SURFACE AND GROUNDWATER MONITORING PROGRAMME

Rooipoort Developments (Pty) Ltd

November 2018

Report compiled for:

Rooipoort Developments (Pty) Ltd

Mr. Henk Van Zuydam

P.O. Box 161

Delportshoop

8377

Prepared by:

TURN180 ENVIRONMENTAL CONSULTANTS

Contact person: Mr. G. L. De Villiers

Postal Address: Suite 221

Private Bag X01

BRANDHOF

9324

Tel: 072 967 7962

E-mail: louis@turn180.co.za

Refer to **Annexure 1** in the IWWMP for the expertise of the project team.

EXECUTIVE SUMMARY

Background

Rooipoort Developments (Pty) Ltd (**"RD"**) established an alluvial diamond processing and recovery plant to extract diamonds from gravel on the following properties:

- Zand Plaats 5/102
- Vogelstruispan 101
- Vogelstruispan 98
- Bergplaats 100
- Klipfontein 99

These properties are located towards the north east and east of the town of Schmidtsdrift in the Northern Cape. The most southern border starts at the N8 from Kimberley to Schmidtsdrif and the northern border of the mining area borders the Vaalbos National Park. The Vaal River borders the western side of the mining area.

The initial Mining Right was held by DBCM. A Section 11 transfer application in terms of the MPRDA was submitted to the DMR.

A Water Use License was issued by the DWS on 19 November 2015 for the following water uses in terms of Section 21 of the NWA:

Section 21(a): The abstraction of a volume of 248 000 m^3/annum of water from the Vaal River for mining purposes.

Section 21(g):

- The disposal of water containing waste in a manner which may detrimentally impact on a water resource: allowing the fine material to settle in the Fine Tailings settling Panels (FTSP) to be used during rehabilitation to backfill voids, and
- Dust suppression on roads using the process water.

The WUL was only authorised on one property (i.e. Zand Plaats 102/5) with one location for each use which is as follows:

Activity	Latitude	Longitude
Section 21(a): Abstraction of water from the Vaal River	28° 40' 45.444"	24° 03' 40.1508"

(**Abstraction point**)		
Section 21(g): Disposing of water and fine tailings in the settling panels (**Location of panels**).	28° 40' 42.6360"	24° 04' 03.0360"
Section 21(g): Dust suppression	28° 41' 38.4"	24° 05' 39.84"

The mining operation on Zand Plaats 102/5 was completed in 2016 during which time the entire operation relocated to Vogelstruis Pan 101, Vogelstruis Pan 98 and Bergplaats 100. This included that new voids/cuts be made for the excavation of gravels. The first cut, which contains a separation wall is used for the discharge the fine material suspended in water where the fine material settles, and water drains through the screen from where it is recovered and reused in the process plant. This is done to rehabilitate the first cut with material. When the first cut is full it will be left to dry and covered with overburden and topsoil and the second cut will be rehabilitated in the same way. The use of the Zand Plaats Fine Tailings Settling Panels ceased, and the facility was rehabilitated early in 2018 as it is dry.

The area as indicated in the WUL where roads are sprayed with water also moved. An IWULA was submitted to the DWS in June 2017 for a license to authorise the already licensed water uses on all 5 properties as indicated above.

As per the request by the DWS the abstraction point of water from the Vaal River is still on Portion 5 of Zand Plaats 102 as per the license. This water is then transported through a pipe to the processing plant and mining operations on Vogelstruis Pan 101, Vogelstruis Pan 98 and Bergplaats 100. The abstraction point will relocate to Bergplaats 100 if the WUL is issued to include all 5 properties.

The 2017 IWULA included applications for the following water uses:

Section 21(a): Ground water will be abstracted from two boreholes. The water will be utilised for domestic use for employees at the plant and the site offices. The volume applied for is 10 000 m^3/annum. This volume is less than the threshold as indicated for the C92A and C92B catchments in the Revision of the General Authorisation for the taking and storing of water (Notice 538 of 2 September 2016). Note that with the domestic water use at the office, a small volume of water will be abstracted for drinking water for the game on the farm. However, this will not amount to a large volume of water. This water will be pumped into a 5 000 L tank with sloped sides to allow animals to access the water. It should be noted that the same borehole will be used for the abstraction of water at the site offices.

Section 21(b): Applications are also submitted for the storage of water in the First Cut and the Process Water Dam (**PWD**). It is important that the reader note that the water contained in these dams is not water taken from the drainage system. Water in the First Cut consists of gravel suspended in water from

the processing plant. The water is recovered and pumped to the PWD from where it is re-used in the plant or for dust suppression. Water from the Vaal River is pumped to the PWD to top-up the level. Neither of these facilities are in-stream storage dams which will have an impact on downstream water users.

The capacity of these facilities is as follows:

- First Cut – 250 000 m^3. The First Cut is not lined and consists of previously mined voids and is therefore an excavation in the ground. There are no surface walls and the facility maintains a freeboard of 1 m beneath the soil suface.
- PWD – 3 200 m^3. An excavation was made which was lined by plastic liner. This facility receives water abstracted from the Vaal River and the First Cut. Water from the PWD is re-used in the plant and for dust suppression.

Section 21(c) and (i): This application is submitted for the establishment of roads/"driveways" through watercourses (**Crossings**). The applicant is in the process of compiling all necessary information and specialist studies to submit such an application. Note that these Crossings are not intended to impede the flow of water in the watercourses as it is constructed on the bed of the watercourses where possible. However, some of the Crossings have resulted in ridges impeding any flow, although the obstructions are only about 0.5 m. Other crossings have pipes or other infrastructure to allow water to drain freely. The watercourses are non-perennial in a low rainfall area.

An application is also submitted for the applicant to undertake the operations within 100 m from watercourses on the mining area.

Section 21(e): An application is submitted for the spraying of water from the PWD on roads in an attempt to suppress dust. This water is regarded as "dirty water". The volume of water sprayed on the roads is approximately 300 m^3/day depending of operation and weather conditions.

Section 21(g): Applications are submitted for the "disposal" of water containing waste into the First Cut and the PWD, although water is recovered and re-used in these facilities (please refer to the section 21(b) part for indication of volumes and extent).

An application is also included for the backfilling of material from the process plant and screens into voids to rehabilitate them. The material used for backfilling the voids amounts to approximately 135 000 m^3/month.

NEW APPLICATION IN 2018

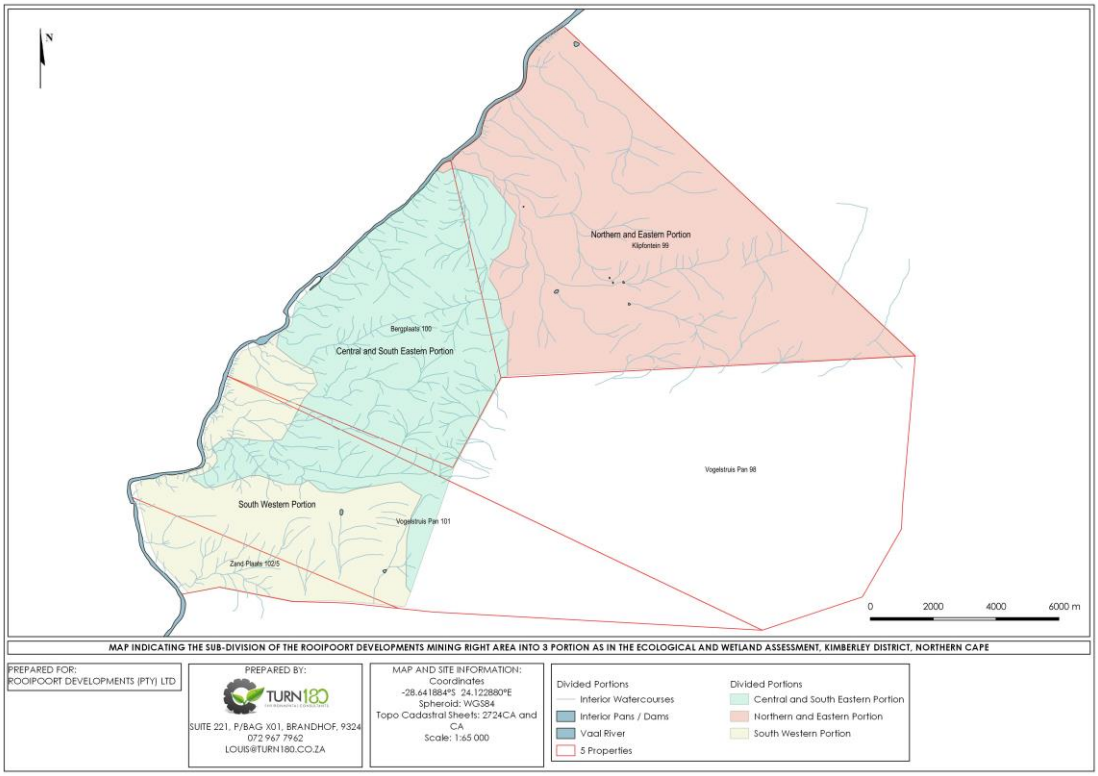
Although this IWWMP is submitted as an updated report on the existing WUL it also serves as a supporting document to the new WULA submitted for the undertaking of an additional water use by RD. The additional water use will involve the mining of alluvial gravel for diamonds inside the Vaal River,

