mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Environmental Consolidation and Amendment of the Environmental Management Programme for Thubelisha, Trichardtsfontein and Vaalkop Operations

SUBMITTED FOR ENVIRONMENTAL AUTHORISATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 2008) (NEMA) AND THE NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008 (ACT NO. 59 OF 2008) (NEM:WA) IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT NO. 28 of 2008) AS AMENDED (MPRDA).

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File Reference Number SAMRAD:	MP30/5/1/2/2/138MR (Referance number obtained from the Sasol Mining Right)

This document has been prepared by Digby Wells Environmental.

Report Type:	**EIA and EMP Report**
Project Name:	**Environmental Consolidation and Amendment of the Environmental Management Programme for Thubelisha, Trichardtsfontein and Vaalkop Operations**
Project Code:	**SAS3869**

Name	Responsibility	Signature	Date
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Barbara Wessels	Report Reviewer	BWessels	October 2017
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IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014 (as amended), any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner (EAP) must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative process: -

- determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- determine the: -
  - nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
  - degree to which these impacts: -
    - can be reversed;
    - may cause irreplaceable loss of resources, and
    - can be avoided, managed or mitigated.
- identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- identify suitable measures to manage, avoid or mitigate identified impacts; and
- identify residual risks that need to be managed and monitored.

EXECUTIVE SUMMARY

Introduction

Sasol Mining (Pty) Ltd (Sasol Mining) holds mining rights for the Twistdraai Colliery: Thubelisha Shaft (TCTS) (Ref: MP30/5/1/2/2/138MR) and the Vaalkop mining area (Ref MP30/5/1/2/2/128MR), which was incorporated into the regional Sasol Mining Right. It must be noted that no EMPr was compile for the Vaalkop mining right area even though a mining right was approved. Further to this, the mining right for the Trichardtsfontein Mine (Ref: MP30/5/1/2/2/10056MR) was ceded from Glencore Operations South Africa (Pty) Ltd in accordance with Section 11 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) to Sasol Mining.

It is therefore required that the Environmental Management Programme Reports (EMPrs) for the above mentioned mining right areas be compiled (Vaalkop), consolidated and updated to reflect changes in the mining plans and methodologies and consider additional infrastructure requirements.

The mining method which is currently being undertaken at TCTS includes bord and pillar mining method as well as high extraction mining in some areas. This mining method has also been proposed for Vaalkop. However, the mining method proposed for the extraction of coal at Trichardtsfontein only included the conventional bord-and-pillar method.

Twistdraai Thubelisha is now proposing that in addition to the bord-and-pillar mining method, high extraction mining will be undertaken at the Trichardtsfontein Mine. Since this activity was excluded from the previous approved EMPr (2014), an amendment of the Trichardtsfontein EMPr is required to identify and assess the impacts associated with high extraction mining, particularly relating to surface subsidence.

Additionally it is proposed that Twistdraai Thubelisha will construct two ventilation shafts at TCTS (known as East ventilation shaft) and two ventilation shafts on Trichardtsfontein (known as South ventilation shaft). A Listed activity under listing notice 1 is considered to be triggered in accordance with the new Environmental Impact Assessment (EIA) Regulations, 2014 (As amended) promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) for the construction and operation of the ventilation shafts.

Digby Wells is therefore proposing a submission in terms of the provisions of Section 102 of the MPRDA and Regulation 31 of the EIA regulations, 2014 (as amended) promulgated in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) to obtain the required authorisation for both the amendment and consolidation process of the EMPrs (referred to in general as the Environmental Authorisation (EA) Amendment process). A basic assessment process will also be undertaken to obtain environmental authorisation for the construction and operation of the ventilation shafts. This will be undertaken as a consolidated process in accordance with the One Environmental System.

Project Applicant

The particulars for the consolidation project are detailed in the table below.

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Project Overview

The consolidation project area owned by Sasol Mining Twistdraai Thubelisha Colliery comprises three Mining Right areas namely TCTS, Trichardtsfontein and Vaalkop. Twistdraai Thubelisha Colliery is currently mining TCTS and proposes to start mining Trichardtsfontein within the next few months. Vaalkop mining area, although a priority to Twistdraai Thubelisha Colliery will only start mining in 2029.

The Trichardtsfontein project area is 3 170 ha in size, but only an area of approximately 1 382 ha will be undermined. The coal seam depth at Trichardtsfontein is estimated to be at an approximate depth of 200 m below surface. The Vaalkop project area is approximately 8 600 ha in extent, but only limited areas will be mined by high extraction method while the rest of the area will be mined by bord-and-pillar mining method. It is estimated that the coal seam depth at Vaalkop is approximately 160 – 200 m below surface. The TCTS project area is 7 200 ha in size. The coal seam depth at TCTS is estimated to be at a depth of 160–180 m below the surface and the seam is approximately 2 – 5 m thick. In all mining right areas will only mine the No 4 seam as it is the only seam of coal that is economically viable. Due to the variation in depth of mining and coal seam an assumption has been made that mining will be undertaken between 30 m and 215 m. Therefore all impact assessments and specialist studies have assessed the impacts of mining utilising bord and pillar with high extraction at this depth.

Need and Desirability of the Project

Sasol Mining has for many years provided coal to its petrochemical operations which is then sold to both the domestic and international markets as well as for export purposes. TCTS has been operating as an underground coal mine since 2010, it is proposed that Trichardtsfontein will begin mining once authorisation has been granted to include the high extraction method of mining as well as the construction and operation of the ventilation shafts. Additional coal will be extracted from the Vaalkop operation once mining commences in 2029.

Sasol's annual contribution to the South African GDP amounts to approximately R 40 billion of which R 22 billion is a direct contribution. Sasol produces approximately 34% of the countries liquid fuel requirements and as least 20% of the countries saleable coal.

Sasol Mining supplies coal to Sasol Synfuels Operation (SSO) who process the coal to produce petrol, diesel, chemicals and chemical by-products. Additionally, a certain amount of coal is exported to European and Asian markets.

Sasol Mining contributes substantially to the creation of employment and development of various social initiatives to assist and provide opportunities to Historically Disadvantaged South Africans (HDSA)s. It is not predicted that any new job opportunities will be created from the various mines however the mine will have a cumulative impact on the social environment as various mines within Mpumalanga are proposed to reach Life of Mine within the next five years. Through the acquisition of the various reserves and commencement of the mining operation it would be possible to extend the life of the Secunda Synfuels Plant to 2050 as well as to continue supplying coal for export, thus ensuring Job security of the employees at the TCTS operation as well as continued supply of coal for the production of transportation fuels and chemicals.

It is envisaged that the consolidation project will result in a negative impact on the physical environment and positive on the social environment as mining continues to develop from TCTS to Trichardtsfontein and Vaalkop. It is noted that the mining rights for all mining areas have previously been granted and therefore these impacts would have been anticipated and considered.

The consolidation project however proposes the change of mining method from bord and pillar to bord and pillar with high extraction mining method and therefore it is envisaged that even though the current environmental state has already been altered by mining activities (TCTS) the use of high extraction mining could have a negative impact to the environment due to the resultant subsidence which is anticipated. It should be noted that rock engineering reports and relevant regulations are adhere to in current Sasol mining area The construction of the ventilation shafts is not anticipated to have a significant negative impact on the environment given the localised extend.

Baseline Environment

The information contained in this section which highlights the baseline environment of the consolidation project has been obtained from the various EMPrs, literature reviews, previous specialist studies, desktop research and aerial imagery. As the TCTS, Trichardtsfontein and Vaalkop operations are situated next to each other, the information has been consolidated as opposed to providing baseline information for each operation.

Previous as well as new specialist studies have been completed for the consolidation project. These studies were completed in 2008, 2014 and 2017. The baseline environment has therefore been updated and this information utilised to complete this report. The following specialist studies completed in 2017 have also been undertaken to assess the impacts of the consolidation project with specific focus on the Vaalkop mining right area:

- Air Quality Specialist Study (Appendix E);
- Noise Specialist Study (Appendix F);
- Social Specialist Study (Appendix G);
- Heritage Specialist Study (Appendix H);
- Soils, Land Use and Land Capability Specialist Study (Appendix I);
- Fauna and Flora Specialist Study (Appendix J);
- Wetlands Specialist Study (Appendix K);
- Surface Water Specialist Study (Appendix L);
- Aquatic Ecology Specialist Study (Appendix M);
- Groundwater Specialist Study (Appendix N); and
- Rehabilitation and Closure (Appendix O).

The baseline environment is presented in Section 10 (Part A). Various environmental monitoring plans are included in Section 8 (Part B) of this report and should be implemented to measure compliance, determine if mitigation measures are effective and determine trends over the life of the consolidation project.

A summary has been provided in Table A.

Table A: Specialist Baseline Summary

Aspect	Baseline Summary
Air Quality	The consolidation project site is situated within a region that is characterised by coal mining activities and cultivation which includes maize cropping and grazing. Emissions generated from mining activities are often associated with fugitive dust emissions, such as: PM_{10}, $PM_{2.5}$ and dust fallout and gaseous emissions such as SO_2, NO_2 and CO are mostly from generator sets. Emissions from this consolidation project are likely to be associated with upcast from the ventilation shafts into the ambient atmosphere. Surface emission sources will be limited to the tipping from the incline shaft via conveyor to a bunker, coal crusher and from the surface stockpile area located on the western side of the bunker. The bunker is enclosed, as such emissions from tipping is considered negligible (as a spray system is present), to further minimise emissions.
Geology	The consolidation project area's coal reserve falls within the north-eastern part of the Highveld Coalfield. The coalfield is underlain by pre-Karoo rocks, mainly Bushveld Complex and Pretoria Group volcanics. Over the years glaciation events resulted in the deposition of tilite (Dwyka Formation) on the basement rocks over most of the area. The stratigraphy of the consolidation project area is comprised of the No. 2, No. 3, No. 4L, No. 4H, No. 5L and the No. 5H Coal Seams, with sandstone and siltstone as inter-burden. Only No. 4 Coal Seam is economically viable to mine in the Trichardtsfontein area. The No. 5, No. 3 and No. 2 Coal Seams are currently considered uneconomical since they are too thin and erratic in distribution.
Soil	The information presented in this section has been sourced from Earth Science Solutions, 2008. The soil types for Trichardtsfontein and TCTS are relatively similar and therefore the soil properties of this area has been grouped and discussed together while the soil at Vaalkop has been discussed separately. **TCTS and Trichardtsfontein** The soils range from good quality agricultural soils with moderate dryland cropping potential and moderate to good irrigation potential, to shallow, poor quality soils those are at best useful as grazing lands. The soil pH ranged between 4.40 and 6.90 (slightly acidic) with a base status ranging from mesotrophic to dystrophic. **Vaalkop** The consolidation project site is dominated by the presence of soils suited to agriculture such as Hutton and Avalon and the remainder of the consolidation project area consists of soils with low agricultural potential and wetland soils.

Aspect	Baseline Summary
Groundwater	Groundwater levels acquired from the hydrocensus vary between 0 and 32 meters below ground level (mbgl), with an average of 5 mbgl. The localised groundwater level depth of 32 mbgl is a result of abstraction for domestic use. With the exclusion of deeper groundwater levels, undisturbed groundwater levels across the site show a strong correlation with topography. All boreholes are within the SANS standards for drinking water with the exception of three boreholes located at Vaalkop with elevated nitrate and sulfate concentrations, three boreholes located at Trichardtsfontein with elevated nitrate and sodium concentrations and five sixteen boreholes located at TCTS with elevated fluorine, magnesium and iron concentrations. The groundwater quality is predominantly identified to be calcium-magnesium-bicarbonate type which is typically encountered in freshly recharged aquifers expected to contain water with relatively short residence time.
Surface Water	Surface water monitoring information was obtained from monitoring undertaken in 2007 and 2011 at TCTS. Digby Wells undertook a site visit March 2017 to collect water samples from the streams within and around the consolidation project area, 11 samples were collected (6 new sites and 5 TCTS existing sites). The TCTS monitoring results indicated that the water quality in the area has been impacted due to existing land uses such as agricultural and mining activities in the area and the interim RWQO for a number of constituents are exceeded. MU1 of the Witbank Dam catchment represents the head waters of the catchment. No further contribution to the deteriorating water quality as a result of activities at TCTS should be allowed. The water quality monitoring results for Trichardtsfontein and Vaalkop indicated that pH levels were high in the soils. The north eastern part of the consolidation project area is predominantly comprised of cultivated land. Most Highveld soils are naturally acidic, and for that reason, farmers mostly add lime to their soils. Runoff from these soils is likely the cause of elevated level of pH. In all the monitoring points, EC exceeded the target water quality range (<40 mS/m) of the SAWQG Irrigation standards. There is no set EC/TDS limit or standard for the Olifants catchment. Also, elevated levels of Chlorides which exceeds the Olifants RWQO (5 ug/l or 0.005 mg/l) were observed in all the monitoring sites. Chloride inputs to surface waters can arise from irrigation return flows, sewage effluent discharges (if it occurs) and discharges various industrial processes (SAWQG). Elevated Ammonia levels exceeding the Olifants RWQO (0.1 mg/l) were observed at monitoring point SASSW03, SASSW04, SASSW05 and R14403W. This may be associated with organic decomposition from mostly animal waste in the streams, since there is no sewage discharge in the affected streams.

