent agricultural return flow.								
Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Negative	Local	Medium	Medium term	Medium	Probable	Certain	Reversible	Replaceable
With mitigation measures								
Negative	Local	Low	Medium term	Low	Unlikely	Sure	Reversible	Replaceable

Description of impact Construction of holding dam Construction of furrow/ pipeline Washing down of lose sediments down the drainage lines **Mitigation measures** Construct during dry season, limit footprint, vegetate disturbed areas								
Type Nature	Spatial Extent	Severity	Duration	Significance	Probability	Confidence	Reversibility	Irreplaceability
Without mitigation								
Negative	Local	Medium	Medium term	Medium	Probable	Certain	Reversible	Replaceable
With mitigation measures								
Negative	Local	Low	Medium term	Low	Unlikely	Sure	Reversible	Replaceable

Some of the decision-making authorities prescribe an impact assessment according to a premeditated methodology (Table 23.1, Appendix).

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

The assessment indicates that the impacts are acceptable, provided that the mitigation measures are adequate to contain these impacts (Table 6).

23 Risk Matrix

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

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

The methodology is tabled in the Appendix.

The Risk Matrix indicates that the risk to the aquatic environment are low and even insignificant. A General Authorisation should be in order for this application and a License is deemed not to be the indicated level of authorisation.

Table 7 Risk Matrix

No.	Activity	Aspect	Impact	Significance	Risk Rating
1	Establishment of new vineyard, loosening of soil	Mobilisation of sediments	Agri-chemicals in drainage line and Orange River	28	Low
2	Operation of new vineyard	Over-irrigation	Riparian habitat destruction	44	Low
3	Construction of holding dam and furrow	Mobilisation of sediments	Sediments in drainage line and Orange River	24	Low

Table 7 Continued Risk Rating

No	Flow	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Conse-quence
1	1	2	2	1	1.5	1	1	3.5
2	1	2	2	1	1.5	1	3	5.5
3	1	1	1	1	1	1	1	3

No	Frequency of activity	Frequency of impact	Legal issues	Detection	Likelihood	Significance	Risk Rating
1	1	1	5	1	8	28	Low
2	1	1	5	1	8	44	Low
3	1	1	5	1	8	24	Low

24 Resource Economics

The goods and services delivered by the environment, in this case the drainage line at Turksvy Farm, 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 27) 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	4
Stream flow regulation	4
Sediment trapping	4
Phosphate trapping	2
Nitrate removal	2
Toxicant removal	2
Erosion control	3
Carbon storage	2
Biodiversity maintenance	5
Water supply for human use	0
Natural resources	0
Cultivated food	1
Cultural significance	0
Tourism and recreation	0
Education and research	1

0	Low
5	High

The drainage line's major contribution comes with its tree line, maintained by shallow groundwater in its alluvium. The tree line adds significantly to habitat diversity and biodiversity in an otherwise drab and monotonous landscape.