drainage lines and watercourses located within the mining right area on the previously mentioned 5 properties, including the riparian habitat areas. An application is therefore submitted in terms of Section 21(c) and (i) to authorise the above water use associated with conducting the mining operations on the entire footprint of the mining right area where diamonds can be feasibly mined.

The new WULA includes all watercourses on all 5 properties under the mining right of RD and will include the entire length of the Vaal River bordering the mining right area to the west, which is approximately 28 km as well as all watercourses, drainage lines, wetlands and sensitive areas located on the interior of the mining right area to the east of the Vaal River. The total footprint of the mining right area is approximately 20 721 ha and covers Portion 5 of the farm Zand Plaats 102, a Portion of the farm Vogelstruis Pan 98, a Portion of the farm Vogelstruis Pan 101, the farm Klipfontein 99 and the farm Bergplaats 100.

For the purpose of this WULA the entire mining right was subdivided into 4 different areas due to the extent of the study area. The area and project are divided into the following areas and activities:

- Mining inside and within 100m from the Vaal River,
- Mining inside and within 100m from interior watercourses subdivided into the following areas:
  - The south western portion,
  - Central and south eastern portion, and
  - The northern and eastern portion.



Vaal River:

Mining of the areas inside the Vaal River will occur by making diversion channels inside the Vaal River diverting the flow of water in the river and drying the bed and banks of the river. Mining will occur on sections of approximately 1,5 km in length inside the Vaal River and will occur mainly in the dry season (between April and December) when the water level inside the Vaal River is low. Only one diversion channel is to be constructed and operational at any given time to minimise the risk of contamination of the river system.

The diversion channels will be constructed to consist of the following:

- A transitional zone where the natural river channel is diverted towards the new constructed diversion channel,
- The diversion channel with an embankment on the right flank to separate the natural river channel from the diversion channel, and
- A transition zone that allows the flow back to the natural river channel.

It was recommended by the Civil Engineer that the Diversion Channels be constructed to allow for flow of $50m^3/s$. This was determined by analysing the flows at gauging station C9H024 in the Vaal River. Based on the flow data it was determined that the maximum monthly flood sizes in the Vaal River was experienced during the months of January to March. Although the data indicated that the flow was greater than $50m^3/s$ during December it was recommended that no Diversion Channels will be

operated during December breaks. Diversion channels will therefore be constructed and operated during April to November. However, there is still a moderate risk of flooding during April months if the Diversion Channels are constructed to cater for a flow of 50m^3/s. It is therefore recommended that weather patterns and current flow be monitored during this month and the risks of flooding be assessed prior to construction during April months. It is advised that the appointed Civil Engineer be consulted prior to construction.

As mentioned above each Diversion Channel will be designed with a length of 1.5km. The berm inside the river downstream of the transition zone and downstream of the diversion channel will be approximately 3.5m in height including the freeboard of 0.8m. The purpose of the berm will be to reduce and /or prevent the risk of sedimentation downstream in the Vaal River and to divert the flow into the diversion channel to prevent contamination. However, this berm might be higher but will never exceed a height of 4.5m. Due to the fluctuating width of the Vaal River over the study area each diversion channel will be designed separately to include the structure width. It is however expected that the entire diversion channel and river bed area will have a width of approximately 50m. Due to the location of the mining activities it is not expected that the mining activities will exceed a depth of 3m.

Only 1 Diversion Channel will be constructed and operational at any given time.

<u>Mining inside interior watercourses:</u>

The entire study area contains approximately 434 seasonal (non-perennial) streams where mining is proposed. The largest amount of these watercourses is mainly found close to the Vaal River. The mining method to be used during the mining of the interior watercourses will involve the strip-mining method where topsoil and vegetation will be stripped from the surface and stockpiled. Overburden will be removed and stockpiled separately where after the diamond bearing gravel will be excavated from the void and transported to the process plant. Gravels will be returned from the process plant and will be used to fill the void where after overburden and topsoil will be returned to complete rehabilitation. Before replacing the topsoil layer, the area will be sloped to allow watercourses to drain to the Vaal River. The banks of the watercourse will then be revegetated. The main focus will be to prevent ponding and/or erosion from occurring inside the watercourses and the banks of these watercourses. The miing activities will occur in the following order:

- Mining of the catchment outside a 30m buffer from watercourses,
- Rehabilitation of the catchment until a manner of natural vegetation has established,
- Mining of interior watercourses,
- Rehabilitation of the interior watercourses,
- Mining of the banks (i.e. 100m from active channel) of the Vaal River,

- Rehabilitation of Vaal River banks,
- Construction of Diversion Channels and mining inside the Vaal River, and
- Rehabilitation of the Vaal River mining areas and Diversion Channel.

It should be noted that the catchments of areas Diamant Koppie and M6 have been mined and rehabilitated as part of the existing mining operations. The M5 area is currently mined and areas L1 and L2 will be mined in the future following the above order of mining activities. If this WULA is authorised RD will return to the areas where mining and rehabilitation was completed to mine the interior watercourses and the Vaal River.

"Mining in the catchment will mobilise sediments and clear the vegetation layer which will increase the sediment load in watercourses significantly. As long as they are unmodified, they will be able to manage this increase to some extent. However, if they are mined at the same time as the catchment the increased sediment load will have an unacceptably high impact and will also affect the Vaal River into which these flows." (*Rehabilitation Plan, D. Van Rensburg, 2018*).

Although the construction of the diversion channels and the excavation of the gravel will occur inside the river and interior watercourses the existing process plant will be used which is located further than 100 m from any watercourse. Activities inside the watercourses will be limited to excavation, loading and hauling and backfilling of material from the process plant. No material storage, toilet facilities, vehicle maintenance and repair, plant or any other structure, infrastructure and/or activities will occur within watercourses apart from construction of diversion channels, excavation and loading and hauling. The existing DMS plant as described below will be used for the processing of gravels.

PROCESS DESCRIPTION

The various identified mining sites, demarcated by an extensive prospecting programme conducted by De Beers, is mined by conventional open cast alluvial mining methods.

All of the gravel resources on Rooipoort are mined using the strip mining method, which utilises excavators, front-end loaders and dumper trucks.