Aspect	Baseline Summary
Wetlands	The wetland types that dominate the landscape are floodplain wetlands, channelled valley bottoms and seeps. In addition, there are some depression wetlands within the consolidation project area. The largest wetland present is associated with the Steenkoolspruit that runs through the consolidation project area. The entire consolidation project area is characterised by extensive wetlands, amounting to 6080.1 ha (26 % of consolidation project area). Additionally, these wetlands are identified as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESA) according to the Mpumalanga Biodiversity Sector Plan (2013). The Mine plan indicates that approximately 3406.2 ha of wetlands, most of these highlighted as being at highest risk from mining within the Mining and Biodiversity Guideline Report (2013), and is proposed to be undermined. The majority of the wetlands are PES C (moderately modified), followed by PES D and PES B. The wetlands have been altered from their natural state as the area has been largely transformed by agricultural activities, roads, railway lines, dams etc.
Flora	The consolidation project area falls within the Eastern Highveld Grassland and Soweto Highveld Grassland as described by Mucina and Rutherford (2006) in the Grassland Biome. The majority of the consolidation project site has undergone transformation due to cultivation for maize and the presence of pastures with alien vegetation also present. Livestock were also observed throughout most of the site and evidence of overgrazing was recorded in grassland areas; showing a dominance of increaser species and some erosion. Despite these impacts, areas that were left intact showed a high diversity of grasses and forbs, particularly members of the Asteraceae family and the *Helichrysum genus*. The disturbed grassland areas included former cultivated fields that had been colonised by alien plants and pioneer species. The more natural habitats found in the consolidation project site include riparian habitat, rocky grassland, *Eragrostis* - dominated Grassland and ephemeral pans.
Fauna	An assessment based on actual records indicates the presence of 18 mammalian species that were previously collected from the area, but not necessarily still present in the area. Four of these species are regarded as species of special concern. The wetlands within the project site are an important habitat for common water birds. The agricultural fields of the property harbour a number of typical highveld endemics. These included several widow, weaver and bishop species. The grassland area is also ideal habitat for quail and button-quail species although these species are highly nomadic and were not identified during the site investigation. Three amphibians were encountered during this field survey. Two species of reptile, a rinkhals (*Hemachatus haemachatus*) and Brown house snake (*Lamprophis fuliginosus*) were identified during the field survey. The Montane Dwarf Burrowing Skink (*Scelotes mirus)*, a South African endemic, has also been recorded. Other rare reptiles may be found which include the rare Many-Spotted Snake (*Amplorhinus multimaculatus)*, Berg Adder (*Bitis Atropos)*, Thin-tailed Legless Skink (*Acontias gracilicauda)*, Breyer's Long-tailed Seps (*Tetradactylus breyeri)*, Black-spotted Dwarf Gecko (*Lygodactylus nigropunctatus)* and Spotted Dwarf Gecko (*L. ocellatus)*, as well as Rough-haired Golden Mole (*Chrysospalax*

Aspect	Baseline Summary
	villosus). Five butterfly species were observed within the consolidation project site. Dung beetles (*Scarabeus sp*) were located throughout the property and wherever cattle faeces were evident.
Aquatic	Standard River Ecosystem Monitoring Programme techniques were used to determine the PES of the following river reaches within the B11C and B11D quaternary catchments which were assessed during two seasonal surveys (i.e. high-flow and low-flow conditions):Trichardtspruit; Debeerspruit; Piekespruit; and Steenkoolspruit. It is important to note that a number of unnamed tributaries of the above mentioned reaches were also assessed. For the purpose of the study these tributaries included: Debeerspruit Tributary; Piekespruit Tributary; and Steenkoolspruit Tributary. The PES of the above mentioned river reaches varied. The categorisations for the assessed reaches ranged from largely modified (category D) to moderately modified (category C). This was largely attributed to the existing impacts within the catchment area, comprised mainly of cultivation and livestock as well as other mining operations in the B11D quaternary catchment. These activities were believed to facilitate elevated pH and conductivity values within the assessed systems, which have possibly led to the loss of a number of fish and macroinvertebrate taxa.
Noise	Based on the daytime results from the noise measurements it is noted that the LAeqI levels measured above the SANS guideline for the maximum allowable outdoor daytime rating level for ambient noise in rural districts (45 dBA). The noise levels ranged from 50 dBA to 57 dBA. The night time results also measured above the SANS guideline for the maximum allowable outdoor night time rating level for ambient noise in rural districts (35 dBA). The noise levels ranged from 42 dBA to 53 dBA.
Visual	Overall the consolidation project area is rural. On the western side of the consolidation project area the Sasol Secunda industrial complex of stacks and cooling towers is a significant presence in the distance. Directly adjacent to the consolidation project area is the town of Trichardt. The main public route through the area is the N17, from Kinross to Bethal. The views from this road are primarily of farmlands with a few significant visual intrusions such as the Syferfontein and Thubelisha conveyors and transfer stations on the western side of the property and the Sasol Synfuels Complex mentioned above. The Thubelisha shaft can also be seen from the N17. It is also noted that Eskom power stations and various other open cast mines operate around the area which may be visible for the project area.

Aspect	Baseline Summary
Social	The consolidation project is located within Wards 5, 15 and 25 of the Govan Mbeki local municipality (GMLM). This area made up of Wards 5, 15 and 25 covers approximately 1 700 km^2 and has a total population of roughly 32 400, of which most reside in Ward 25 (39.6%), followed by Ward 15 (31.9%) and Ward 5 (28.5%). On average, close to a third (30.9%) of the consolidation project area's adult population obtained Grade 12. The highest concentration of adults who had no schooling is found in Ward 15 (12.6%). The Wards 5, 15 and 25 consists of approximately 9 000 households at an average occupancy rate of 3.6 persons per household. Of the 9 000 households, approximately 800 were hovels – the largest number of these (approx. 620) were located in Ward 15. Nearly three-quarters of households in this municipality live in formal dwellings. The remainder in the Gert Sibande district municipality (GSDM) is split between traditional (10%) housing and informal dwellings (17%). A number of planned developments are located within the consolidation project area which includes the Terra Nova Township, Trichardtsfontein Extension 8 (however it could not be confirmed by the municipality whether this project is still confirmed), TARU Township and Secunda Extension 8.
Cultural Heritage	The area is underlain by lithologies with palaeontological sensitivity. Additionally, identified tangible heritage resources demonstrate that the consolidation project site under consideration comprise a cultural landscape affiliated with the Later Farming Community (LFC) and historical period. LFC resources identified in previously completed assessments account for 24% (10 records) of the recorded heritage resources within the consolidation project site (van Schalkwyk, 2003b; Karodia & Nel, 2014a). Furthermore, a review of aerial imagery confirmed that previously unrecorded stone walled settlements occur within the site-specific study area. The historical period of the site-specific study area is dominated by burial grounds and graves, and historical built environment resources. These resources account for 44% and 32% respectively of the identified resources recorded in earlier assessments

Approach and Methodology for the Public Participation Process

The Public Participation Process (PPP) was developed to ensure compliance with environmental regulatory requirements and to provide Interested and Affected Parties (I&APs) with an opportunity to evaluate the consolidation project. During this process stakeholders are able to provide inputs and to receive feedback from the environmental specialists and/or proponent. This section provides an overview of the PPP undertaken.

A summary of the PPP activities undertaken during the Amendment Application phase are provided in Table 9-1 of this report. Consultation with I&APs during the Impact Assessment Phase was undertaken as follows:

- Telephonic pre-consultation was held with the various land owners as well as adjacent land owners;

- The Amendment Report / BAR was available at Public Libraries and on the Digby Wells website;
- Project announcement materials were emailed and posted to the stakeholder database – an SMS was also sent to stakeholders;
- An advertisement was placed in a local newspaper;
- Site notices were placed at various public places;
- Key stakeholders were consulted telephonically; and
- A comment and Reponses Report (CRR) will be compiled to incorporate all comments received during the PPP.

The draft EIA/EMP report has been submitted to the public for their input and comments for a period of 30 days. The commenting period is from **Wednesday, 31 January 2018 to Thursday, 1 March 2018**. The draft EIA/EMP has been made available for review at the locations listed below and was also available on the Digby Wells website (www.digbywells.com). Electronic copies (CDs) are available from the Digby Wells Public Participation Office.

Project Alternatives

As part of the 2008 TCTS EIA /EMPr that was completed for the operation of the mine, alternatives were considered for the TCTS mining operation. No alternative for Trichardtsfontein and Vaalkop were considered as no infrastructure besides the ventilation shafts was proposed to be constructed.

The only alternative for this amendment process can be considered for the location of the ventilation shafts. The location of the ventilation shafts is dependent on the underground operation and where additional ventilation is required in the underground workings for health and safety purposes. It is noted that the ventilation shafts have been positioned based on health and safety as well as environmental factors. It can be confirmed that the preferred ventilation shaft location is situated outside the 1:100 floodline however it is located within 500 m buffer of the wetlands and aquatic habitats. Therefore a general authorisation for a water use licence will need to be applied for. The placing of shaft infrastructure is done carefully to avoid impacts on the few wetlands in the area.

Impact Assessment Summary

The EIA/EMP report, the associated specialist studies and the PPP have been undertaken and completed in line with the legislative requirements discussed in Section 6 (Part A) of this report. A quantitative impact rating methodology was applied to determine the significance of the expected impacts pre-mitigation and post-mitigation. Table B and Table C provide a summary of the impacts expected during the operational and decommissioning phases of the consolidation project. The tables contain impacts with a moderate to major significance rating pre mitigation as well as all positive impacts. It is noted that no significant impacts associated with the construction phase of the ventilation shafts have been identified. Section 11 (Part A) of this report lists and assesses the potential impacts, together with the associated mitigation measures. All the potential impacts have been assessed in Appendix D.

Table B: Summary of the Moderate to Major Impacts expected during the Operational Phase

Phase	Activity	Aspect	Impact	Rating	Rating
Operational Phase	Theft during the operation of the mine	Social	Theft of cattle, farming equipment and other valuables within the consolidation project site associated with increased activity from the mine	Moderate (negative) -	Negligible (negative) -
Operational Phase	Maintenance of roads and topsoil stockpiles	Soil, Land Use and Land Capability	Topsoil losses can occur during the operational phase as a result of rainwater runoff and wind erosion from roads and soil stockpiles where steep slopes are present. Compaction of soils during operational phase will occur.	Moderate (negative) -	Negligible (negative) -
Operational Phase	Potential impacts of operational phase on soils, land capability and land use (30 – 100 m below ground level)	Soil, Land Use and Land Capability	Collapsed underground mine roof could potentially cause significant surface subsidence. This may restrict post mining land capability and agricultural productivity. Surface cracking and subsidence could occur due to large areas that could be affected by high extraction.	Major (negative) -	Moderate (negative) -

Phase	Activity	Aspect	Impact	Rating	Rating
Operational Phase	High Extraction Underground Mining	Fauna and Flora	No direct loss of fauna, flora or sensitive ecosystems will occur, except if subsidence occurs. However, undermining of sensitive areas/landscapes leading to changes that will negatively affect the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mine varies from 30 to 215 m.	Major (negative) -	Moderate (negative) -
Operational Phase	Potential Impacts on Wetlands: Underground Mining (30-100 m below ground level)	Wetland	Undermining of wetlands leading to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mining is between 30 – 100 m below ground level.	Major (negative) -	Major (negative) -
Operational Phase	Potential Impacts on Wetlands: Underground Mining (>100 m below ground level)	Wetland	Undermining of wetlands leading to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mining is >100 m below ground level.	Moderate (negative) -	Minor (negative) -
Operational Phase	Operation of the mine	Surface Water	Water contamination leading to deterioration of water quality	Moderate (negative) -	Minor (negative) -

Phase	Activity	Aspect	Impact	Rating	Rating
Operational Phase	Underground mining high to definite risk subsidence areas	Aquatic	Subsidence of land within the river catchment and subsidence of land underneath river channels resulting in poor ecosystem functioning	Major (negative) -	Major (negative) -
Operational Phase	Underground mining low risk subsidence areas	Aquatic	Subsidence of land within the river catchment and subsidence of land underneath river channels resulting in poor ecosystem functioning	Moderate (negative) -	Minor (negative) -
Operational Phase	Underground mining	Geology	With high-extraction mining/ stooping the impact on the geology includes both the excavation of the coal seams as well as the impact on the overlying aquifer above the high-extraction mining/ stooped areas with potential resultant surface subsidence.	Moderate (negative) -	Moderate (negative) -
Operational Phase	Subsidence as a result of high extraction and the impact on groundwater	Groundwater	Groundwater quality deterioration	Moderate (negative) -	Minor (negative) -
Operational Phase	Sustained employment during operation	Social	Job creation during operation	Minor (positive) +	Moderate (positive) +
Operational Phase	Operation of the Mine	Social	Economic Growth will result in a positive contribution to GDP	Minor (positive) +	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Rating
Operational Phase	Operation of the Mine	Social	Community development induced by Local Economic Development (LED) and Corporate Social Investment (CSI)	Minor (positive) +	Moderate (positive) +

Table C: Summary of the Moderate to Major Impacts expected during the Decommissioning and Closure phase

Phase	Activity	Aspect	Impact	Rating	Rating
Decommissioning Phase	Decommissioning of the Mine	Social	Dependency on Mine for sustaining local economy	Moderate (negative) -	Minor (negative) -
Decommissioning Phase	Mine closure and rehabilitation	Wetland	Post-mining decant of groundwater will have negative impacts on the wetlands as this water is likely to be of a poor water quality.	Major (negative) -	Minor (negative) -
Decommissioning Phase	Mine closure and rehabilitation	Surface Water	Decant of mine water leading to deterioration of water quality in the nearby streams	Moderate (negative) -	Negligible (negative) -
Decommissioning Phase	Mine closure and rehabilitation	Aquatic	Decant of severely contaminated water into local aquatic ecosystems	Moderate (negative) -	Minor (negative) -

Phase	Activity	Aspect	Impact	Rating	Rating
Decommissioning Phase	Mine decanting and contamination of surface water bodies *No decant is expected at the shafts however subsidence, sinkholes and unsealed deep boreholes are potential decant locations and monitoring is required*	Groundwater	Decanting of the closed mine	Moderate (negative) -	Negligible (negative)-
Decommissioning Phase	Subsidence as a result of high extraction	Groundwater	Lowering of the water table	Moderate (negative) -	Minor (negative) -

Conclusions and Recommendations

The impacts identified are expected to be confined to site specific impacts and the significance of such impacts is greatly reduced with the implementation of mitigation and management measures. The major concerns originate around possible impacts on surface water, soil, wetlands, aquatic ecology and groundwater quality as a result of possible subsidence which could be experienced during the operational phase as a result of high extraction mining and post closure which may result in decant and contamination of potential water resources.

It must be noted that although the impacts associated with the consolidation project are significant and has and will resulted in damage to the environment (as discussed in the impact assessment Section 11), through the implementation of the mitigation and management measures most of these impacts will be reduced. It should be noted however that the impacts associated with high extraction mining between 30 – 100 metres below ground level have been found to have a significant impact on the environment and no mitigation measures can be proposed to avoid this impact. It is therefore suggested that areas identified to have high to definite risk of subsidence are not mined as indicated in Plan 24 in Appendix B.

Mining activities are currently occurring at TCTS which is a fully operational mine. Additionally, a mining right has been obtained for Trichardtsfontein and the Vaalkop Area has been incorporated within the regional Sasol Mining Right. Therefore, should authorisation not be obtained for the amended and consolidated EMPr, mining activities will still be undertaken at TCTS and Trichardtsfontein. However, a health and safety risk is posed as ventilation shafts are required to increase the amount of oxygen being brought underground. Additionally, high extraction mining will not be utilised while mining Trichardtsfontein. As no EMPr has been compiled for Vaalkop, no mining activities will be permitted to be undertaken unless this consolidation project is approved. This may mean that the coal reserve is not fully realised which will lead to a loss in economic revenue which will impact on the economy. Additionally, should these pillars be left, other potential mining companies may attempt to apply to extract these pillars once mining has ceased. Even if these pillars are not mined, once mining activities have ceased, over time these pillars may become weakened through natural weathering processes which can result in cracking and subsidence where pillar strength is reduced which may have an impact on both the environment and health and safety. Sasol Mining will also operate under two separate mining rights with two separate EMPrs which may prove to be inefficient in terms of management of the mines.