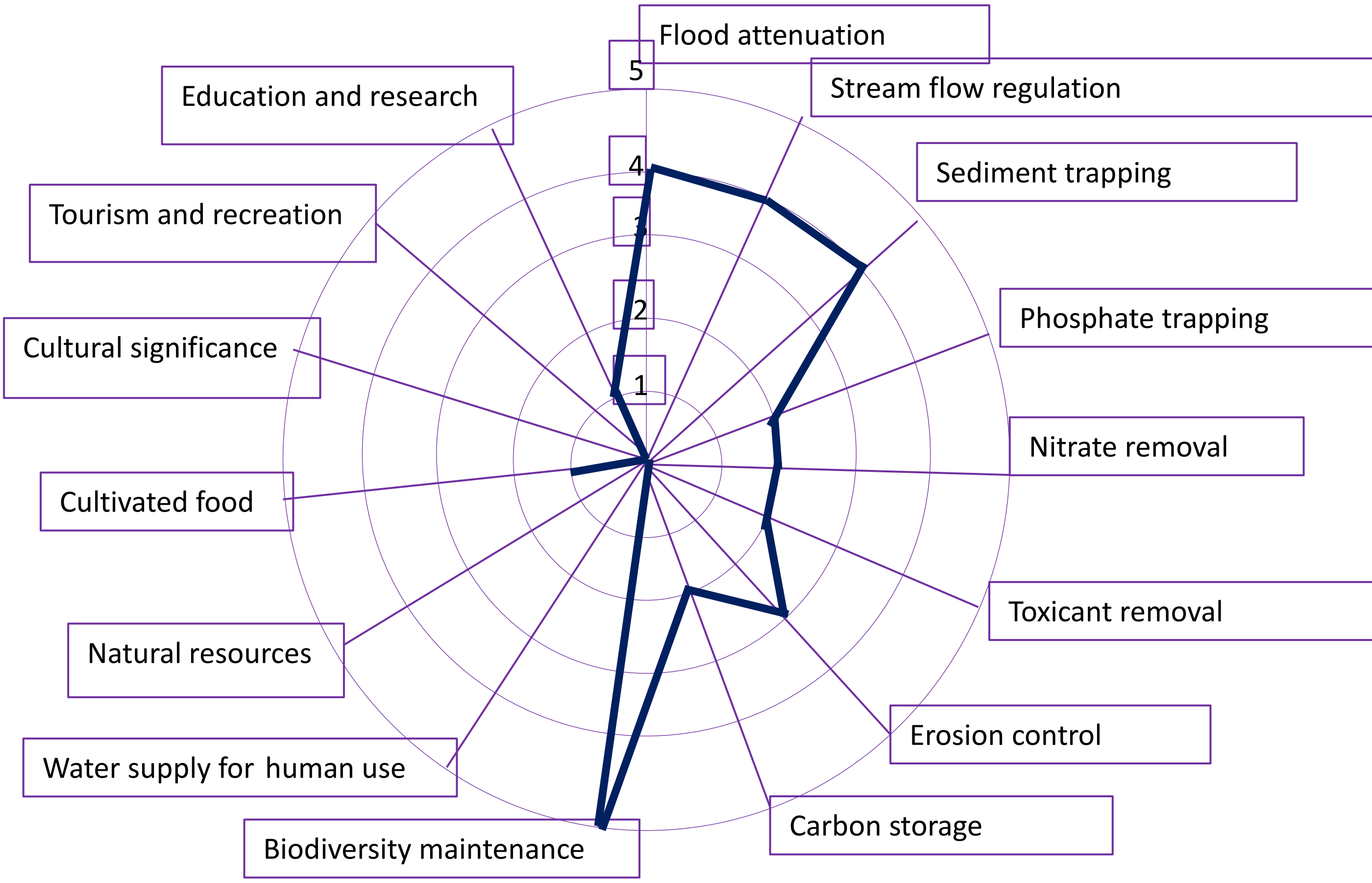


Figure 27. Resource Economics Footprint of the Drainage Line

The size of the star shape of Figure 27 attracts the attention of the decision-makers. This shape (spider diagram) is small, indicating that the water course has a small economic foot print. Apart from a small measure of flood attenuation, stream flow regulation and sediment trapping, the drainage line is not important, from a resource economics point of view.

The resource economics spider diagram for the Orange River is a perfect round circle, with a score of 5 for all of the measured parameters.

The developments at Turksvy Farm is not about to change the shape of these spider diagrams.

25 Conclusions

Figure 28 has been adapted from one of the most recent DWS policy documents.