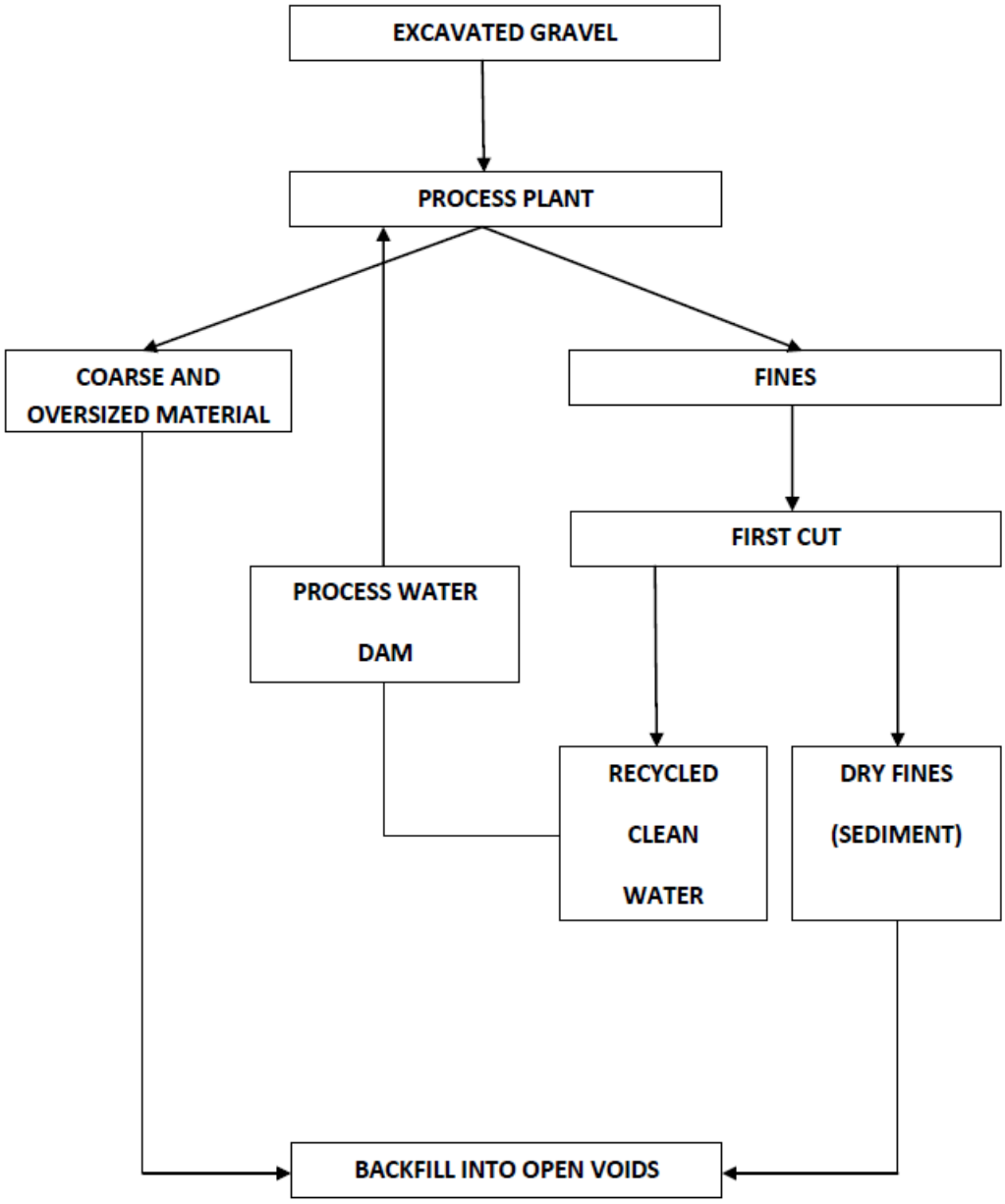
The areas which are mined is surveyed and a survey base line is established across the working area of each resource. In the case of Diamond Koppie, blocks of approximately 100m X 50m was, and will be demarcated along its base line, whereas 100m X 200m strips are demarcated for each of the remaining deposits (M5, M6 and L2). The width of these cuts are ussually not 100 m as it becomes difficult to clear overburden over such a large area. One block at a time is opened for each deposit, but three blocks are open at any given time. One block is stripped of overburden, gravel is removed from a second block and a third block is backfilled and rehabilitated. Any topsoil from these blocks is removed and stockpiled on the high ground side of the excavation. Overburden is also removed and kept separate

from the topsoil. The landowner permits the applicant to have a maximum of 6 ha of voids open at any given time.

The gravels are extracted from each block using a 70 ton excavator. The gravels are then transported to the Dense Medium Separator (**"DMS"**) plant by haul trucks where it is screened through rotary barrel screens to <75mm. The remaining <75mm material is scrubbed and screened to -32mm, +2mm, whereafter it is processed through the DMS plant and the final recovery section. The DMS units have been reduced from 4 units to only 2 units with the addition of the Bourevestnik Plant (**"BV"**). The BV plant is an X-Ray machine treating -50 mm to +5 mm material and uses little water making the plant water efficient as is evident when comparing the volume licensed to the volume abstracted. The BV only uses water for cooling purposes and will top-up a small volume of water every hour. This is minimal.

Once processed, the plant tailings and oversize material are hauled back to the excavation and backfilled into the same trench from which it was extracted. This is performed by the haul trucks that were used to transport the gravels from the excavation site to the Plant.

OPERATIONAL DIAGRAM – PRODUCTS PRODUCED AND PATHWAYS



The figure above indicates the process and the products produced by the process. During the processing of the material, the grits and fine material will continuously be pumped to the First Cut on site. The First Cut was designed to allow the suspended fine material to settle in the first pond. Water will flow through a stone diversion between the two ponds. Clean water will be pumped from the second pond back to the PWD to be re-used in the process plant or for dust suppression. When the mining in the area is completed the First Cut will be left to dry and will be backfilled with oversized material, overburden and soil. The overburden and topsoil will be replaced to the voids to cover the backfilled dry fine gravel and plant gravels.

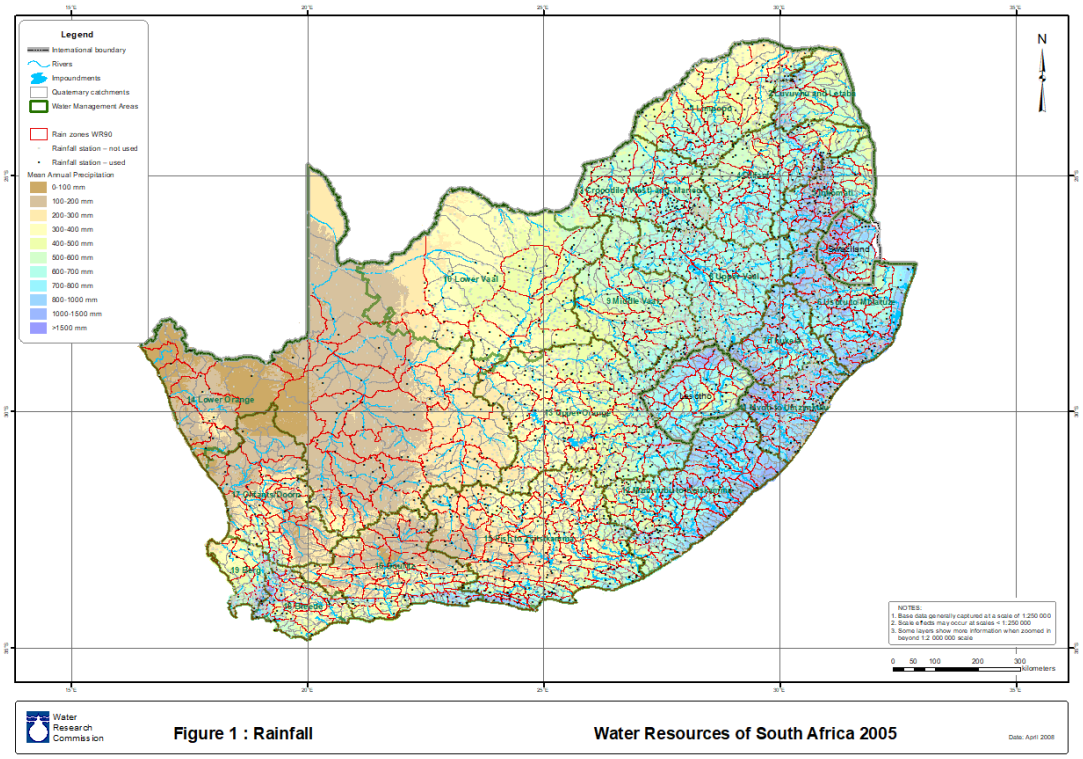
The mining process inside the Vaal River and interior watercourses is described in the Executive Summary above.