It is therefore recommended that the consolidation project be granted Environmental Authorisation.

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Part A: Scope of Assessment and Environmental Impact Assessment Report

1 Introduction

Sasol Mining (Pty) Ltd (Sasol Mining) holds mining rights for the Twistdraai Colliery: Thubelisha Shaft (TCTS) and the Vaalkop mining area, which were both incorporated into the regional Sasol Mining Right (Ref: MP30/5/1/2/2/138MR). It must be noted that no EMPr was compile for the Vaalkop mining right area even though a mining right was approved. Further to this, the mining right for the Trichardtsfontein Mine (Ref: MP30/5/1/2/2/10056MR) was ceded from Glencore Operations South Africa (Pty) Ltd in accordance with Section 11 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) to Sasol Mining. Sasol Mining is proposing that the Trichardtsfontein mining right area be incorporated into the regional Sasol Mining Right (Ref: MP30/5/1/2/2/138MR). Therefore all mining right areas will operate under a single mining right (Sasol Mining Right).

It is therefore required that the Environmental Management Programme Reports (EMPrs) for the above mentioned mining right areas be compiled (Vaalkop), consolidated and updated to reflect changes in the mining plans and methodologies and consider additional infrastructure requirements.

The project which includes the Trichardtsfontein Mine, Vaalkop and TCTS is located between the town of Trichardt and Bethal in the province of Mpumalanga. The town of Evander is 17 km to the West and Secunda is 10 km South West of the Trichardtsfontein and TCTS mining area. Vaalkop is located 5 km southeast of Bethal and 17 km southwest of Trichardt. The consolidation project area and coal reserve are located within the Bethal Magisterial District, the Gert Sibande District Municipality (GSDM) and the Govan Mbeki Local Municipality (GMLM).

The mining method which is currently being undertaken at TCTS includes bord and pillar mining method as well as high extraction mining in some areas. This mining method has also been proposed for Vaalkop. However, the mining method proposed for the extraction of coal at Trichardtsfontein only included the conventional bord-and-pillar method, with the use of continuous miners feeding shuttle cars.

Twistdraai Thubelisha is now proposing that in addition to the bord-and-pillar mining method, high extraction mining will be undertaken at the Trichardtsfontein Mine. Since this activity was excluded from the previous approved EMPr (2014), an amendment of the Trichardtsfontein EMPr is required to identify and assess the impacts associated with high extraction mining, particularly relating to surface subsidence. Sasol Mining therefore undertook the required specialist studies to determine the impact that may be experienced from high extraction mining methods.

Additionally it is proposed that Twistdraai Thubelisha will construct two ventilation shafts at TCTS (known as East ventilation shaft) and two ventilation shafts on Trichardtsfontein (known as South ventilation shaft). A Listed activity under listing notice 1 is considered to be triggered in accordance with the new Environmental Impact Assessment (EIA) Regulations, 2014 (As amended) promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) for the construction and operation of the ventilation shafts.

Digby Wells is therefore proposing a submission in terms of the provisions of Section 102 of the MPRDA and Regulation 31 of the EIA regulations, 2014 (as amended) promulgated in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) to obtain the required authorisation for both the amendment and consolidation process of the EMPrs (referred to in general as the Environmental Authorisation (EA) Amendment process). A basic assessment process will also be undertaken to obtain environmental authorisation for the construction and operation of the ventilation shafts. This will be undertaken as a consolidated process in accordance with the one environmental system.

Therefore the proposed process will be undertaken in accordance with the MPRDA and NEMA, in support of the required authorisations as listed below:

- Authorisation for the four ventilation shafts;
- Change in mining method for Trichardtsfontein and amendment of the Trichardtsfontein EMPr;
- Compilation of the EMPr for Vaalkop;
- Consolidation of Trichardtsfontein mining right into Sasol Mining Right; and
- Consolidation of the TCTS EMPr, Vaalkop EMPr and the Trichardtsfontein EMPr (referred to as the consolidation project).

To enable this consolidation, information pertaining to consolidation project has been sourced from the approved *TCTS EIA and EMP* compiled by Oryx Environmental, dated 2008 with associated specialist studies and the approved Trichardtsfontein revised EIA and EMP compiled by Digby Wells, dated 2014 with associated specialist studies. Additionally the following specialist studies completed in 2017 have also been undertaken to assess the impacts of the consolidation project with specific focus on the Vaalkop mining right area:

- Air Quality Specialist Study (Appendix E);
- Noise Specialist Study (Appendix F);
- Social Specialist Study (Appendix G);
- Heritage Specialist Study (Appendix H);
- Soils, Land Use and Land Capability Specialist Study (Appendix I);
- Fauna and Flora Specialist Study (Appendix J);
- Wetlands Specialist Study (Appendix K);
- Surface Water Specialist Study (Appendix L);
- Aquatic Ecology Specialist Study (Appendix M);

- Groundwater Specialist Study (Appendix N); and
- Rehabilitation and Closure (Appendix O).

2 Item 3: Project Applicant

2.1 Item 3(a)(i): Details of the EAP

Digby Wells and Associates (South Africa) (Pty) Ltd (trading as Digby Wells Environmental – hereafter Digby Wells) has been appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the EA Amendment process. The details of the EAP are provided in Table 2-1.

Table 2-1: Contact details of the EAP

Name of Practitioner:	Miss Barbara Wessels
Telephone:	011 789 9495
Fax:	011 069 6801
Email:	BarbaraWessels@digbywells.com

2.2 Item 3(a)(ii): Expertise of the EAP

2.2.1 The Qualifications of the EAP

Barbara Wessels obtained a BSc (Geography and Environmental Management) degree in 2005 from the University of Johannesburg. She has been working as an environmental consultant since 2006 with the main focus on the mining industry. Refer to Appendix A for her CV.

2.2.2 Summary of the EAP's Past Experience

Barbara Wessels has 11 years of consulting experience. She has good knowledge of the relevant environmental legislation and associated processes. During her career she has compiled numerous Environmental Impact Assessment and Environmental Management Programme (EMP) reports and managed the associated multi-disciplinary processes. Other environmental related projects she has been involved with include due diligence, EMP auditing, closure cost assessments, water use licensing, waste management, aquatic assessments and biomonitoring as well as the compilation of rehabilitation plans. She has worked in various African countries and was seconded to Anglo Platinum (Rustenburg), AngloGold Ashanti Iduapriem Mine (Ghana) providing assistance to the Environmental Manager and Randgold Resources Loulo Gold Mine as acting Environmental Superintendent.

3 Item 3(b): Description of the Property

Farm Name:

Mining Right Reference Number: MP 138 MR (TCTS)	
Farm	**Portion Number**
Rustfontein 109 IS	Portion 3, 6, 13, 48 and 49
Palmietfontein 110 IS	Portion 2, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 and 21.
Tweedraai 139 IS	Portion 1, 2, 6, 10, 11, 12, 13, 15, 16, 19, 21, 22, 24 and 25
Trichardtsfontein 140 IS	Portion 16, 17, 18, 19, 24, 26, 39, 40, 46, 47 and 49.
Frischgewaagd 142 IS	Portion 1, 2, 3, 5, 6, 13, 14, 15, 16, 17, 18, 19, 20 and 21
Rooipoort 144 IS	Portion R, 1, 3, 5, 6, 7, 8, 9, 10, 11, 15, 16, 17, 20, 21, 22, 23 and 25
Zeekoegat 145 IS	Portion 1, 2, 3, 4, 5, 6, 8
Rietfontein 146 IS	Portion 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 17 and18.
Elandsfontein 147	Portion R, 1, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28 and 38
Driefontein137 IS	Portion 66
Rooipoort 143 IS	Portion R, 1, 2,4, 5, 6, 7, 8, 9, 10, 11, 15, 16, 17 and 21.

Mining Right Reference Number: MP 10056 MR (Trichardtsfontein)	
Farm	**Portion Number**
Trichardtsfontein 140 IS	Portion 7, 8, 10, 13, 14, 16, 17, 18, 19, 21, 22, 28, 32, 33, 34, 35, 38, 40, 41, 42, 43, 45, 48, 54, 60, 65, 66 and 77
Rooipoort 143 IS	Portion 2 and 3
Rooipoort 144 IS	Portion 3

Mining Right Reference Number: MP 138 MR (Vaalkop)	
Farm	**Portion Number**
Rustfontein 109 IS	Portion 6, 7, 12 and 13.

Vaalkoop 104 IS	Portion R, 1, 4, 5, 6, 8, 9, 10, 11, 12, 14
Ongezien 105 IS	Portion R, 3, 6, 8 and 10
Ongezien 567 IS	Remaining Extent
Witrand 103 IS	Portion 2, 10, 13 and 23
Yzervatkfontein 106 IS	Portion 1, 3, 6, 7, 8, 10 and 11
K-Stad 79 IS	Portion 5
Holffontein 111 IS	Portion 2 and 3
Palmietfontein 110 IS	Portion 3, 4, 7, 8, 21
Leddaar 78 IS	Portion 9
Witrand 569 IS	Remaining Extent

Application Area (Ha):

MP 138 MR (TCTS)

Total Hectares: 14515.6 ha

Farm	Hectares (Ha)
Rustfontein 109 IS	245.3
Palmietfontein 110 IS	1440.4
Holfontein 111 IS	194.1
Tweedraai 139 IS	1269.9
Trichardsfontein 140 IS	2013.6
Frischgewaagd 142 IS	2815.8
Rooipoort 144 IS	1301.1
Zeekoegat 145 IS	1904.0
Rietfontein 146 IS	797.1
Elandsfontein 147	2065.3
Driefontein137 IS	187.7
Rooipoort 143 IS	475.4

MP 10056 MR (Trichardsfontein)

Total Hectares: 2659.6 ha

Farm	Hectares
Trichardsfontein 140 IS	2016.5
Rooipoort 143 IS	180.8
Rooipoort 144 IS	462.3

MP 128 MR (Vaalkop)

Total Hectares: 7952.7 ha

Farm	Hectares
Rustfontein 109 IS	500.2
Vaalkoop 104 IS	1368.2
Ongezien 105 IS	1450.1
Ongezien 567 IS	384.5
Witrand 103 IS	268.3
Yzervatkfontein 106 IS	2319.6
K-Stad 79 IS	398.0
Holffontein 111 IS	222.2
Palmietfontein 110 IS	668.5
Leddaar 78 IS	146.7
Witrand 569 IS	226.4

Magisterial District:	Bethal Magisterial District

Distance and direction from nearest town:

MP 138 MR (TCTS)

Farm	Distance and Direction from Nearest Town
Rustfontein 109 IS	7 km West of Bethal
Palmietfontein 110 IS	8.6 km West of Bethal
Tweedraai 139 IS	4 km North of Trichardt
Trichardsfontein 140 IS	620 m North of Trichardt
Frischgewaagd 142 IS	3.8 km NE of Trichardt
Rooipoort 144 IS	3.9 km East of Trichardt
Zeekoegat 145 IS	12.9 km West of Bethal
Rietfontein 146 IS	9 km East of Trichardt
Elandsfontein 147	7.8 km SE of Bethal
Driefontein137 IS	1.2 km West of Trichardt
Rooipoort 143 IS	3.9 km NE of Trichardt

MP 10056 MR (Trichardsfontein)

Farm	Distance and Direction from Nearest Town
Trichardsfontein 140 IS	1 km NE of Trichardt
Rooipoort 143 IS	4 km NE of Trichardt
Rooipoort 144 IS	3.5 km SE of Trichardt

MP 128 MR (Vaalkop)

Farm	Distance and Direction from Nearest Town
Rustfontein 109 IS	6.6 km NW of Bethal
Vaalkoop 104 IS	8.7 km NW of Bethal
Ongezien 105 IS	6.5 km NW of Bethal
Ongezien 567 IS	8.5 km NW of Bethal
Witrand 103 IS	12.9 km NW of Bethal
Yzervatkfontein 106 IS	9.0 km NW of Bethal
K-Stad 79 IS	12.9 km NW of Bethal
Holffontein 111 IS	12 km NW of Bethal
Palmietfontein 110 IS	8.7 km NW of Bethal
Leddaar 78 IS	14.6 km NW of Bethal
Witrand 569 IS	10.8 km NW of Bethal

The distance and direction of the consolidation project and other major settlements is shown in the table below.