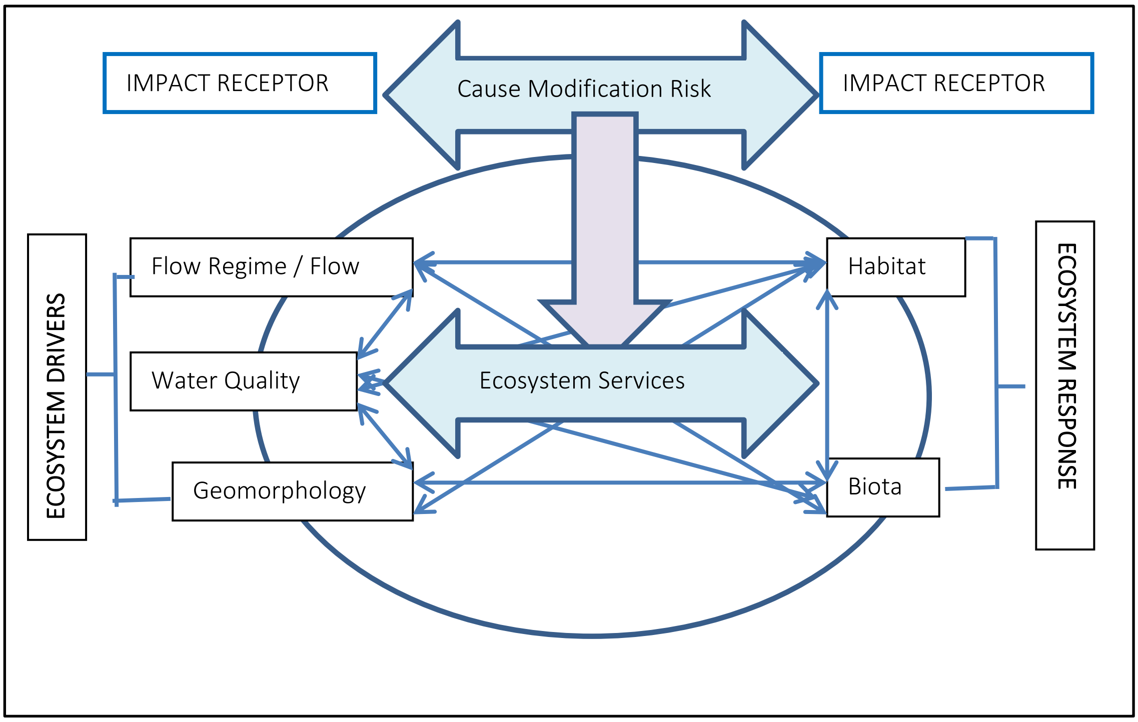


Figure 28 Minimum Requirements for a S21(c) and (i) Application

An anthropogenic activity can impact on any of the ecosystem drivers or responses and this can have a knock-on effect on all of the other drivers and responses. This, in turn, will predictably impact on the ecosystem services (Figure 28). The WULA and the EAI must provide mitigation measured for these impacts.

The driver of the drainage lines is the occasional flood that follows sudden and intense rainfall events. This is followed by prolonged droughts and intense summer heat that prevents the development of any viable aquatic habitat. This is apart from shallow ground water that explains the growth of a somewhat more prolific vegetation along the drainage lines.

The proposed new vineyard, as well as the holding dam and its furrow, is not about to change any of the drivers. Neither would the ecological goods and services be affected.

The possible impacts on the aquatic environment are small, if not negligible. These impacts are entirely insignificant if compared to the already impacts of a large-scale regional farming industry on the banks of the Orange River, together with its major water abstraction and massive irrigation return flow.

It is there fore suggested that the proposed development is authorised with a General Authorisation.

26 References

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. *Freshwater Fishes of Southern Africa*. Southern Book Publishers, Halfway House.

Van Driel, D. 2019. *Fresh Water Report. Louisvale Sewer*. WATSAN Africa, Cape Town.

27 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:  26 May 2020

28 Résumé

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

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

- Fresh Water Report Klaarstroom Waste Water Treatment Works
- Fresh Water Report Calvinia Sports Grounds Irrigation
- Fresh Water Report CA Bruwer Agricultural Development Kakamas
- Fresh Water Report Zwartfontein Farm Dam, Hermon
- Statement Delsma Farm Wetland, Hermon
- Fresh Water Report Lemoenshoek Farms Pipelines Bonnyvale
- Fresh Water Report Water Provision Pipeline Brandvlei
- Fresh Water Report Erf 19992 Upington
- Botanical Report Zwartejongensfontein Sand Mine, Stilbaai
- Fresh Water Report CA Bruwer Feldspath Mine, Kakamas
- Sediment Yield Calculation, Kenhardt Sand Mine
- Wetland Demarcation, Grabouw Traffic Center
- Fresh Water Report, Osdrift Sand Mine, Worcester
- Fresh Water Report, Muggievlag Storm Water Canal, Vredenburg
- Fresh Water Report, Marksman’s Nest Rifle Range, Malmesbury
- Biodiversity Report, Muggievlak Storm Water Canal, Vredenburg
- Strategic Planning Report, Sanitation, Afghanistan Government, New Delhi, India
- Fresh Water Report, Potable Water Pipeline, Komaggas
- Fresh Water Report, Wastewater Treatment Works, Kamieskroon

29 Appendix

29.1 Biomonitoring Score Sheet

SASS5 Score Sheet										
Date	17 May 20	**Taxon**	**Weight**	**Score**	**Taxon**	**Weight**	**Score**	**Taxon**	**Weight**	**Score**
Locality	Orange River	Porifera	5		**Hemiptera**			**Diptera**		
	Turksvy Dam	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3		Corixidae	3	3	Blepharoceridae	15	
		Oligochaeta	1		Gerridae	5		Ceratopogonidae	5	
Coordinates	33°42' 53.07"	Huridinea	3		Hydrometridae	6		Chironomidae	2	2
	19°23'25.02"	**Crustacea**			Naucoridae	7	7	Culicidae	1	
		Amphipodae	13		Nepidae	3		Dixidae	10	
DO mg/l	8.8	Potamonautidae	3		Notonectidae	3	3	Empididae	6	
Temperature °C	16.6	Atyidae	8	8	Pleidae	4	4	Ephydridae	3	
pH	7.15	Palaemonidae	10		Veliidae	5	5	Muscidae	1	
EC mS/m	35	Hydracarina	8		**Megaloptera**			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	69	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	13	Perlidae	12		**Trichoptera**			Tabanidae	5	
ASPT	5.3	**Ephemeroptera**			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		**Gastropoda**		
Other Biota	Small fish	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		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	5			
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5				
		Gomphidae	6	6	Haliplidae	5				
		Libellulidae	4		Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5	5			
					Limnichidae	10				
					Psephenidae	10				
Score				30			32			7

29.2 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 29.2.1 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 29.2.2 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 29.2.3 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 29.2.4 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.

29.3 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	1
Fully covered by legislation (wetlands are legally governed)	5
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