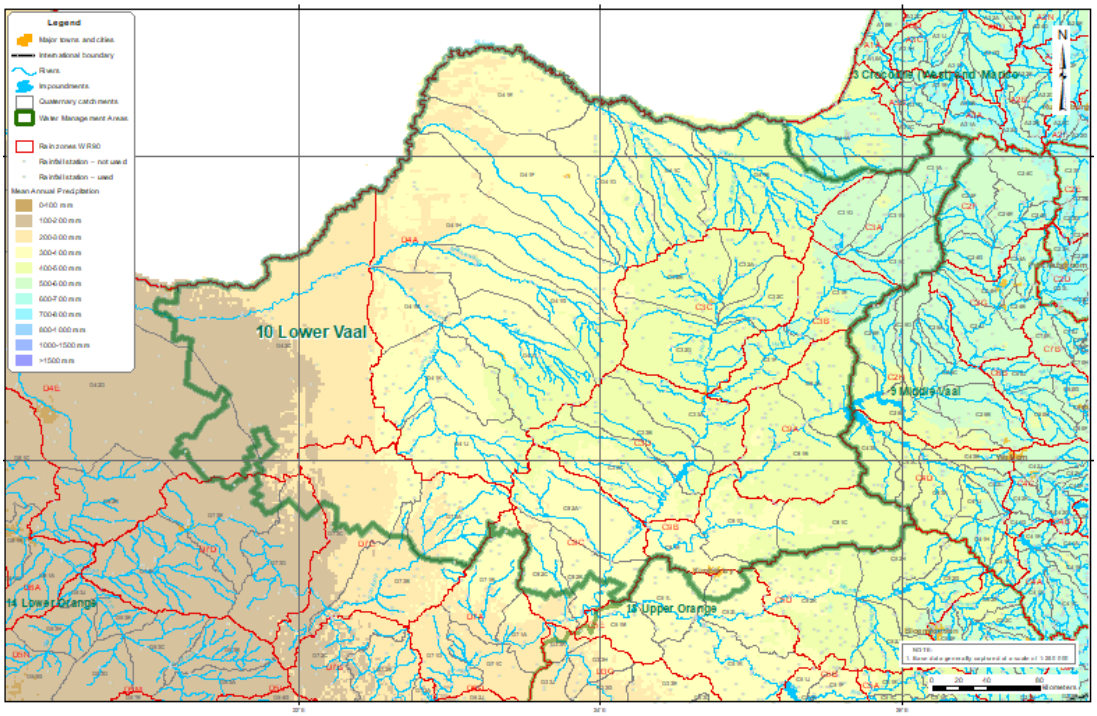
BACKGROUND ENVIRONMENTAL INFORMATION

Rainfall

The site is located in rainfall zone C9C which is a low rainfall, semi-arid region with an average rainfall of between 300 - 400 mm per annum which occurs largely as thunderstorms between October and March. Rooipoort is located in evaporation zone 7A with a mean annual evaporation of more than 2 600 mm/annum (approximately 2 896 mm/annum) (Water Resources of South Africa, 2005). The surface water runoff in the area is therefore typically restricted to very high rainfall events.

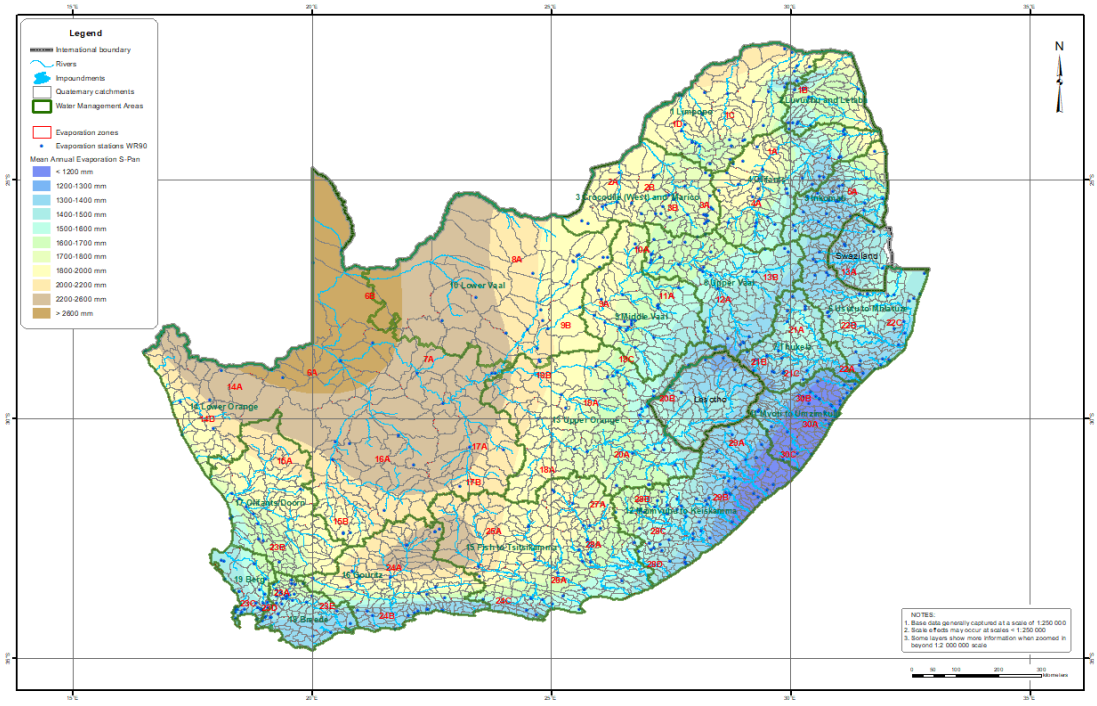
The average storm water runoff volumes are thus relative low, but it would be necessary to manage storm water during high rainfall events. The runoff in the area is between 5 – 10 mm/annum. However, this is probably due to the low rainfall.





Water Research Commission

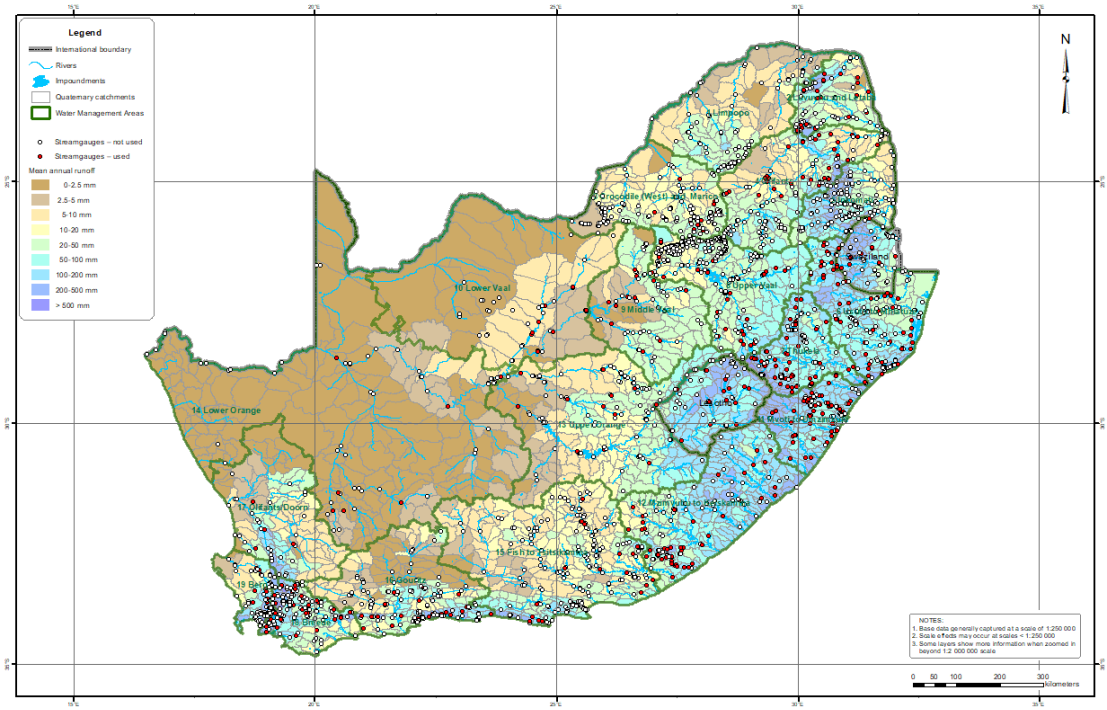
Figure 1.10 : Rainfall: Lower Vaal WMA **Water Resources of South Africa 2005**