Town	TSTS and Trichardsfontein Distance (km)	Direction	Vaalkop Distance (km)	Direction
Secunda	11	Southwest	20	Southwest
Trichardt	0	South	17	Southwest
Bethal	33	East	5	Southeast

21 digit Surveyor General Code for each farm portion:

MP 138 MR (TCTS)

Property	Portion	21 digit SG code
Driefontein 137 IS	66	T0IS00000000013700066
Elandsfontein 147 IS	1	T0IS0000000014700001

	Elandsfontein 147 IS	4	T0IS00000000014700004
	Elandsfontein 147 IS	5	T0IS00000000014700005
	Elandsfontein 147 IS	6	T0IS00000000014700006
	Elandsfontein 147 IS	8	T0IS00000000014700008
	Elandsfontein 147 IS	9	T0IS00000000014700009
	Elandsfontein 147 IS	10	T0IS00000000014700010
	Elandsfontein 147 IS	11	T0IS00000000014700011
	Elandsfontein 147 IS	12	T0IS00000000014700012
	Elandsfontein 147 IS	13	T0IS00000000014700013
	Elandsfontein 147 IS	14	T0IS00000000014700014
	Elandsfontein 147 IS	15	T0IS00000000014700015
	Elandsfontein 147 IS	16	T0IS00000000014700016
	Elandsfontein 147 IS	17	T0IS00000000014700017
	Elandsfontein 147 IS	18	T0IS00000000014700018
	Elandsfontein 147 IS	19	T0IS00000000014700019
	Elandsfontein 147 IS	20	T0IS00000000014700020
	Elandsfontein 147 IS	21	T0IS00000000014700021
	Elandsfontein 147 IS	22	T0IS00000000014700022
	Elandsfontein 147 IS	23	T0IS00000000014700023
	Elandsfontein 147 IS	24	T0IS00000000014700024
	Elandsfontein 147 IS	25	T0IS00000000014700025
	Elandsfontein 147 IS	26	T0IS00000000014700026
	Elandsfontein 147 IS	27	T0IS00000000014700027
	Elandsfontein 147 IS	28	T0IS00000000014700028
	Elandsfontein 147 IS	38	T0IS00000000014700038
	Elandsfontein 147 IS	Rem	T0IS00000000014700000
	Frischgewaagd 142 IS	1	T0IS00000000014200001
	Frischgewaagd 142 IS	2	T0IS00000000014200001
	Frischgewaagd 142 IS	3	T0IS00000000014200001
	Frischgewaagd 142 IS	5	T0IS00000000014200001
	Frischgewaagd 142 IS	6	T0IS00000000014200001
	Frischgewaagd 142 IS	13	T0IS00000000014200001

	Frischgewaagd 142 IS	14	T0IS00000000014200001
	Frischgewaagd 142 IS	15	T0IS00000000014200001
	Frischgewaagd 142 IS	16	T0IS00000000014200001
	Frischgewaagd 142 IS	17	T0IS00000000014200001
	Frischgewaagd 142 IS	18	T0IS00000000014200001
	Frischgewaagd 142 IS	19	T0IS00000000014200001
	Frischgewaagd 142 IS	20	T0IS00000000014200001
	Frischgewaagd 142 IS	21	T0IS00000000014200001
	Palmietfontein 110 IS	2	T0IS00000000011000002
	Palmietfontein 110 IS	4	T0IS00000000011000004
	Palmietfontein 110 IS	5	T0IS00000000011000005
	Palmietfontein 110 IS	6	T0IS00000000011000006
	Palmietfontein 110 IS	7	T0IS00000000011000007
	Palmietfontein 110 IS	9	T0IS00000000011000009
	Palmietfontein 110 IS	10	T0IS00000000011000010
	Palmietfontein 110 IS	11	T0IS00000000011000011
	Palmietfontein 110 IS	12	T0IS00000000011000012
	Palmietfontein 110 IS	13	T0IS00000000011000013
	Palmietfontein 110 IS	14	T0IS00000000011000014
	Palmietfontein 110 IS	15	T0IS00000000011000015
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	Rietfontein 146 IS	4	T0IS00000000014600004
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	Rietfontein 146 IS	6	T0IS00000000014600006

		Rietfontein 146 IS	7	T0IS00000000014600007
		Rietfontein 146 IS	8	T0IS00000000014600008
		Rietfontein 146 IS	9	T0IS00000000014600009
		Rietfontein 146 IS	11	T0IS00000000014600011
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		Rietfontein 146 IS	17	T0IS00000000014600017
		Rietfontein 146 IS	18	T0IS00000000014600018
		Rooipoort 144 IS	1	T0IS00000000014400001
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		Rooipoort 144 IS	4	T0IS00000000014400004
		Rooipoort 144 IS	5	T0IS00000000014400005
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		Rooipoort 144 IS	9	T0IS00000000014400009
		Rooipoort 144 IS	10	T0IS00000000014400010
		Rooipoort 144 IS	11	T0IS00000000014400011
		Rooipoort 144 IS	15	T0IS00000000014400015
		Rooipoort 144 IS	16	T0IS00000000014400016
		Rooipoort 144 IS	17	T0IS00000000014400017
		Rooipoort 144 IS	21	T0IS00000000014400021
		Rooipoort 144 IS	Rem	T0IS00000000014400000
		Rustfontein 109 IS	3	T0IS00000000010900003
		Rustfontein 109 IS	6	T0IS00000000010900006
		Rustfontein 109 IS	13	T0IS00000000010900013
		Rustfontein 109 IS	48	T0IS00000000010900048
		Rustfontein 109 IS	49	T0IS00000000010900049
		Trichardtsfontein 140 IS	16	T0IS00000000014000016
		Trichardtsfontein 140 IS	17	T0IS00000000014000017

Trichardtsfontein 140 IS	18	T0IS00000000014000018
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Trichardtsfontein 140 IS	49	T0IS00000000014000049
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Tweedraai 139 IS	6	T0IS00000000013900006
Tweedraai 139 IS	10	T0IS00000000013900010
Tweedraai 139 IS	11	T0IS00000000013900011
Tweedraai 139 IS	12	T0IS00000000013900012
Tweedraai 139 IS	13	T0IS00000000013900013
Tweedraai 139 IS	15	T0IS00000000013900015
Tweedraai 139 IS	16	T0IS00000000013900016
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Tweedraai 139 IS	24	T0IS00000000013900024
Tweedraai 139 IS	25	T0IS00000000013900025
Zeekoegat 145 IS	1	T0IS00000000014500001
Zeekoegat 145 IS	2	T0IS00000000014500002
Zeekoegat 145 IS	3	T0IS00000000014500003
Zeekoegat 145 IS	4	T0IS00000000014500004
Zeekoegat 145 IS	5	T0IS00000000014500005
Zeekoegat 145 IS	8	T0IS00000000014500008

MP 10056 MR (Trichardtsfontein)

Property	Portion	21 digit SG code

Rooipoort 143 IS	2	T0IS00000000014300002
Rooipoort 143 IS	3	T0IS00000000014300003
Rooipoort 144 IS	3	T0IS00000000014400003
Trichardtsfontein 140 IS	7	T0IS00000000014000007
Trichardtsfontein 140 IS	8	T0IS00000000014000008
Trichardtsfontein 140 IS	10	T0IS00000000014000010
Trichardtsfontein 140 IS	13	T0IS00000000014000013
Trichardtsfontein 140 IS	14	T0IS00000000014000014
Trichardtsfontein 140 IS	16	T0IS00000000014000016
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Trichardtsfontein 140 IS	28	T0IS00000000014000028
Trichardtsfontein 140 IS	32	T0IS00000000014000032
Trichardtsfontein 140 IS	33	T0IS00000000014000033
Trichardtsfontein 140 IS	34	T0IS00000000014000034
Trichardtsfontein 140 IS	35	T0IS00000000014000035
Trichardtsfontein 140 IS	38	T0IS00000000014000038
Trichardtsfontein 140 IS	40	T0IS00000000014000040
Trichardtsfontein 140 IS	41	T0IS00000000014000041
Trichardtsfontein 140 IS	42	T0IS00000000014000042
Trichardtsfontein 140 IS	43	T0IS00000000014000043
Trichardtsfontein 140 IS	45	T0IS00000000014000045
Trichardtsfontein 140 IS	48	T0IS00000000014000048
Trichardtsfontein 140 IS	54	T0IS00000000014000054
Trichardtsfontein 140 IS	60	T0IS00000000014000060
Trichardtsfontein 140 IS	65	T0IS00000000014000064
Trichardtsfontein 140 IS	66	T0IS00000000014000066
Trichardtsfontein 140 IS	77	T0IS00000000014000077

MP 138 MR (Vaalkop)

Property	Portion	21 digit SG code
Holfontein 111 IS	2	T0IS00000000011100002
Holfontein 111 IS	3	T0IS00000000011100003
K-Stad 79 IS	5	T0IS00000000007900005
Legdaar 78 IS	9	T0IS00000000007800009
Ongezien 105 IS	3	T0IS00000000010500003
Ongezien 105 IS	6	T0IS00000000010500006
Ongezien 105 IS	8	T0IS00000000010500008
Ongezien 105 IS	10	T0IS00000000010500010
Ongezien 105 IS	Rem	T0IS00000000010500000
Ongezien 567 IS	Rem	T0IS00000000056700000
Palmietfontein 110 IS	3	T0IS00000000011000003
Palmietfontein 110 IS	4	T0IS00000000011000004
Palmietfontein 110 IS	7	T0IS00000000011000007
Palmietfontein 110 IS	8	T0IS00000000011000008
Palmietfontein 110 IS	21	T0IS00000000011000021
Rustfontein 109 IS	6	T0IS00000000010900006
Rustfontein 109 IS	7	T0IS00000000010900007
Rustfontein 109 IS	12	T0IS00000000010900012
Rustfontein 109 IS	13	T0IS00000000010900013
Vaalkop 104 IS	1	T0IS00000000010400001
Vaalkop 104 IS	4	T0IS00000000010400004
Vaalkop 104 IS	5	T0IS00000000010400005
Vaalkop 104 IS	6	T0IS00000000010400006
Vaalkop 104 IS	8	T0IS00000000010400008
Vaalkop 104 IS	9	T0IS00000000010400009
Vaalkop 104 IS	10	T0IS00000000010400010
Vaalkop 104 IS	11	T0IS00000000010400011
Vaalkop 104 IS	12	T0IS00000000010400012
Vaalkop 104 IS	14	T0IS00000000010400014
Vaalkop 104 IS	Rem	T0IS00000000010400000

	Witrand 103 IS	2	T0IS00000000010300002
	Witrand 103 IS	10	T0IS00000000010300010
	Witrand 103 IS	13	T0IS00000000010300013
	Witrand 103 IS	23	T0IS00000000010300023
	Witrand 569 IS	Rem	T0IS00000000056900000
	Yzervarkfontein 106 IS	1	T0IS00000000010600001
	Yzervarkfontein 106 IS	3	T0IS00000000010600003
	Yzervarkfontein 106 IS	6	T0IS00000000010600006
	Yzervarkfontein 106 IS	7	T0IS00000000010600007
	Yzervarkfontein 106 IS	8	T0IS00000000010600008
	Yzervarkfontein 106 IS	10	T0IS00000000010600010
	Yzervarkfontein 106 IS	11	T0IS00000000010600011

4 Item 3(c) of Appendix 3: Locality Map

The consolidation project falls within the Govan Mbeki Local Municipality within the Gert Sibande District Municipality. A regional plan and local setting plan have been included as Plan 1 and Plan 2 respectively, within Appendix B.

5 Item 3(d) of Appendix 3: Description of the Scope of the proposed Overall Activity

The purpose of this report is to amend and consolidate the Mining Rights and EMPrs pertaining to the TCTS, Trichardtsfontein, into a single Mining Right and EMPr and to compile the Vaalkop EMPr and consolidate it within the same report. Sasol Mining is also including additional infrastructure in the form of two new ventilation shafts to be constructed at TCTS (East ventilation shaft) and two new ventilation shafts to be constructed at Trichardtsfontein (South ventilation shaft) which requires environmental authorisation. The upcast ventilation shafts are proposed to be approximately 1.5 ha each while the downcast ventilation shaft will be approximately 0.25 ha each.

Additionally Sasol Mining wish to change the mining method approved for Trichardtsfontein from only bord and pillar to bord and pillar mining method with high extraction mining. The consolidated mine layout plan is attached as Plan 3, Appendix B. A more detailed depiction of the TCTS infrastructure plan is provided in Plan 3 A in Appendix B.

To obtain the environmental authorisation to construct the TCTS mine (now constructed) various listed activities were applied for and granted in 2008. No listed activities were previously applied for to undertake mining activities at Trichardtsfontein. Additionally, no listing activities will be triggered for the operation of Vaalkop as no infrastructure is proposed to be constructed.

Table 5-1 shows a list of approved Listed Activities for the TCTS and the corresponding 2014 Listed Activities in terms of the NEMA 2014 Regulations (As amended). Table 5-2 shows all new activities that will be undertaken as part of this consolidation project and the listed actives which are triggered. Based on this assessment it has been determined that a basic assessment process will need to be undertaken to obtain authroisation for the construction and operation of the ventilation shafts.

5.1 Item 3(d)(i): Listed and specified activities

Table 5-1: Previously Authorised Listed Activities for TCTS

Name of Activity	Listed Activity	Applicable Listing Notice	Corresponding Listed Activities in terms of 2014 NEMA Regulations (as amended by 327 of 07 April 2017)
The construction of a 10 000 ton coal silo	1 (c)	No. R. 386 of 2006	Activity 17 of GN R 984 of 2014
Conveyor crossings over streams	1 (m)	No. R. 386 of 2006	Activity 17 of GN R 984 of 2014
500 Ml dirty water storage dams	1 (n)	No. R. 386 of 2006	Activity 6 of GN R 984 of 2014
Package sewage treatment plant at the shaft	1 (s)	No. R. 386 of 2006	Activity 6 of GN R 984 of 2014
Bulk fuel storage at the shaft	7	No. R. 386 of 2006	Activity 14 of GN R 983 of 2014
Ongoing proving of the coal reserves during the life of mine	8	No. R. 386 of 2006	Activity 17 of GN R 984 of 2014
Ongoing proving of the coal reserves during the life of mine	9	No. R. 386 of 2006	Activity 17 of GN R 984 of 2014
Pumping out of groundwater influxes into the mine	13	No. R. 386 of 2006	No longer listed under NEMA. Governed under NWA
Access road to the shaft	15	No. R. 386 of 2006	Activity 24 of GN R 983 of 2014
Construction of a 132 kVa powerline from the existing Twistdraai Colliery to the new Twistdraai Colliery: Thubelisha Shaft	1 (l)	No. R. 387 of 2006	Activity 11 of GN R 983 of 2014

Name of Activity	Listed Activity	Applicable Listing Notice	Corresponding Listed Activities in terms of 2014 NEMA Regulations (as amended by 327 of 07 April 2017)
Pre-treatment (pH balancing) of mine water for use in the continuous miners underground.	1 (p)	No. R. 387 of 2006	No Longer Listed Activity
Development of the shaft area of the mine and conveyor infrastructure.	2	No. R. 387 of 2006	Activity 17 of GN R 984 of 2014
The establishment of a coal mine and drilling to define the coal reserve.	7	No. R. 387 of 2006	Activity 17 of GN R 984 of 2014
The establishment of a coal mine and drilling to define the coal reserve.	8	No. R. 387 of 2006	Activity 17 of GN R 984 of 2014

Table 5-2: Proposed activities to be undertaken for the consolidation project

Name of Activity	Listed Activity	Applicable Listing Notice
Four ventilation shafts (two upcast and two downcast) – 3.5 ha	27	GNR 983 EIA Regulations of 2014 (as amended by 327 of 07 April 2017)
Change in mining method from bord and pillar to bord and pillar with high extraction for Trichardtsfontein and amendment of the Trichardtsfontein EMPr	N/A	N/A
Compilation of the EMPr for Vaalkop	N/A	N/A
Consolidation of Trichardtsfontein mining right into Sasol Mining Right. *Noted: Vaalkop and TCTS mining right already consolidated*	N/A	N/A

Name of Activity	Listed Activity	Applicable Listing Notice
Consolidation of the TCTS EMPr, Vaalkop EMPr and the Trichardtsfontein EMPr	N/A	N/A

5.2 Item 3(d)(ii): Description of the Activities to be undertaken

5.2.1 Project Location

The consolidation project which includes the Trichardtsfontein Mine, Vaalkop and TCTS is located between the town of Trichardt and Bethal in the province of Mpumalanga. The town of Evander is 17 km to the West and Secunda is 10 km South West of the Trichardtsfontein and TCTS mining area. Vaalkop is located 5 km southeast of Bethal and 17 km southwest of Trichardt. The consolidation project area and coal reserve are located within the Bethal Magisterial District, the Gert Sibande District Municipality (GSDM) and the Govan Mbeki Local Municipality (GMLM).