Water Research Commission

Figure 2a : Evaporation (WR90 S-pan) **Water Resources of South Africa 2005**

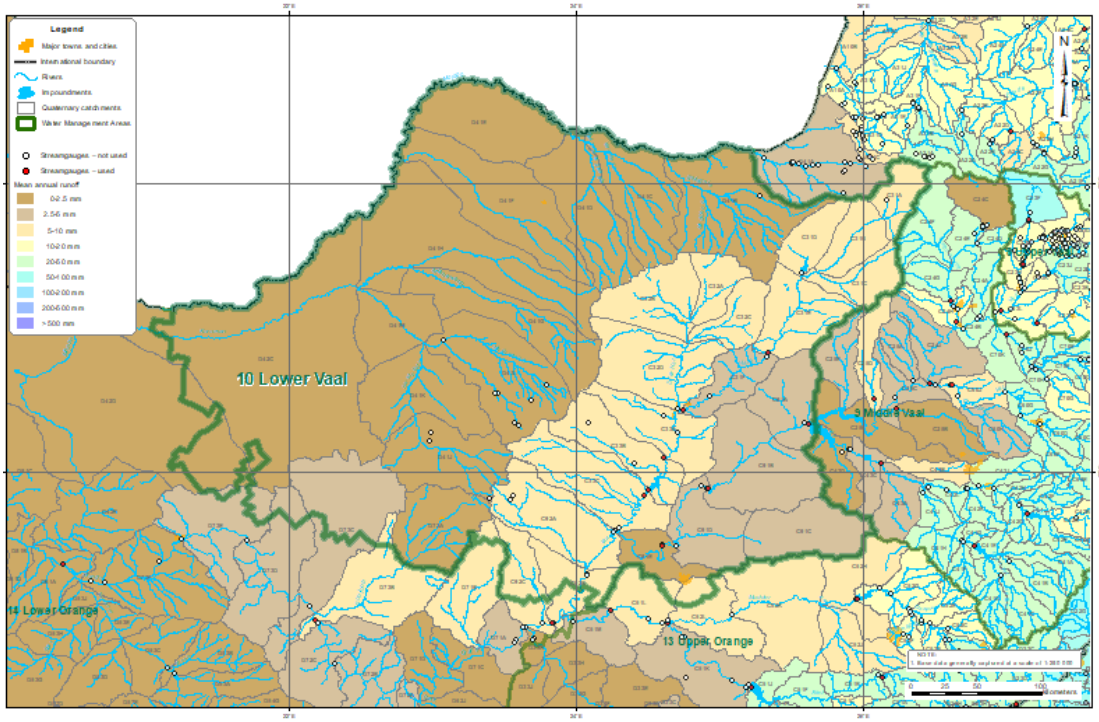
Date: April 2008



Water Research Commission

Figure 3 : Runoff **Water Resources of South Africa 2005**

Date: April 2008



Water Research Commission

Figure 3.10 : Runoff : Lower Vaal WMA **Water Resources of South Africa 2005**

Infiltration

Under normal conditions or undisturbed land, the rate of infiltration is average 80%. The type of development or land modification has an impact on the rate of infiltration and therefore the amount of storm water generated.

The infiltration of storm water will not be significantly impacted by the operations. Open pits or excavations will contain insignificant volumes of the storm water which could not be diverted around active working areas. This water will be allowed to infiltrate.

The contribution of elevated runoff water volumes is also insignificant, unlike paved areas like in township areas that will increase the amount of storm water significantly. During rehabilitation of voids where mining is completed the applicant aims to create a surface which is not level in order to decrease the velocity of runoff allowing more water to infiltrate. After backfilling of the voids the pores between particles will be larger than that of virgin soil which will further promote infiltration.

Runoff is generated whenever the rain reaches the ground faster than it can infiltrate and the energy of the runoff water is a direct function of its potential to cause erosion.

Topography

The topography of the entire site is low with few steep slopes and is classified as a plain that slopes towards the Vaal River in the west. However, over the entire mining right area there are several low-lying hills where there are some slopes with a steeper gradient. The area is located between 1130 and 1011 m above sea level. The area was used for game farming which did not alter the topography. However, recent mining activities have had an impact on the topography of the areas where mining activities took place.

There are numerous waterways at Rooipoort which drains into the Vaal River. Closer to the river in the flood plain area, drainage features have developed where storm water is collected and discharges along defined waterways into the Vaal River. Due to the low rainfall, these waterways are mainly seasonal.

Evapotranspiration

Evapotranspiration is the process whereby water is extracted from the soil by plants and respires as vapour through their leaves. The evapotranspiration is estimated to be 0.1 mm/day in the winter to 3 mm/day in summer. Although large areas will be disturbed during mining the impact of evapotranspiration will be negligible. This will also be ameliorated by the concurrent re-vegetation of rehabilitated open pits that are backfilled as mining progresses.

Recharge

Recharge is the vertical movement of surface water through the unsaturated zone to reach the ground water horizon. The rate of recharge is estimated to be 3 % of the Mean Annual Rainfall **(MAR).**

The rate of recharge and the MAR of the area are very low which reduces the potential of ground water pollution significantly. The risk of surface- or ground water contamination is further reduced because of the nature of the operation and the inert characteristics of material that is mined.

Stream flow

There are a number of non-perennial drainage lines and pans in the mine area outside the flood plain that can flood their banks to cover large areas. Storm water occurs as sheet flow that converges in more definable water-ways closer to the Vaal River.

Groundwater flow

The combination of a relative deep ground water table, geology and low relief make the area not conducive for the formation of any fountains or the recharge of surface water features from ground water.

SURFACE AND GROUNDWATER MONITORING

Identification of 'dirty areas'

There are some areas located at the Rooipoort mining operations which may have an impact on surface and groundwater quality. These are the following:

- **Potentially hazardous substance storage areas**

These areas include the areas used for the storage of diesel, oil and other potentially hazardous substances which may have an impact on groundwater in the event of major spillages.

Although the potential for groundwater contamination occurring as a result of the above is very unlikely, the necessary precautionary measures are still implemented to further reduce the risk. This includes the storage of all potentially hazardous substances inside bunded areas which can contain 110% of the volume of the substance. Any spills from these areas are cleaned up and contaminated soil disposed of according to best practice.

- **Hazardous waste storage areas**

Hazardous waste storage areas include the areas where contaminated soil, contaminated rags, old oil, oil filters, etc. are disposed of and/or stored for future disposal. Please note that all hazardous waste is disposed of by contractors.

Contaminated soil which was caused by leaking vehicles, drums, spills, etc. is cleaned up by removing the spill with the contaminated soil and disposing thereof in a skip dedicated for this. This skip is removed from site when full by the licensed contractor (i.e. EnviroServ).

Other hazardous waste which includes old oil drained during servicing of machinery and vehicles and oil filters are stored inside tanks which are located inside bunded areas. The oil and filters are removed from site by a contractor (i.e. Eden Oils) to be recycled.