The consolidation project is situated within a region that is characterised by Coal mining activities and cultivation which includes maize cropping and grazing. The Isibonelo and Syferfontein coal mines are situated to the northwest of the consolidation project area. The distance and direction of the consolidation project and other major settlements is shown below in Table 5-3.

Table 5-3: Distance and direction to major settlements

Town	TSTS and Trichardtsfontein Distance (km)	Direction	Vaalkop Distance (km)	Direction
Secunda	11	Southwest	20	Southwest
Trichardt	0	South	17	Southwest
Bethal	33	East	5	Southeast

There are a number of human settlements within and adjacent to the consolidation project area. Farmsteads and farm worker houses are scattered over the consolidation project area. On the farm Trichardtsfontein 140 IS, portion 7, an informal cemetery containing four graves marked with cairns have been identified. A township development known as Terra Nova has been established within the Trichardtsfontein MRA. The development involves two phases; Phase 1 which has been zoned as mixed residential and has been completed while Phase 2 which will comprise a “lifestyle estate” with equestrian facilities and other open space components which will be completed within the next few years.

5.2.2 Land Tenure

The consolidation project area is located on a number of properties, as shown in the Table 5-4. The regional setting and the local setting for consolidation project is depicted in Plan 1 and Plan 2 respectively (refer to Appendix B). Plan 4 illustrates the land tenure Map (Appendix B).

Table 5-4: Project properties

SG_Code	Port_Farm	Property	Registered
T0IS00000000056500000	R/565	Grootvlei 565 IS	
T0IS00000000014000070	70/140	Trichardtsfontein 140 IS	
T0IS00000000014000069	69/140	Trichardtsfontein 140 IS	
T0IS00000000014000002	2/140	Trichardtsfontein 140 IS	Nederduitsch Hervormde Kerk Trichardt
T0IS00000000014000072	72/140	Trichardtsfontein 140 IS	
T0IS00000000014000017	17/140	Trichardtsfontein 140 IS	Barka Eiendomme Pty Ltd
T0IS00000000014000001	1/140		
T0IS00000000014000008	8/140	Trichardtsfontein 140 IS	Nederduitsch Hervormde Kerk
T0IS00000000014000067	67/140	Trichardtsfontein 140 IS	
T0IS00000000014000068	68/140	Trichardtsfontein 140 IS	
T0IS00000000014000000	R/140		
T0IS00000000057400002	2/574		
T0IS00000000011400007	7/114		
T0IS00000000011100003	3/111		
T0IS00000000011100002	2/111		
T0IS00000000007900005	5/106		
T0IS00000000010600003	3/106	Yzervarkfontein 106 IS	AM Familie Trust
T0IS00000000010500000	R/105		
T0IS00000000014400016	16/144		
T0IS00000000014400019	19/144	Rooipoort 144 IS	
T0IS00000000014400020	20/144	Rooipoort 144 IS	
T0IS00000000014400022	22/144	Rooipoort 144 IS	
T0IS00000000014400023	24/144	Rooipoort 144 IS	
T0IS00000000014400025	25/144	Rooipoort 144 IS	

SG_Code	Port_Farm	Property	Registered
T0IS00000000014600016	16/146	Rietfontein 146 IS	
T0IS00000000014600020	20/146	Rietfontein 146 IS	
T0IS00000000010400006	6/104	Vaalkop 104 IS	Maritz Johannes Marthinus
T0IS00000000010900040	40/109	Rustfontein 109 IS	Elwikus Eiendomme CC
T0IS00000000011000018	18/110	Palmietfontein 110 IS	Van Niekerk, Micheal Daniel
T0IS00000000014000054	54/140	Trichardtsfontein 140 IS	Agata Eiendomme
T0IS00000000011500014	14/115	Syferfontein 115 IS	Colorado Park (Pty) Ltd
T0IS00000000013700066	66/137	Driefontein 137 IS	Govan Mbeki Local Municipality
T0IS00000000014000018	18/140	Trichardtsfontein 140 IS	Govan Mbeki Municipality: Munisipality Trichardt
T0IS00000000014000026	26/140	Trichardtsfontein 140 IS	Govan Mbeki Municipality: Munisipality Trichardt
T0IS00000000014000012	12/140	Trichardtsfontein 140 IS	Govan Mbeki Municipality: Munisipality Trichardt
T0IS00000000014200013	13/142	Frischgewaagd 142 IS	J N B Familie Trust
T0IS00000000010400009	9/104	Vaalkop 104 IS	Satori Trust
T0IS00000000027500029	29/275	Driehoek 275 IS	Transnet Ltd
T0IS00000000014000039	39/140	Trichardtsfontein 140 IS	Transnet Ltd
T0IS00000000014000038	38/140	Trichardtsfontein 140 IS	Transnet Ltd
T0IS00000000014000041	41/140	Trichardtsfontein 140 IS	Transnet Ltd
T0IS00000000014000040	40/140	Trichardtsfontein 140 IS	Transnet Ltd
T0IS00000000014000037	37/140	Trichardtsfontein 140 IS	Transnet Ltd

SG_Code	Port_Farm	Property	Registered
T0IS00000000014000023	23/140	Trichardtsfontein 140 IS	Transnet Ltd
T0IS00000000014000003	3/140	Trichardtsfontein 140 IS	Transnet Ltd
T0IS00000000014000044	44/140	Trichardtsfontein 140 IS	Transnet Ltd
T0IS00000000014000025	25/140	Trichardtsfontein 140 IS	Transnet Ltd
T0IS00000000014000036	36/140	Trichardtsfontein 140 IS	Transnet Ltd
T0IS00000000014000043	43/140	Trichardtsfontein 140 IS	Transnet Ltd
T0IS00000000010500006	6/105	Ongeziend 105 IS	Transnet Ltd
T0IS00000000014600009	9/146	Riefontein 146 IS	Transnet Ltd
T0IS00000000014600008	8/146	Riefontein 146 IS	Transnet Ltd
T0IS00000000014600015	15/146	Riefontein 146 IS	Transnet Ltd
T0IS00000000014700017	17/147	Elandsfontein 147 IS	Transnet Ltd
T0IS00000000014700006	6/147	Elandsfontein 147 IS	Transnet Ltd
T0IS00000000010900007	7/109	Rustfontein 109 IS	Abosolve (Pty) Ltd
T0IS00000000010900013	13/109	Rustfontein 109 IS	Abosolve (Pty) Ltd
T0IS00000000010900003	3/109	Rustfontein 109 IS	Abosolve (Pty) Ltd
T0IS00000000010900012	12/109	Rustfontein 109 IS	Abosolve (Pty) Ltd
T0IS00000000010900006	6/109	Rustfontein 109 IS	Abosolve (Pty) Ltd
T0IS00000000010400005	5/104	Vaalkop 104 IS	Louw Albertus Bernhardus
T0IS00000000010900008	8/109	Rustfontein 109 IS	Louw Albertus Bernhardus
T0IS00000000014600005	5/146	Riefontein 146 IS	Pretorius Andre Francois
T0IS00000000014600003	3/146	Riefontein 146 IS	Pretorius Andries Wilhelmus Jacobus
T0IS00000000014600004	4/146	Riefontein 146 IS	Pretorius Andries Wilhelmus Jacobus
T0IS00000000014700028	28/147	Elandsfontein 147 IS	Pretorius Andries Wilhelmus Jacobus

SG_Code	Port_Farm	Property	Registered
T0IS00000000014700018	18/147	Elandsfontein 147 IS	Pretorius Andries Wilhelmus Jacobus
T0IS00000000014600006	6/146	Riefontein 146 IS	Jevon Owen Vernon
T0IS00000000014600014	14/146	Riefontein 146 IS	Jevon Owen Vernon
T0IS00000000014600012	12/146	Riefontein 146 IS	Jevon Owen Vernon
T0IS00000000014600001	1/146	Riefontein 146 IS	Jevon Owen Vernon
T0IS00000000014400008	8/144	Rooipoort 144 IS	Boshoff Petrus Philiphus
T0IS00000000014400011	11/144	Rooipoort 144 IS	Ben Taljaard Familie Trust
T0IS00000000010600008	8/106	Yzervarkfontein 106 IS	Grobler Balthazer Johannes
T0IS00000000007800009	28734	Legdaar 78 IS	Grobler Balthazer Johannes
T0IS00000000014700005	5/147	Elandsfontein 147 IS	Tribet Inv (Pty) Ltd
T0IS00000000014000077	77/140	Trichardtsfontein 140 IS	Terblanche Corneluis Johannes
T0IS00000000014000013	13/140	Trichardtsfontein 140 IS	Terblanche Corneluis Johannes
T0IS00000000010400014	14/104	Vaalkop 104 IS	Dries Cronje Boerdery CC
T0IS00000000056900000	R/569	Witrand 569 IS	Dries Cronje Boerdery CC
T0IS00000000013900025	25/139	Tweedraai 139 IS	Anglo Operations (Pty) Ltd
T0IS00000000014400005	5/144	Rooipoort 144 IS	W F Te Water Senior Trust
T0IS00000000014400007	7/144	Rooipoort 144 IS	W F Te Water Senior Trust
T0IS00000000014400004	4/144	Rooipoort 144 IS	W F Te Water Senior Trust
T0IS00000000011500005	5/115	Syferfontein 115 IS	Theron Daniel Albertus
T0IS00000000014200021	21/142	Frischgewaagd 142 IS	Theron Daniel Albertus
T0IS00000000014200020	20/142	Frischgewaagd 142 IS	Theron Daniel Albertus
T0IS00000000014200018	18/142	Frischgewaagd 142 IS	Theron Daniel Albertus

SG_Code	Port_Farm	Property	Registered
T0IS00000000014200002	2/142	Frischgewaagd 142 IS	Frisgewaagd Trust
T0IS00000000014200005	5/142	Frischgewaagd 142 IS	Frisgewaagd Trust
T0IS00000000014700015	15/147	Elandsfontein 147 IS	Nel, Gabriel BJ
T0IS00000000013900002	2/139	Tweedraai 139 IS	De Wet Gabriel Francois
T0IS00000000013900024	24/139	Tweedraai 139 IS	De Wet Gabriel Francois
T0IS00000000013900010	10/139	Tweedraai 139 IS	De Wet Gabriel Francois
T0IS00000000014200003	3/142	Frischgewaagd 142 IS	De Wet Johanna Jacoba
T0IS00000000014200016	16/142	Frischgewaagd 142 IS	De Wet Gabriel Francois
T0IS00000000014200017	17/142	Frischgewaagd 142 IS	De Wet Gabriel Francois
T0IS00000000014500004	4/145	Zeekoegat 145 IS	De Wet Gabriel Francois
T0IS00000000010500003	3/105	Ongezien 105 IS	Hirschowitz Harry
T0IS00000000010400000	R/104	Vaalkop 104 IS	AB Louw Familie Trust
T0IS00000000014700009	9/147	Elandsfontein 147 IS	Palmietfontein Trust
T0IS00000000014700019	19/147	Elandsfontein 147 IS	Palmietfontein Trust
T0IS00000000014700020	20/147	Elandsfontein 147 IS	Palmietfontein Trust
T0IS00000000011000005	5/110	Palmietfontein 110 IS	Zeekoegat Trust
T0IS00000000014500001	1/145	Zeekoegat 145 IS	Zeekoegat Trust
T0IS00000000014000007	7/140	Trichardtsfontein 140 IS	J A Kruger Familie Trust
T0IS00000000014200014	14/142	Frischgewaagd 142 IS	J A Kruger Familie Trust
T0IS00000000014200015	15/142	Frischgewaagd 142 IS	J A Kruger Familie Trust
T0IS00000000014500005	5/145	Zeekoegat 145 IS	J A Kruger Familie Trust
T0IS00000000011000007	7/110	Palmietfontein 110 IS	J A Kruger Familie Trust

SG_Code	Port_Farm	Property	Registered
T0IS00000000011000002	2/110	Palmietfontein 110 IS	J A Kruger Familie Trust
T0IS00000000011000004	4/110	Palmietfontein 110 IS	J A Kruger Familie Trust
T0IS00000000014500003	3/145	Zeekoegat 145 IS	J A Kruger Familie Trust
T0IS00000000014500002	2/145	Zeekoegat 145 IS	J A Kruger Familie Trust
T0IS00000000011000014	14/110	Palmietfontein 110 IS	J A Kruger Familie Trust
T0IS00000000014700004	4/147	Elandsfontein 147 IS	J A Kruger Familie Trust
T0IS00000000014700000	R/147	Elandsfontein 147 IS	J A Kruger Familie Trust
T0IS00000000014000060	60/140	Trichardtsfontein 140 IS	SA National Roads Agency Ltd
T0IS00000000014000061	61/140	Trichardtsfontein 140 IS	SA National Roads Agency Ltd
T0IS00000000014000062	62/140	Trichardtsfontein 140 IS	SA National Roads Agency Ltd
T0IS00000000014000056	56/140	Trichardtsfontein 140 IS	SA National Roads Agency Ltd
T0IS00000000014000066	66/140	Trichardtsfontein 140 IS	SA National Roads Agency Ltd
T0IS00000000010900049	49/109	RUSTFONTEIN 109 IS	Suid Afrikaanse Nasionale Padagentskap Ltd
T0IS00000000014400021	21/144	ROOIPOORT 144 IS	Suid Afrikaanse Nasionale Padagentskap Ltd
T0IS00000000014600017	17/146	Riefontein 146 IS	SA National Roads Agency Ltd
T0IS00000000014600018	18/146	Riefontein 146 IS	SA National Roads Agency Ltd
T0IS00000000014500008	8/145	Zeekoegat 145 IS	SA National Roads Agency Ltd