- **Toilet facilities**

The site makes use of chemical toilets which are serviced by an independent contractor. A septic tank was installed at the site office. The capacity of this system shall always be monitored to prevent contamination.

- **Workshop and/or vehicle repair areas**

Any spillages occurring at the workshop or during emergency repairs on site will be cleaned as indicated under *hazardous waste storage areas* by removing the spill and contaminated soil and storing of it in a skip for removal by the contractor. Any spills will be cleaned immediately.

- **Process Water Dam (PWD)**

The PWD contains water abstracted from the Vaal River and water recovered from the Firs Cut. This includes water from the process plant and is therefore regarded as water which contains waste.

Although the water is considered to contain waste, it should be noted that no chemicals are added to the process and water is therefore clean. The likelihood of the water contaminating groundwater is insignificant. The PWD is also lined with plastic liner reducing the chance of water infiltrating.

- **First Cut**

The First Cut consists of the first excavation in the mining area. The cut was separated by oversized material into two ponds. The first pond is the area where fine material suspended in water is discharged to from the plant. In this first pond the fine material will settle, and clean water will flow through the oversized material to the second dam from where it is pumped to the PWD to be reused in the process plant and for dust suppression.

It is important to mention again that diamond mining from gravel is a category 3 mining activity where the activity will not produce any acid mine drainage and no chemical substances are added to the process. Therefore, the likelihood of contamination of groundwater is very low. However, the water recovered from the First Cut and water from the boreholes in the area is sampled and analysed bySMT Labs in Bloemfontein. The results of the last analysis are included in this report below below.

- **Voids and operational mining areas**

Operational mining areas are considered to be "dirty areas" as there are activities undertaken in these areas which may lead to contamination of surface and groundwater. The impacts may occur from the spillage of petrochemical and other hazardous substances from vehicles and the mobilisation of fine material which may cause siltation of watercourses during and after rain events.

Method and frequency of sampling

All water resources as indicated in the results below is and will be monitored quarterly to determine if there is any pollution at the sources. Samples will be taken of all sources and submitted to SMT labs in Bloemfontein and Aquatico in Pretoria for analysis. These results will be communicated to the applicant and sent to the Department of Water and Sanitation.

In the event that the operation relocates to another part of the mining right area and the currently mined area is rehabilitated, new sampling points will be established. A new / updated monitoring programme will be submitted to the DWS indicating all the new points

Indication of sample points:

Vaal Up: Sample taken in the Vaal River upstream of the operation.

SD: Recovered water in the First Cut

Vaal Down: Sample taken in the Vaal River downstream of the operation.

Compound: Employees residents located outside the mining area

LQ BH: Borehole located at the supervisors living courters outside the mining area,

Office BH: This is the borehole at the site offices. Water is used for domestic purposes.

(Refer to the map indicating all the monitoring points).

It should be noted that in the event that the new WULA is authorised and the mining activities inside watercourses commences the Surface and Groundwater Monitoring Programme will be updated to include the sampling of surface water inside these watercourses. Sampling will be conducted monthly to include samples taken up- and downstream of the entire mining right area. This is the northern boundary in the Vaal River at the Vaalbos National Park boundary and the N8 / Vaal River bridge at the southern boundary. Furthermore, samples will also be taken up- and downstream of every diversion channel to include analysis for turbidity and suspended solids.

Table 1: Bacterial report for Vaal Up

TEST REPORT

Report number: SMT18/000937

SMT LABS
4 Anjou street
Bayswater
Bloemfontein
9301

T0678

	Sample
Laboratory number:	TU1804-1.4
Sample type:	Water sample
Client sample reference:	V Up
Commencement date of test:	2018-09-20
Completion date of test:	2018-09-27
Condition of sample:	Acceptable

Test Method Used	Analysis	Units	Results	Limits	UOM	Statement of conformity
SMT-TM-01	Total plate count	Cfu/ml	970		3.5%	
SMT-TM-02	E.coli Count	Cfu/100ml	>150		3.2%	
SMT-TM-02	Coliforms Count	Cfu/100ml	>150		3.2%	

NOTES:
Cfu: Colony Forming Units ND: Not Detected
ND defined as <10 Cfu/g/ml (Food)
or <1Cfu/area (Swabs and Air plates) or
<1 Cfu/ml/100ml (Water)
NA: Not applicable UOM: Uncertainty of Measurement

These results relate only to the items tested and to the sample as received from the client.
This report shall not be reproduced, except in full, without the approval of the laboratory.
* Not SANAS Accredited tests and not included in the SANAS schedule of accreditation.
** Subcontracted test not included in the SANAS schedule of accreditation of this laboratory.
(I) Results could be influenced as a result of deviation noted under "Unacceptable" "Condition of sample".
Results lies within measurement uncertainty of this laboratory.
Decision on Statement of Conformity lies within the responsibility of the customer.

Table 2: Bacterial report for First Cut recovered water:

TEST REPORT

Report number: SMT18/000937

SMT LABS
4 Anjou street
Bayswater
Bloemfontein
9301

T0678

	Sample
Laboratory number:	TU1804-1.3
Sample type:	Water sample
Client sample reference:	Sumes
Commencement date of test:	2018-09-20
Completion date of test:	2018-09-27
Condition of sample:	Acceptable

Test Method Used	Analysis	Units	Results	Limits	UOM	Statement of conformity
SMT-TM-01	Total plate count	Cfu/ml	2 920		3.5%	
SMT-TM-02	E.coli Count	Cfu/100ml	26		3.2%	
SMT-TM-02	Coliforms Count	Cfu/100ml	>150		3.2%	

NOTES:
Cfu: Colony Forming Units ND: Not Detected
ND defined as <10 Cfu/g/ml (Food)
or <1Cfu/area (Swabs and Air plates) or
<1 Cfu/ml/100ml (Water)
NA: Not applicable UOM: Uncertainty of Measurement

These results relate only to the items tested and to the sample as received from the client.

* Not SANAS Accredited tests and not included in the SANAS schedule of accreditation.
** Subcontracted test not included in the SANAS schedule of accreditation of this laboratory.
(!) Results could be influenced as a result of deviation noted under "Unacceptable" "Condition of sample".
Results lies within measurement uncertainty of this laboratory.
Decision on Statement of Conformity lies within the responsibility of the customer.

Table 3: Bacterial report Office BH:

TEST REPORT

Report number: SMT18/000937

SMT LABS
4 Anjou street
Bayswater
Bloemfontein
9301

T0678

	Sample
Laboratory number:	TU1804-1.2
Sample type:	Water sample
Client sample reference:	Office
Commencement date of test:	2018-09-20
Completion date of test:	2018-09-27
Condition of sample:	Acceptable

Test Method Used	Analysis	Units	Results	Limits	UOM	Statement of conformity
SMT-TM-01	Total plate count	Cfu/ml	170		3.5%	
SMT-TM-02	E.coli Count	Cfu/100ml	>150		3.2%	
SMT-TM-02	Coliforms Count	Cfu/100ml	>150		3.2%	

NOTES:
Cfu: Colony Forming Units ND: Not Detected
ND defined as <10 Cfu/g/ml (Food)
or <1Cfu/area (Swabs and Air plates) or
<1 Cfu/ml/100ml (Water)
NA: Not applicable UOM: Uncertainty of Measurement

These results relate only to the items tested and to the sample as received from the client.
This report shall not be reproduced, except in full, without the approval of the laboratory.
* Not SANAS Accredited tests and not included in the SANAS schedule of accreditation.
** Subcontracted test not included in the SANAS schedule of accreditation of this laboratory.
(!) Results could be influenced as a result of deviation noted under "Unacceptable" "Condition of sample".
Results lies within measurement uncertainty of this laboratory.
Decision on Statement of Conformity lies within the responsibility of the customer.

Table 4: Bacterial report Vaal downstream:

TEST REPORT

Report number: SMT18/000937

SMT LABS
4 Anjou street
Bayswater
Bloemfontein
9301

T0678

	Sample
Laboratory number:	TU1804-1.6
Sample type:	Water sample
Client sample reference:	V Down
Commencement date of test:	2018-09-20
Completion date of test:	2018-09-27
Condition of sample:	Acceptable

Test Method Used	Analysis	Units	Results	Limits	UOM	Statement of conformity
SMT-TM-01	Total plate count	Cfu/ml	5 900		3.5%	
SMT-TM-02	E.coli Count	Cfu/100ml	25		3.2%	
SMT-TM-02	Coliforms Count	Cfu/100ml	>150		3.2%	

Comment:

Approved signatory:

Shirleen Theisinger	Managing Director	Theisinger
Name in full	Designation	Signature

NOTES:
Cfu: Colony Forming Units ND: Not Detected
ND defined as <10 Cfu/g/ml (Food)
or <1Cfu/area (Swabs and Air plates) or
<1 Cfu/ml/100ml (Water)
NA: Not applicable UOM: Uncertainty of Measurement

These results relate only to the items tested and to the sample as received from the client.
This report shall not be reproduced, except in full, without the approval of the laboratory.
* Not SANAS Accredited tests and not included in the SANAS schedule of accreditation.
** Subcontracted test not included in the SANAS schedule of accreditation of this laboratory.
(I) Results could be influenced as a result of deviation noted under "Unacceptable" "Condition of sample".
Results lies within measurement uncertainty of this laboratory.
Decision on Statement of Conformity lies within the responsibility of the customer.

--End of Document--

Table 5: Bacterial report LQ BH:

TEST REPORT

Report number: SMT18/000937

SMT LABS
4 Anjou street
Bayswater
Bloemfontein
9301

T0678

	Sample
Laboratory number:	TU1804-1.5
Sample type:	Water sample
Client sample reference:	LQ
Commencement date of test:	2018-09-20
Completion date of test:	2018-09-27
Condition of sample:	Acceptable

Test Method Used	Analysis	Units	Results	Limits	UOM	Statement of conformity
SMT-TM-01	Total plate count	Cfu/ml	ND		3.5%	
SMT-TM-02	E.coli Count	Cfu/100ml	ND		3.2%	
SMT-TM-02	Coliforms Count	Cfu/100ml	52		3.2%	

NOTES:
Cfu: Colony Forming Units ND: Not Detected
ND defined as <10 Cfu/g/ml (Food)
or <1Cfu/area (Swabs and Air plates) or
<1 Cfu/ml/100ml (Water)
NA: Not applicable UOM: Uncertainty of Measurement

These results relate only to the items tested and to the sample as received from the client.
This report shall not be reproduced, except in full, without the approval of the laboratory.
* Not SANAS Accredited tests and not included in the SANAS schedule of accreditation.
** Subcontracted test not included in the SANAS schedule of accreditation of this laboratory.
(!) Results could be influenced as a result of deviation noted under "Unacceptable" "Condition of sample".
Results lies within measurement uncertainty of this laboratory.
Decision on Statement of Conformity lies within the responsibility of the customer.

Table 7: Water test results:

aquatico Laboratories (Pty). Ltd.

ilac-MRA sanas Testing Laboratory T0685

Test Report Page 1 of 4

Client: Turn 180 Environmental Consultants Pty Ltd
Address: 8 Conde Street, Bayswater, Bloemfontein, 9324
Report no: 57646
Project: Turn 180 Environmental Consultants Pty Ltd

Date of certificate: 02 October 2018
Date accepted: 25 September 2018
Date completed: 02 October 2018
Revision: 0

Lab no:					56766	56767	56768	56769	56770
Date sampled:					20-Sep-2018	20-Sep-2018	20-Sep-2018	20-Sep-2018	20-Sep-2018
Sample type:					Water	Water	Water	Water	Water
Locality description:			**Uncertainty of measurement %**	**SANS 241-1:2015**	V Down - Vaalrivier D/S	V Up - Vaalrivier U/S	Office - Borehole U/S	BV - Borehole	LQ - Borehole
	Analyses	**Unit**	**Method**						
A	pH @ 25°C	pH	ALM 20	4.23	5 - 9.7	8.63	8.55	8.14	7.82	8.04
A	Electrical conductivity (EC) @ 25°C	mS/m	ALM 20	9.52	< 170	78.3	78.8	88.0	108	127
A	Total dissolved solids (TDS)	mg/l	ALM 26		< 1200	463	465	606	684	832
A	Total alkalinity	mg CaCO3/l	ALM 01	10.41		116	129	463	411	449
A	Chloride (Cl)	mg/l	ALM 02	11.39	< 300	68.2	66.5	22.1	94.9	124
A	Sulphate (SO_4)	mg/l	ALM 03	9.39	< 500	166	161	56.6	74.6	118
A	Nitrate (NO_3) as N	mg/l	ALM 06	9.85	< 11	<0.194	<0.194	2.33	1.60	2.20
A	Nitrite (NO_2) as N	mg/l	ALM 07	7.15	< 0.9	0.145	0.145	0.145	0.066	0.070
A	Orthophosphate (PO_4) as P	mg/l	ALM 04	6.42		<0.005	<0.005	<0.005	<0.005	<0.005
A	Fluoride (F)	mg/l	ALM 08	10.11	< 1.5	0.727	0.369	0.523	0.374	0.795
A	Calcium (Ca)	mg/l	ALM 30	8.78		45.3	49.9	94.2	89.4	98.5
A	Magnesium (Mg)	mg/l	ALM 30	7.54		35.5	34.1	52.7	49.1	62.9
A	Sodium (Na)	mg/l	ALM 30	7.96	< 200	65.3	62.2	51.1	83.6	110
A	Potassium (K)	mg/l	ALM 30	12.05		11.4	10.8	0.914	1.35	3.86
A	Aluminium (Al)	mg/l	ALM 31	8.59	< 0.3	<0.002	<0.002	<0.002	<0.002	<0.002
A	Chromium (Cr)	mg/l	ALM 31	7.61	< 0.05	<0.003	<0.003	<0.003	<0.003	<0.003
A	Copper (Cu)	mg/l	ALM 31	4.55	< 2	0.003	0.002	0.019	<0.002	0.003
A	Zinc (Zn)	mg/l	ALM 31	9.31	< 5	<0.002	<0.002	0.011	<0.002	<0.002
A	Cobalt (Co)	mg/l	ALM 31	7.94		<0.003	<0.003	<0.003	<0.003	<0.003
A	Cadmium (Cd)	mg/l	ALM 31	7.89	< 0.003	<0.002	<0.002	<0.002	<0.002	<0.002
A	Lead (Pb)	mg/l	ALM 31	8.85	< 0.01	<0.004	<0.004	<0.004	<0.004	<0.004
A	Total hardness	mg CaCO3/l	ALM 26			259	265	452	425	505
A	Calcium hardness	mg CaCO3/l	ALM 26			113	125	235	223	246
A	Magnesium hardness	mg CaCO3/l	ALM 26			146	140	217	202	259
A	Chemical oxygen demand (COD)	mg/l	ALM 10	19.13		64.2	119	73.2	49.9	59.3
A	Total suspended solids (TSS)	mg/l	ALM 25	5.69		22	6.0	<4.5	<4.5	5.0
N	Dissolved oxygen (DO)	mg/l	ALM 28			2.78	2.81	2.62	2.32	2.45
A	Arsenic (As)	mg/l	ALM 34	10.93	< 0.01	<0.006	<0.006	<0.006	<0.006	<0.006
A	Selenium (Se)	mg/l	ALM 34	11.42	< 0.04	<0.002	<0.002	<0.002	<0.002	0.002

A = Accredited N = Non accredited O = Outsourced S = Sub-contracted NR = Not requested RTF = Results to follow NATD = Not able to determine ATR = Alternative test report ; The results relates only to the test item tested.
Results reported against the limit of detection.
Results marked 'Not SANAS Accredited' in this report are not included in the SANAS Schedule of Accreditation for this laboratory.
Uncertainty of measurement available on request for all methods included in the SANAS Schedule of Accreditation.