SG_Code	Port_Farm	Property	Registered
T0IS00000000014000065	65/140	Trichardtsfontein 140 IS	SA National Roads Agency Ltd
T0IS00000000014000016	16/140	Trichardtsfontein 140 IS	Gosler Prop (Pty) Ltd
T0IS00000000014700024	24/147	Elandsfontein 147 IS	Adams Jan Hendrik
T0IS00000000014700038	38/147	Elandsfontein 147 IS	Greyling Jacobus Johannes Andries
T0IS00000000010500008	8/105	Ongeziend 105 IS	JNB Familie Trust
T0IS00000000014400015	15/144	Rooipoort 144 IS	Boshoff Familie Trust
T0IS00000000010600001	1/106	Yzervarkfontein 106 IS	Jorica Boerdery (Pty) Ltd
T0IS00000000010600010	10/106	Yzervarkfontein 106 IS	Jorica Boerdery (Pty) Ltd
T0IS00000000010400008	8/104	Vaalkop 104 IS	Louw Joachim Paulus
T0IS00000000010400001	1/104	Vaalkop 104 IS	Louw Joachim Paulus
T0IS00000000010400004	4/104	Vaalkop 104 IS	Louw Joachim Paulus
T0IS00000000010400010	10/104	Vaalkop 104 IS	Louw Joachim Paulus
T0IS00000000010400011	11/104	Vaalkop 104 IS	Louw Joachim Paulus
T0IS00000000010400012	12/104	Vaalkop 104 IS	Louw Joachim Paulus
T0IS00000000011000008	8/110	Palmietfontein 110 IS	Louw Joachim Paulus
T0IS00000000011000003	3/110	Palmietfontein 110 IS	Louw Joachim Paulus
T0IS00000000014000046	46/140	Trichardtsfontein 140 IS	R & R Professional Services CC
T0IS00000000014400010	10/144	Rooipoort 144 IS	Bornman Familie Trust
T0IS00000000014400009	9/144	Rooipoort 144 IS	Bornman Familie Trust
T0IS00000000014000063	63/140	Trichardtsfontein 140 IS	Govan Mbeki Municipality
T0IS00000000014700023	23/147	Elandsfontein 147 IS	Steyn Michael Frederik
T0IS00000000010500010	10/105	Ongeziend 105 IS	Augoustinos Marios Thios
T0IS00000000014700010	10/147	Elandsfontein 147 IS	Augoustinos Marious Thios
T0IS00000000013900020	20/139	Tweedraai 139 IS	Vosstoffel (Pty) Ltd
T0IS00000000013900001	1/139	Tweedraai 139 IS	Vosstoffel (Pty) Ltd

SG_Code	Port_Farm	Property	Registered
T0IS00000000014000010	10/140	Trichardtsfontein 140 IS	Sasol Mining (Pty) Ltd
T0IS00000000013900021	21/139	Tweedraai 139 IS	Sasol Mining (Pty) Ltd
T0IS00000000013900013	13/139	Tweedraai 139 IS	Sasol Mining (Pty) Ltd
T0IS00000000013900019	19/139	Tweedraai 139 IS	Sasol Mining (Pty) Ltd
T0IS00000000013900022	22/139	Tweedraai 139 IS	Sasol Mining (Pty) Ltd
T0IS00000000011500009	9/115	Syferfontein 115 IS	Sasol Mining (Pty) Ltd
T0IS00000000011500008	8/115	Syferfontein 115 IS	Sasol Mining (Pty) Ltd
T0IS00000000013900006	6/139	Tweedraai 139 IS	Sasol Mining (Pty) Ltd
T0IS00000000011500011	11/115	Syferfontein 115 IS	Sasol Mining (Pty) Ltd
T0IS00000000011500015	15/115	Syferfontein 115 IS	Sasol Mining (Pty) Ltd
T0IS00000000014200006	6/142	Frischgewaagd 142 IS	Sasol Mining (Pty) Ltd
T0IS00000000014200001	1/142	Frischgewaagd 142 IS	Sasol Mining (Pty) Ltd
T0IS00000000014200019	19/142	Frischgewaagd 142 IS	Sasol Mynbou (Pty) Ltd
T0IS00000000014400001	1/144	Rooipoort 144 IS	Sasol Mining (Pty) Ltd
T0IS00000000014300003	3/143	Rooipoort 143 IS	Sasol Mynbou (Pty) Ltd
T0IS00000000014300002	2/143	Rooipoort 143 IS	Sasol Mynbou (Pty) Ltd
T0IS00000000013900016	16/139	Tweedraai 139 IS	Sasol Mining (Pty) Ltd
T0IS00000000013900015	15/139	Tweedraai 139 IS	Sasol Mining (Pty) Ltd
T0IS00000000013900012	12/139	Tweedraai 139 IS	Sasol Mining (Pty) Ltd
T0IS00000000011000006	6/110	Palmietfontein 110 IS	T & N Vervoer CC
T0IS00000000010300013	13/103	Witrand 103 IS	Van Der Merwe Anna
T0IS00000000010300014	14/103	Witrand 103 IS	Van Der Merwe Anna
T0IS00000000010300023	23/103	Witrand 103 IS	Van Der Merwe Anna
T0IS00000000010300010	10/103	Witrand 103 IS	Van Der Merwe Anna
T0IS00000000011000021	21/110	Palmietfontein 110 IS	MMB Boerdery CC
T0IS00000000014000048	48/140	Trichardtsfontein 140 IS	Ahmed & Ebrahim Inv Pty Ltd
T0IS00000000014000015	15/140	Trichardtsfontein 140 IS	Trichardfontein Inv Co Ltd
T0IS00000000014700026	26/147	Elandsfontein 147 IS	Holtzhausen Rudolph Johannes Gerhardus

SG_Code	Port_Farm	Property	Registered
T0IS00000000014000028	28/140	Trichardtsfontein 140 IS	Swanepoel Roelof Johannes Hendrik
T0IS00000000014600007	7/146	Riefontein 146 IS	Logie Ronald Llewellyn
T0IS00000000014700027	27/147	Elandsfontein 147 IS	Logie Ronald Llewellyn
T0IS00000000014700011	11/147	Elandsfontein 147 IS	Logie Ronald Llewellyn
T0IS00000000014700012	12/147	Elandsfontein 147 IS	Logie Ronald Llewellyn
T0IS00000000014000032	32/140	Trichardtsfontein 140 IS	National Government of the Republic of South Africa
T0IS00000000014000033	33/140	Trichardtsfontein 140 IS	National Government of the Republic of South Africa
T0IS00000000014000034	34/140	Trichardtsfontein 140 IS	National Government of the Republic of South Africa
T0IS00000000014400003	3/144	Rooipoort 144 IS	National Government of the Republic of South Africa
T0IS00000000014400017	17/144	Rooipoort 144 IS	National Government of the Republic of South Africa
T0IS00000000014000021	21/140	Trichardtsfontein 140 IS	Gedeelte 21 Trichardtfontein Eiendomme CC
T0IS00000000014000022	22/140	Trichardtsfontein 140 IS	Gedeelte 21 Trichardtfontein Eiendomme CC
T0IS00000000014700021	21/147	Elandsfontein 147 IS	S J Zietsman CC
T0IS00000000014000047	47/140	Trichardtsfontein 140 IS	Dun-Cron Electrical CC
T0IS00000000014000024	24/140	Trichardtsfontein 140 IS	Dun-Cron Electrical CC
T0IS00000000014600013	13/146	Riefontein 146 IS	Victor de Gaulle
T0IS00000000014700013	13/147	Elandsfontein 147 IS	Barnard Coraldene
T0IS00000000011000017	17/110	Palmietfontein 110 IS	CRL Ranches (Pty) Ltd
T0IS00000000011000015	15/110	Palmietfontein 110 IS	CRL Ranches (Pty) Ltd

SG_Code	Port_Farm	Property	Registered
T0IS00000000011000009	9/110	Palmietfontein 110 IS	CRL Ranches (Pty) Ltd
T0IS00000000011000011	11/110	Palmietfontein 110 IS	CRL Ranches (Pty) Ltd
T0IS00000000011000013	13/110	Palmietfontein 110 IS	CRL Ranches (Pty) Ltd
T0IS00000000011000016	16/110	Palmietfontein 110 IS	CRL Ranches (Pty) Ltd
T0IS00000000011000010	10/110	Palmietfontein 110 IS	CRL Ranches (Pty) Ltd
T0IS00000000011000012	12/110	Palmietfontein 110 IS	CRL Ranches (Pty) Ltd
T0IS00000000014700001	1/147	Elandsfontein 147 IS	Livanos, Christie
T0IS00000000010600006	6/106	Yzervarkfontein 106 IS	Neuman Helene
T0IS00000000014000014	14/140	Trichardtsfontein 140 IS	Noord Vrystaat Gran & Vee (Pty) Ltd
T0IS00000000014400000	R/144	Rooipoort 144 IS	Robertson Hendrik Marthinus
T0IS00000000014600011	11/146	Riefontein 146 IS	Jevon Magdalena Dorothea Catharina
T0IS00000000014600002	2/146	Riefontein 146 IS	Jevon Magdalena Dorothea Catharina
T0IS00000000014000019	19/140	Trichardtsfontein 140 IS	Eagle Logistics CC
T0IS00000000014000052	52/140	Trichardtsfontein 140 IS	Kathy Trust
T0IS00000000014000053	53/140	Trichardtsfontein 140 IS	Kathy Trust
T0IS00000000014000031	31/140	Trichardtsfontein 140 IS	Afgri Operations Ltd
T0IS00000000056700000	R/567	Ongezien 567 IS	Rustfontein Eiendoms Trust
T0IS00000000010300002	2/103	Witrand 103 IS	Lirich Trust
T0IS00000000010600000	R/106	Yzervarkfontein 106 IS	Ystervarkfontein Beleggings (Pty) Ltd
T0IS00000000010600011	11/106	Yzervarkfontein 106 IS	Hoeveld Boerdery Trust
T0IS00000000010600007	7/106	Yzervarkfontein 106 IS	Dries Cronje Boerdery CC
T0IS00000000014700022	22/147	Elandsfontein 147 IS	Silver Fox Prop Inv (Pty) Ltd

SG_Code	Port_Farm	Property	Registered
T0IS00000000014700025	25/147	Elandsfontein 147 IS	Silver Fox Prop Inv (Pty) Ltd

5.2.3 Project Overview

The consolidation project area owned by Sasol Mining Twistdraai Thubelisha Colliery comprises three mining right areas namely TCTS, Trichardtsfontein and Vaalkop. Twistdraai Thubelisha Colliery is currently mining TCTS and proposes to start mining Trichardtsfontein within the next few months. Vaalkop mining area although a priority to Twistdraai Thubelisha Colliery will only start mining in 2029. To ensure the mines operate in a more efficient and effective manner Twistdraai Thubelisha Colliery intends to compile (Vaalkop) and consolidate all amended EMPrs into one merged EMPr.

The Trichardtsfontein project area is 3 170 ha in size, but only an area of approximately 1 382 ha will be undermined. The coal seam depth at Trichardtsfontein is estimated to be at an approximate depth of 140 – 160 m below surface. The infrastructure (including access shafts) will be on the adjacent mining property of Sasol Mining at the TCTS. However, two ventilation shafts (up and downcast) have been proposed to be construction on TCTS and two ventilation shafts (up and downcast) have been proposed to be construction on Trichardtsfontein which will assist in providing sufficient ventilation to the underground mining area.

The Vaalkop project area is approximately 8 600 ha in extent. The initial mining activities in this area will be conducted as green field operations as no existing infrastructure for coal mining exists in the area. It is foreseen that the Thubelisha conveyor could possibly be utilised. All mining activities will be conducted by means of underground mining operations, such as the bord-and-pillar and high extraction mining method. No infrastructure will be constructed on the Vaalkop project area as all required infrastructure will be located at the TCTS site. It is estimated that the coal seam depth at Vaalkop is approximately 80 - 120 m below surface.

The TCTS project area is 7 200 ha in size. The coal seam depth at TCTS is estimated to be at a depth of 140 - 170 m below the surface and the seam is approximately 2 – 5 m thick.

In all mining right areas will only mine the No 4 seam as it is the only seam of coal that is economically viable.

Due to the variation in depth of mining and coal seam an assumption has been made that mining will be undertaken between 30 m and 215 m. Therefore all impact assessments and specialist studies have assessed the impacts of mining utilising bord and pillar with high extraction at this depth.

5.2.4 Mining Resource

The Highveld Coalfield extends over an area of approximately 7 000 km^2. A portion of this coalfield is currently exploited by the Sasol Mining operations. The Karoo Supergroup, in which the coal deposits occur, has a thickness of more than 300 m near Standerton in the south and then thins northwards towards the rim of the main Karoo basin. Strata belonging to the Basement Complex and other pre-Karoo formations form the base of the Karoo Sequence. The coal deposits are contained within the Karoo Sequence. The area is underlain by Ecca Group sandstones, shales and Coal seams of the Vryheid formation which may be intruded by dolerite sills and dykes.

The western boundary of the Highveld Coalfield is defined by outcrops of the pre-Karoo Witwatersrand (conglomerate, shale and quartzite) and Ventersdorp (Basalt) Supergroups, while the Eastern Transvaal Coalfield (Shale, sandstone, coal and dolerite sill) forms the western boundary.

The stratigraphy of the consolidation project area coal reserve is comprised of the No. 2, No. 3, No. 4L, No. 4H, No. 5L and the No. 5H coal seams, from bottom to top, with mostly sandstones, siltstones and less frequently, shale, as interburden.

The No. 4 and No. 5 coal seams are continuously developed over the coal reserve, but only the No. 4 coal seam is economically viable to mine with an approximate thickness of 2 – 5 metres. The No. 5, No. 3 and No. 2 coal seams are currently considered uneconomical since they are too thin and erratic in distribution. Due to the presence of a shallow dolerite sill over the area, clay in the soil horizon is mostly formed in situ from the weathering of the dolerite. The weathering depth is highly variable because of the presence of widespread dolerite sub-outcrops.

5.2.5 Mining Method

Due to the depth of the resource (i.e 30 - 215 m) which includes all coal seams over the three mining areas), underground mining will be used to access the ore body. A high extraction method of mining using bord-and-pillar mining with pillar extraction is currently being used at the TCTS and is proposed to be utilised at the Trichardtsfontein and Vaalkop reserve areas. In mechanised bord and pillar mining, extraction is achieved by developing a series of roadways (bords) in the coal seam connected by splits (cut-throughs) to form pillars. In high extraction mining, all the pillars are extracted to allow the roof to collapse in a controlled manner (Stooping). Initially mining will occur to the east and west and move towards the north and south. As per GN704 regulation, stooping will occur outside of the 1:100 floodlines and/or 100 m from the streams, whichever is greater.

Access to the reserves will be achieved via a vertical man and materials shaft and an incline coal shaft located at TCTS. Therefore, no surface infrastructure is proposed to be constructed at the Trichardtsfontein or Vaalkop reserve areas. Coal exits the mine by conveyor via an incline shaft located on the farm Frischgewaagdt 142 IS. The RoM reserve for the TCTS is estimated at 146 million tons. The production rate for the TCTS is estimated at 7.7 million tons of coal per annum. TCTS Life of Mine (LoM) is about 19 years therefore will reach LoM by 2046. A life of Mine Plan for TCTS is provided in Plan 5 C (Appendix B).

Coal mined from the Trichardtsfontein area will be fed through a feeder breaker and then transported by an underground conveyor belt system to the surface at the TCTS, for beneficiation or for sale as raw coal. Between four and six sections will be mined at different times, at a production rate of approximately 80 000 tonnes per section/month. Although total annual production from this area will vary, it will be approximately 2.1 Million tonnes per annum (Mt/a), with a LoM of about 13 years (Plan 5 B– Appendix B).

Coal mined from the Vaalkop area will be fed through a feeder breaker and then transported by an underground conveyor belt system to the surface at the TCTS, for beneficiation or for sale as raw coal. A total annual production rate from the mine will vary, it will be approximately 5.6 Million tonnes per annum (Mt/a), with a LoM of about 18 years (Plan 5 A– Appendix B).

5.2.6 Mining Processing

Coal mined at the Trichardtsfontein and Vaalkop mining areas will be transported by an underground primary conveyor (approximately 3 000 m) to the existing TCTS. Coal mined from the TCTS, Trichardtsfontein and Vaalkop reserves will be transported to the surface via a conveyor belt.

Coal is crushed and stored in a bunker with an emergency coal stockpile for additional storage adjacent to it. It is then transported from the TCTS shaft to the existing Twistdraai Export Plant by existing overland conveyor for beneficiation.

5.2.7 Mine Infrastructure and Operation

The infrastructure layout plan for the consolidation project is included in Plan 3, Appendix B. The infrastructure required to undertake mining activities for the consolidation project are mainly situated at TCTS (Plan 3 A in Appendix B); however it is proposed that two additional ventilation shafts will be constructed at Trichardtsfontein (South Ventilation Shaft) and two additional ventilation shafts will be constructed at TCTS (East Ventilation Shaft) however no infrastructure will be located at Vaalkop.

5.2.7.1 Ventilations Shafts (To be constructed)

To ensure adequate ventilation of a mine, provision is made for suitable paths (airways or air courses) for the air to flow down the mine to the working places and suitable routes out of the mine when it has become unsuitable for further use. The primary ventilation system thus consists of an intake or intakes (or downcasts) through which the fresh air passes through the mine workings, and an exhaust or exhausts (or upcasts) where the air passes after having ventilated the working places of the mine. Mine fans can be installed on the intake airshaft, return airshafts, or both, either on the surface or underground.

It is proposed that two ventilation shafts (downcast and upcast) will be constructed at the TCTS mine (East Ventilation Shaft) while two ventilation shafts (downcast and upcast) will be constructed at the Trichardtsfontein reserve area (South Ventilation Shaft). The upcast ventilation shafts are proposed to be approximately 1.5 ha while the downcast ventilation shaft will be approximately 0.25 ha.

5.2.7.2 TCTS Mine Infrastructure (Already Constructed)

The infrastructure located at TCTS includes the following:

- An above ground shaft which is located around the vertical man and materials shaft and consists of the following:
  - A service water pre-treatment plant;
  - Offices, stores parking and change house and workshop;
  - Bulk fuel storage and substation;
  - Service water storage reservoir, sewage treatment plant;
  - A ventilation shaft and fans; and
  - Clean/dirty water separation canals, berms and dirty water dams.

The conveyor from the incline shaft dumps coal into a silo to the south of the shaft. The silo has been constructed using reinforced concrete with a roof to prevent coal dust dispersion. A coal stockpile area is located to the western side of the bunker. Coal from the silo exits onto a conveyor to a crusher and then is transported via overland conveyor to a washing plant at the Twistdraai Export Plant. The dirty water generated between the coal shaft, silo, crusher and stockpile drain to the dirty water dam to the east and down slope of the stockpile area. Access roads were built to the shaft complex from the N17.

5.2.7.3 Roads, Conveyors and Powerlines

Coal will exit via the incline shaft at TCTS onto an overland conveyor with a service road which runs parallel to it and runs to the wash plant at the Twistdraai Export Plant.

An overland conveyor, 11kVa powerline and service water pipeline is located within the same servitude and runs adjacent to the transfer station on the existing conveyor, south of the N17. After this point the pipeline turns into the existing Syferfontein conveyor servitude towards the Syferfontein Colliery and only the service road and 11kVa powerline continue adjacent to the TCTS conveyor until it reaches the Twistdraai Export Plant. Tarred access roads have been constructed to the shaft complex from the N17. The 11 kVa powerlines reticulate power from the main shaft substation. A 132 kVa powerline has been constructed from a substation at the Twistdraai Colliery: East ventilation shaft to the TCTS.

5.2.7.4 Water Management

5.2.7.4.1 Underground Mining

All stooping will be outside of the 1:100 year floodlines. The minimisation of dirty water will be achieved as follows:

- No watercourses will be directly impacted on by the workings;
- The mining plan has been altered significantly to reduce the volume of dirty water to be managed;
- Underground compartments have been identified and targeted so as to allow storage of water underground;
- As far as is practical, the compartments will be on the downstream side of the underground conveyors and associated access ways;
- By iterating with the mine design team, apart from a period between 2016 and 2018, all surplus water can be stored underground. During this period, surface storage will be provided in the 500 Ml surface dirty water dam, at TCTS;
  - Water will be pumped from underground to the pollution control dam on surface;
  - Water will then be abstracted for dust suppression;
  - As storage becomes available in mined out compartments, these areas will be used to store surplus water; and
- The deficit over the remainder of the operational life is the period where there is sufficient storage underground to mean that no water will need to be pumped to surface. This does not imply that there is not water available; water will be generated underground and may in fact be pumped to surface before being placed back underground, depending on the infrastructure layout. However, it would be more energy efficient to be able to pump from underground directly to the underground storage areas.

5.2.7.4.2 Clean and Dirty Water Management

A clean water berm directs clean runoff around the shaft area. Within the shaft area, the site has been divided into “clean” and “dirty” areas. Clean areas include the offices, change houses and parking areas whilst the dirty areas include the workshop areas. Water generated in the clean areas will drain back to the natural environment catchment which is continuously monitored, while dirty areas will drain to a pollution control dam. All carbonaceous material from both the vertical and inclined shafts is stored in an overburden stockpile. The overburden stockpile is located within the shaft area and the entire area drains to a dedicated pollution control dam. Coal is stored in a bunker and a surface stockpile which drains to a dedicated pollution control dam. The sewage plant discharges to the shaft pollution control dam.

The water use on the mine is estimated to be as follows:

- Water for dust suppression at the coal handling area = 150 m^3/day; and
- Water lost underground, being:
- Water lost with coal = 200 m^3/day; and
- Water lost through the ventilation system = 150 m^3/day.

Water will be used by the Continuous Miners (CMs), but most of the water will be recirculated and is not an additional water use. It is estimated that the CM equipment will require around 1 500 m^3/day.

5.2.7.4.3 Water Treatment where required

The pre-treatment of water reused by mining activities during the operational phase is expected due to the poor quality of water. The current preferred strategy is to treat the water only for hardness during the operational phase, so as to prevent scaling problems on the mining equipment.

Post mining water could potentially be treated to potable standards using the latest technology available at that time. The treated water can be supplied to service providers such as municipalities however this will only be determined once life of mine has been reached.

5.2.7.4.4 Pollution Control Dam

Pollution control dams are located downslope of the following dirty water areas on the mine:

- The shaft area (40 Ml capacity);
- The coal stockpile and bunker area (20 Ml capacity); and
- The transfer station (10 Ml capacity).

Provision has been made for two 500 Ml dams to store mine water surpluses that cannot be stored underground. Only one dam has been constructed, the second dam will only be constructed if necessary.

5.2.7.4.5 Process Water Supply

Process water and water for dust suppression will be obtained via a service water pipeline from Syferfontein Colliery and from the Dirty Water Dams located onsite. Coal washing will not be undertaken at the TCTS.

5.2.7.4.6 Potable Water Supply

Potable water will be obtained from a Rand Water pipeline that passes to the north of the TCTS area.

5.2.7.5 Waste Management

Domestic waste will be disposed of in Secunda at a licensed landfill site (Synfuels Charlie 1 site). Industrial waste will be removed by licensed contractors for recycling. Sewage will be treated before being discharged to the dirty water dam for refuse underground. Licensed contractors (Interwaste/ EnviroServe) will transport hazardous waste to Rietfontein/ Holfontein.

5.2.7.6 Employment

TCTS is currently in operation and therefore a summary of the TCTS operational phase personnel is given in Table 5-5.

Table 5-5: Summary of TCTS operational phase employees

Category	Employment Numbers
Skilled	244
Semiskilled/Unskilled	823
Administrative & Management	154
TOTAL	**1 221**

It is proposed that the Trichardtsfontein and Vaalkop reserves will be mined by Sasol Mining's TCTS employees. No new jobs will be created, but rather a continuation of existing employment. It is envisaged that by year one of the operation, approximately 119 people will be employed and by year five of the operation, approximately 352 people will be employed.

6 Item 3(e): Policy and Legislative Context

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
<u>Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)</u> Section 24 of the Constitution states that everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures, that – i. Prevent pollution and ecological degradation; ii. Promote conservation; and iii. Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development	An EIA process has been undertaken to determine the impacts associated with the consolidation project. As part of the EIA process, mitigation measures and monitoring plans have been recommended to ensure that any potential impacts are managed to an acceptable level to support the rights as enshrined in the Constitution.	A Regulation 31 and basic assessment application to amend the approved EMP and construct the ventilation shafts for the consolidation project was submitted to the Mpumalanga Regional office of the DMR in Witbank on 30 January 2018 detailing the activities being undertaken as part of the consolidation project. A Section 102 application will be submitted with the final EMPr to the DMR. An Amendment Application Process and Basic Assessment Process have been undertaken which includes the compilation of an Amendment report / BAR where the impacts associated with the activities being undertaken at the various mining operations have been determined (Part A: Section 11). The proposed measures in which to mitigate and manage the impacts are also detailed as part of this process in (Part B: Section 5 and 6). A monitoring programme has also been compiled to ensure the consolidation project does result in significant environmental damage during LoM (Part B: Section 8).
<u>Mineral and Petroleum Resource Development Act. 2002 (Act No. 28 of 2002)</u> The MPRDA sets out the requirements relating to the development of the nation's mineral and petroleum resources. It also aims to ensure the promotion of economic and social development through exploration and mining related activities. The MPRDA requires that mining companies assess the socio-economic impacts of their activities from start to closure and beyond. Companies must develop and implement a comprehensive Social and Labour Plan (SLP) to promote socio-economic development in their host communities and to prevent or lessen negative social impacts. The MPRDA requests that a Mine Works Programme is compiled and submitted to the DMR should a new mining right be applied for, changes within the mining operation occur or the mine wishes to renew the mining right. In accordance with the 2014 regulations, all environmental authorisations and EMPs must be submitted to the DMR in the new format to be compliant with the MPRDA.	Two mining rights were awarded for the TCTS, Trichardtsfontein and Vaalkop operations. An amendment of the EMPr for Trichardtsfontein is required to include high extraction mining method. Additionally a consolidation of all EMPrs is required. A Regulation 31 and basic assessment application for the consolidation project has been lodged with the DMR on 30 January 2018. A Section 102 application will be submitted with the final EMPr to the DMR. A mines work programme to include high extraction mining method will be submitted to the DMR. An Amendment Report (this report), which relates specifically to the consolidation project, has been compiled in accordance with the MPRDA read with the EIA Regulations, 2014.	A, Regulation 31 and basic assessment application to amend the approved EMP and construct the ventilation shafts for the consolidation project was submitted to the Mpumalanga Regional office of the DMR in Witbank on 30 January 2018 detailing the activities being undertaken as part of the consolidation project. A Section 102 application will be submitted with the final EMPr to the DMR. An Amendment Application Process and Basic Assessment Process have been undertaken which includes the compilation of an Amendment report / BAR where the impacts associated with the activities being undertaken at the various mining operations have been determined (Part A: Section 11). The proposed measures in which to mitigate and manage the impacts are also detailed as part of this process in (Part B: Section 5 and 6). A monitoring programme has also been compiled to ensure the consolidation project does result in significant environmental damage during LoM (Part B: Section 8).
<u>National Environmental Management Act, 1998 (Act No. 107 of 1998)</u> The NEMA, as amended was set in place in accordance with section 24 of the Constitution of the Republic of South Africa. Certain environmental principles under NEMA have to be adhered to, to inform decision making for issues affecting the environment. Section 24 (1)(a) and (b) of NEMA state that: *The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.* The EIA Regulations (as amended), Government Notice Regulation (GN) R.982 were published	Environmental authorisation in accordance with NEMA was granted for the TCTS operations. A Listed activity under listing notice 1 (GNR983) is considered to be triggered in accordance with the new Environmental Impact Assessment (EIA) Regulations, 2014 (As amended) promulgated in terms of the NEMA for the construction and operation of the ventilation shafts. A Basic Assessment Process will therefore be undertaken to obtain environmental authorisation for the construction and operation of the ventilation shafts. This will be undertaken as a consolidated process in accordance with	A Regulation 31 and basic assessment application to amend the approved EMP and construct the ventilation shafts for the consolidation project was submitted to the Mpumalanga Regional office of the DMR in Witbank on 30 January 2018 detailing the activities being undertaken as part of the consolidation project. A Section 102 application will be submitted with the final EMPr to the DMR. An Amendment Application Process and Basic Assessment Process have been undertaken which includes the compilation of an Amendment report / Basic Assessment Report (BAR) where the impacts associated with the activities being undertaken at the various mining operations have been determined (Part A: Section 11). The proposed measures in which to mitigate and manage the impacts are also detailed as part of this process in (Part B: Section 5 and 6). A monitoring programme