M. Swanepoel
Technical Signatory

Client: Turn 180 Environmental Consultants Pty Ltd
Address: 8 Conde Street, Bayswater, Bloemfontein, 9324
Report no: 57646
Project: Turn 180 Environmental Consultants Pty Ltd

Date of certificate: 02 October 2018
Date accepted: 25 September 2018
Date completed: 02 October 2018
Revision: 0

Lab no:						56766	56767	56768	56769	56770
Date sampled:						20-Sep-2018	20-Sep-2018	20-Sep-2018	20-Sep-2018	20-Sep-2018
Sample type:						Water	Water	Water	Water	Water
Locality description:				**Uncertainty of measure-ment %**	**SANS 241-1:2015**	V Down - Vaalrivier D/S	V Up - Vaalrivier U/S	Office - Borehole U/S	BV - Borehole	LQ - Borehole
	Analyses	**Unit**	**Method**							
A	Boron (B)	mg/l	ALM 33	8.93	< 2.4	0.083	0.078	0.104	0.208	0.286
A	Barium (Ba)	mg/l	ALM 33	6.13	< 0.7	0.100	0.105	0.094	0.135	0.013
A	Molybdenum (Mo)	mg/l	ALM 33	12.85		<0.004	0.004	<0.004	0.004	0.009
A	Vanadium (V)	mg/l	ALM 33	8.62		0.001	0.001	0.012	0.001	<0.001
N	Bromide (Br)	mg/l	ALM 70			<0.010	0.410	0.600	1.56	1.83
N	Acidity	mg CaCO3/l	ALM 60			<0.001	<0.001	<0.001	35.9	<0.001
N	Redox Potential	mV	ALM 69			102	130	177	172	173

A = Accredited N = Non accredited O = Outsourced S = Sub-contracted NR = Not requested RTF = Results to follow NATD = Not able to determine ATR = Alternative test report ; The results relates only to the test item tested.
Results reported against the limit of detection.
Results marked 'Not SANAS Accredited' in this report are not included in the SANAS Schedule of Accreditation for this laboratory.
Uncertainty of measurement available on request for all methods included in the SANAS Schedule of Accreditation.

Authenticated signature on first page

Client: Turn 180 Environmental Consultants Pty Ltd
Address: 8 Conde Street, Bayswater, Bloemfontein, 9324
Report no: 57646
Project: Turn 180 Environmental Consultants Pty Ltd

Date of certificate: 02 October 2018
Date accepted: 25 September 2018
Date completed: 02 October 2018
Revision: 0

			Uncertainty of measure-ment %	SANS 241-1:2015	
Lab no:					56771
Date sampled:					20-Sep-2018
Sample type:					Water
Locality description:					Slimes - Slimesdam
	Analyses	**Unit**	**Method**		
A	pH @ 25°C	pH	ALM 20	4.23	5 - 9.7	8.46
A	Electrical conductivity (EC) @ 25°C	mS/m	ALM 20	9.52	< 170	107
A	Total dissolved solids (TDS)	mg/l	ALM 26		< 1200	633
A	Total alkalinity	mg CaCO3/l	ALM 01	10.41		147
A	Chloride (Cl)	mg/l	ALM 02	11.39	< 300	123
A	Sulphate (SO_4)	mg/l	ALM 03	9.39	< 500	195
A	Nitrate (NO_3) as N	mg/l	ALM 06	9.85	< 11	0.196
A	Nitrite (NO_2) as N	mg/l	ALM 07	7.15	< 0.9	0.068
A	Orthophosphate (PO_4) as P	mg/l	ALM 04	6.42		<0.005
A	Fluoride (F)	mg/l	ALM 08	10.11	< 1.5	0.904
A	Calcium (Ca)	mg/l	ALM 30	8.78		35.1
A	Magnesium (Mg)	mg/l	ALM 30	7.54		38.3
A	Sodium (Na)	mg/l	ALM 30	7.96	< 200	125
A	Potassium (K)	mg/l	ALM 30	12.05		1.51
A	Aluminium (Al)	mg/l	ALM 31	8.59	< 0.3	<0.002
A	Chromium (Cr)	mg/l	ALM 31	7.61	< 0.05	<0.003
A	Copper (Cu)	mg/l	ALM 31	4.55	< 2	<0.002
A	Zinc (Zn)	mg/l	ALM 31	9.31	< 5	<0.002
A	Cobalt (Co)	mg/l	ALM 31	7.94		<0.003
A	Cadmium (Cd)	mg/l	ALM 31	7.89	< 0.003	<0.002
A	Lead (Pb)	mg/l	ALM 31	8.85	< 0.01	<0.004
A	Total hardness	mg CaCO3/l	ALM 26			245
A	Calcium hardness	mg CaCO3/l	ALM 26			88
A	Magnesium hardness	mg CaCO3/l	ALM 26			158
A	Chemical oxygen demand (COD)	mg/l	ALM 10	19.13		70.1
A	Total suspended solids (TSS)	mg/l	ALM 25	5.69		27
N	Dissolved oxygen (DO)	mg/l	ALM 28			2.69
A	Arsenic (As)	mg/l	ALM 34	10.93	< 0.01	<0.006
A	Selenium (Se)	mg/l	ALM 34	11.42	< 0.04	<0.002

A = Accredited N = Non accredited O = Outsourced S = Sub-contracted NR = Not requested RTF = Results to follow NATD = Not able to determine ATR = Alternative test report ; The results relates only to the test item tested.
Results reported against the limit of detection.
Results marked 'Not SANAS Accredited' in this report are not included in the SANAS Schedule of Accreditation for this laboratory.
Uncertainty of measurement available on request for all methods included in the SANAS Schedule of Accreditation.

Authenticated signature on first page

Client: Turn 180 Environmental Consultants Pty Ltd
Address: 8 Conde Street, Bayswater, Bloemfontein, 9324
Report no: 57646
Project: Turn 180 Environmental Consultants Pty Ltd

Date of certificate: 02 October 2018
Date accepted: 25 September 2018
Date completed: 02 October 2018
Revision: 0

Lab no:				Uncertainty of measure-ment %	SANS 241-1:2015	56771
Date sampled:						20-Sep-2018
Sample type:						Water
Locality description:						Slimes - Slimesdam
	Analyses	**Unit**	**Method**			
A	Boron (B)	mg/l	ALM 33	8.93	< 2.4	0.133
A	Barium (Ba)	mg/l	ALM 33	6.13	< 0.7	0.020
A	Molybdenum (Mo)	mg/l	ALM 33	12.85		0.012
A	Vanadium (V)	mg/l	ALM 33	8.62		0.025
N	Bromide (Br)	mg/l	ALM 70			0.640
N	Acidity	mg CaCO3/l	ALM 60			<0.001
N	Redox Potential	mV	ALM 69			156

A = Accredited N = Non accredited O = Outsourced S = Sub-contracted NR = Not requested RTF = Results to follow NATD = Not able to determine ATR = Alternative test report ; The results relates only to the test item tested.
Results reported against the limit of detection.
Results marked 'Not SANAS Accredited' in this report are not included in the SANAS Schedule of Accreditation for this laboratory.
Uncertainty of measurement available on request for all methods included in the SANAS Schedule of Accreditation.

Authenticated signature on first page

Loc

ation of sample points

Table 3 indicates the location of all the sampling points used during the monitoring of both surface and groundwater monitoring.

Table 3: Geographic location of sampling points

Point	Latitude	Longitude
Compound borehole	28° 42.072'	24° 5.605'
Living Courters Borehole	28° 42.215'	24° 4.829
Site office borehole	28° 38.857'	24° 5.399'
Upstream sample point	28° 37.054'	24° 6.299'
Downstream sample point	28° 42.222'	24° 4.498'
First Cut	28° 37.627'	24° 5.790'

Figure 1: Map indicating the location of the sampling points