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
on 04 December 2014 and promulgated on 08 December 2014. Together with the EIA Regulations (as amended), the Minister also published GN R.983 (Listing Notice No. 1), GN R.984 (Listing Notice No. 2) and GN R.985 (Listing Notice No. 3) in terms of sections 24(2) and 24D of the NEMA, as amended. **GN R. 982: EIA Regulations, 2014 (As Amended)** These three listing notices set out a list of identified activities which may not commence without an Environmental Authorisation from the relevant Competent Authority through one of the following processes: ▪ Regulation GN R. 983 - Listing Notice 1: This listing notice provides a list of various activities which require environmental authorisation and which must follow a basic assessment process. ▪ Regulation GN R. 984 – Listing Notice 2: This listing notice provides a list of various activities which require environmental authorisation and which must follow an EIA process. ▪ Regulation GN R. 985 – Listing Notice 3: This notice provides a list of various environmental activities which have been identified by provincial governmental bodies which if undertaken within the stipulated provincial boundaries will require environmental authorisation. The basic assessment process will need to be followed.	the one environmental system.	has also been compiled to ensure the consolidation project does result in significant environmental damage during LoM (Part B: Section 8).
<u>National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA)</u> On 29 November 2013, the list of waste management activities published under GN R718 of 3 July 2009 (GN R718) was repealed and replaced with a new list of waste management activities under GN R921 of 29 November 2013. Included in the new list are activities listed under Category A, B and C. These activities include inter alia the following: ▪ Category A describes waste management activities requiring a Basic Assessment process to be carried out in accordance with the EIA Regulations supporting an application for a waste management licence; ▪ Category B describes waste management activities requiring an EIA process to be conducted in accordance with the EIA Regulations supporting a waste management licence application; and ▪ Category C describes waste management activities that do not require a WML but these activities will have to comply with the prescribed requirements and standards as prescribed by the Minister, which includes the Norms and Standards for Storage of Waste, 2013. These activities include the storage of general waste at a facility with a capacity to store in excess of 100 m3 and storage of hazardous waste in excess of 80 m3. The Waste Classification and Management Regulations published under GN R 634 of November 2013 require that all wastes be classified according to SANS10234 and managed according to its classification. The National Norms and Standards for the Assessment of Waste for Landfill Disposal were published under GN R635 on 23 August 2013 and prescribe the requirements for the assessment of waste prior to disposal to landfill in terms of Regulation 8(1)(a) of the Waste Classification and Management Regulations.	A Waste Management Licence (WML) in accordance with NEM:WA was granted for the TCTS operations. As no waste related activities are proposed to be conducted on Vaalkop or Trichardtsfontein, no WML is required. The consolidation project does not trigger any additional listed activities in terms of the NEM:WA and therefore have not been applied for as part of this application.	A Regulation 31 and basic assessment application to amend the approved EMP and construct the ventilation shafts for the consolidation project was submitted to the Mpumalanga Regional office of the DMR in Witbank on 30 January 2018 detailing the activities being undertaken as part of the consolidation project. A Section 102 application will be submitted with the final EMPr to the DMR. An Amendment Application Process and Basic Assessment Process have been undertaken which includes the compilation of an Amendment report / BAR where the impacts associated with the activities being undertaken at the various mining operations have been determined (Part A: Section 11). The proposed measures in which to mitigate and manage the impacts are also detailed as part of this process in (Part B: Section 5 and 6). A monitoring programme has also been compiled to ensure the consolidation project does result in significant environmental damage during LoM (Part B: Section 8).

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
The National Norms and Standards for the Disposal of Waste to Landfill were published under GN R 636 of 23 August 2013 and determine the requirements for the disposal of waste to landfill as contemplated in Regulation 8(1)(b) and (c) of the Waste Classification and Management Regulations. The Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits from a Prospecting, Mining, Exploration or Production Operation were published in GNR 632 on 24 July 2015 under section 69(1)(i) of the NEM:WA. The purpose of the Regulations is to regulate the planning and management of residue stockpiles and residue deposits from prospecting, mining, exploration or production operations.		
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) NEM:BA regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act also regulates the protection of species and ecosystems that require national protection and also takes into account the management of alien and invasive species. This Act works in accordance to the framework set under NEMA. The following regulations which have been promulgated in terms of the NEM:BA are also of relevance: ▪ Alien and Invasive Species Lists, 2014 published (GN R.599 in GG 37886 of 1 August 2014) ; ▪ National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations; and ▪ National list of Ecosystems Threatened and in need of Protection under Section 52(1)(a) of the Biodiversity Act (GG 34809, GN R.1002, 9 December 2011).	As part of this consolidation project, flora, fauna, wetlands and aquatic have been investigated to determine the current status of the environment and to determine any potential ecological sensitivity to be avoided and/or mitigated. The study focused specifically on the Vaalkop area while other information obtained from previous studies completed for Trichardtsfontein and TCTS was utilised. There are currently no applications submitted in terms of NEM:BA for the consolidation project.	The biological assessment details the areas within the consolidation project site which are of ecological importance. The findings of the biodiversity assessments in the form of the impacts and the proposed mitigation measures undertaken for the consolidation project site is detailed in Part A: Section 11 and Part B: Section 5 and 6 of this report. A list of threatened species that may occur within and may be impacted by the consolidation project has been listed in Section 10.1.8 and in Appendix J.
National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) The act aims to provide protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas.	Officially protected areas, either Provincially or Nationally that occur close to a consolidation project site could be impacted by the consolidation project.	A Fauna and Flora Impact Assessment has been undertaken to determine whether any protected areas are located within the consolidation project site. It has been determined that the nearest protected area is approximately 30 km to the east of the consolidation project site.
National Water Act, 1998 (Act No. 36 of 1998) (NWA) The NWA provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that the National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA. **GN R704 National Water Act, 1998 (Act No. 36 of 1998)** Regulations 4 and 5 of the regulation on use of water for mining and related activities aimed at the protection of water resources, Government Notice Regulation 704 (GN R No. 704) published in June 1999, states the following: ▪ Regulation 4: No residue deposit, reservoir or dam may be located within the 1:100 year flood line, or less than a horizontal distance of 100 m from the nearest watercourse.	The IWUL for the TCTS was approved in 2011 (04/B11C/ACGIJ/995). It is determined that no IWUL will be applied for the Trichardtsfontein as no activities are triggered for the mining of the area. It is noted that mining of Vaalkop will require an IWUL however this will be applied for separately at a later stage. It should be noted that a general authorisation for a WUL for the construction of the ventilation shafts must be obtained due to the ventilation shafts being located within 500 m of a wetland. Should it be determined that an amendment to the TCTS IWULA is required this will be undertaken by Sasol Mining.	An IWULA was submitted to the DWS for the triggered water uses under Section 21 of the NWA. The IWUL has been approved by the DWS for the TCTS operation and its related water uses. A general authorisation for the construction of the ventilation shafts will be submitted to the DWS.

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Furthermore, person(s) may not dispose of any substance that may cause water pollution. ▪ Regulation 5: No person(s) may use substances for the construction of a dam or impoundment if that substance will cause water pollution. ▪ Regulation 6 is concerned with the capacity requirements of clean and dirty water systems, while Regulation 7 details the requirements necessary for the protection of water resources.		
National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA) According to the NEM: AQA the Department of Environmental Affairs (DEA), the provincial environmental departments and local authorities (district and local municipalities) are separately and jointly responsible for the implementation and enforcement of various aspects of NEM: AQA. A fundamental aspect of the new approach to the air quality regulation, as reflected in the NEM: AQA is the establishment of National Ambient Air Quality Standards (NAAQS) (GN R 1210 of 2009). These standards provide the goals for air quality management plans and also provide the benchmark by which the effectiveness of these management plans is measured.	Air Quality has been considered for the consolidation project. The activities proposed to take place do not trigger any air quality activities and therefore no Air Emissions License will be applied for.	The consolidation project activities have been set out to abide by the NEM: AQA and standards set out in the National Ambient Air Quality Standards. The impacts on air quality associated with all mining activities have been determined (Part A: Section 11). The proposed measures in which to mitigate and manage the impacts are also detailed as part of this process in (Part B: Section 5 and 6). A monitoring programme has also been compiled to ensure the consolidation project does result in significant environmental damage during LoM (Part B: Section 8).
National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) is the overarching legislation that protects and regulates the management of heritage resources in South Africa. The Act requires that Heritage Resources be managed and conserved by a Resource Authority, either nationally, by the South African Heritage Resources Agency (SAHRA) or by the relevant provincial Agency. In this case, the Provincial Heritage Resources Authority Mpumalanga (PHRA-M) is responsible for the identification, conservation and management of heritage resources throughout the province.	An Archaeological Impact Assessment was completed as part of the Amendment Application Process to update and consolidate the EMP which was submitted to the Mpumalanga Provincial Heritage Resources Authority (PHRA-M) and the South African Heritage Resources Authority (SAHRA).	All heritage/archaeological resources associated with the consolidation project site have been identified and will be avoided. Any chance finds will be communicated to SAHRA and the PHRA-M. The impacts to heritage resources have been determined ((Part A: Section 11). The proposed measures in which to mitigate and manage the impacts are also detailed as part of this process in (Part B: Section 5 and 6). A monitoring programme has also been compiled to ensure the consolidation project does result in significant environmental damage during LoM (Part B: Section 8).
National Noise Control Regulations, R.154 of 1992 (the Noise Regulations) promulgated in terms of Section 25 of the Environmental Conservation Act, 1989 (Act 73 of 1989) The National Noise Control Regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) (NCRs) form part of the Environmental Conservation Act and these Regulations apply to external noise. The NCRs differentiates between Disturbing Noise levels (which is objective and scientifically measurable which are generally compared to existing ambient noise level) and Noise Nuisance (which is a subjective measure and is defined as noise that "disturbs or impairs or may disturb or impair the convenience or peace of any person"). Local Authorities use Controlled Areas to identify areas with high noise levels. Restrictions have been set out for development that occurs in these Controlled Areas. These regulations make provision for guidelines pertaining to noise control and measurements. The regulations make reference to the use of the South African National Standards 10103:2008 (SANS) guidelines for the Measurement and Rating of Environmental Noise with Respect to Land Use, Health, and Annoyance and to Speech Communication. As such, a Noise Impact Assessment in accordance with the NCRs must be undertaken for submission to determine the potential disturbing and nuisance noise levels associated with a	Noise assessments have been undertaken for the consolidation project to determine the potential impacts associated with mining activities at TCTS, Trichardtsfontein and Vaalkop including the construction and operation of the ventilation shafts.	The consolidation project activities will be set out to abide by the National Noise-Control Regulations and standards set out in the SANS 10103:2008. The noise impacts have been determined (Part A: Section 11). The proposed measures in which to mitigate and manage the impacts are also detailed as part of this process in (Part B: Section 5 and 6). A monitoring programme has also been compiled to ensure the consolidation project does result in significant environmental damage during LoM (Part B: Section 8).

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
particular development.		
National Development Plan (NDP) Development in South Africa is guided by the NDP, which presents a shared long-term strategic framework within which more detailed development planning can take place to advance the long-term goals adopted in the NDP (National Planning Commission, 2011). The Plan aims to ensure that all South Africans attain a decent standard of living through the elimination of poverty and the reduction of inequality. The NDP 2030 sets a target of creating approximately 11 million new jobs and achieving an annual average economic growth rate of 5.4 % by 2030.	This NDP will be applicable in guiding the consolidation project to ensure that all South Africans attain a decent standard of living through the elimination of poverty and the reduction of inequality	The consolidation project will create various job opportunities for the local communities during the Operational of the mine. The details associated with social upliftment for the consolidation project has been discussed in the Social Labour Plan (SLP).
South African Mining Charter The Mining Charter focuses on sustainable transformation of the mining industry. The Mining Charter seeks to achieve the following objectives: ▪ Promote equitable access to the nation's mineral resources to all the people of South Africa; ▪ Substantially and meaningfully expand opportunities for HDSAs to enter the mining and minerals industry and to benefit from the exploitation of the nation's mineral resources; ▪ Utilise and expand the existing skills base for the empowerment of HDSAs and to serve the community; ▪ Promote employment and advance the social and economic welfare of communities and major labour sending areas; ▪ Encourage beneficiation of South Africa's mineral commodities; and ▪ Promote sustainable development and growth of the mining industry.	A baseline social impact assessment has been undertaken to assess the social and economic aspects of the current social climate. Management and mitigation measures will be developed and aligned to the Mining Charter.	The social impacts associated with all mining activities have been determined (Part A: Section 11). The proposed measures in which to mitigate and manage the impacts are also detailed as part of this process in (Part B: Section 5 and 6). A monitoring programme has also been compiled to ensure the consolidation project does result in significant environmental damage during LoM (Part B: Section 8).

Table 6-1: Provincial Legislation

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Mpumalanga Tourism and Parks Agency Act, 2005 (Act No. 5 of 2005) (MTPA) The MTPA sets out to promote and sustainably manage tourism and nature conservation and provide for the sustainable use of natural resources within the Province. In pursuing its objectives, the MTPA is required to: ▪ Conserve and manage biodiversity; ▪ Develop and manage protected areas; ▪ Promote, develop and market tourism; and ▪ Create growth and transformation within the industry, and thereby economic and employment opportunities for disadvantaged people.	This report has been compiled in accordance with the NEMA and its regulations thereof and relevant Specific Environmental Management Act(s) (SEMAs) where applicable. In addition, the report will, as far as possible, meet the requirements of the MTPA where required.	The biological assessment details the areas within the consolidation project site which are of ecological importance. The findings of the biodiversity assessment in the form of the impacts and the proposed mitigation measures undertaken for the consolidation project site detailed in Part A: Section 11 and Part B: Section 5 and 6 of this report. A list of threatened species that may occur within and may be impacted by the consolidation project has been listed in Section 10.1.8 and in Appendix J.

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA) The MNCA sets out how wild species are to be managed in terms of human use, such as collecting, fishing, hunting, capture, transport and trade. The MNCA deals with rare and endangered species and the powers needed to protect them, as well as the protection of sensitive natural sites from damage and exploitation.	This report has been compiled in accordance with the NEMA and its Regulations. In addition the report will, as far as possible, meet the requirements of the MNCA where applicable.	The biological assessment details the areas within the consolidation project site which are of ecological importance. The findings of the biodiversity assessment in the form of the impacts and the proposed mitigation measures undertaken for the consolidation project site detailed in Part A: Section 11 and Part B: Section 5 and 6 of this report. A list of threatened species that may occur within and may be impacted by the consolidation project has been listed in Section 10.1.8 and in Appendix J.

7 Item 3(f): Need and Desirability of the Proposed Activities

The need and desirability of the consolidation project has been considered at an economic, social and environmental level which has been discussed below.

7.1 Economic Consideration

South Africa economic growth is historically largely focused on the mining sector with specific reference on coal mining which has allowed the economy to be one of the strongest in Africa. Coal provides a total of 6.1% of the country's total merchandise exports. South Africa holds a total of 31 billion tonnes of recoverable coal reserve which is equivalent to 11 % of the world's total coal reserve. This places South Africa as the sixth largest holder of coal in the world. A total of 77% of the coal mined within South Africa is utilised within the energy sector, however 69 million tonnes of coal is exported per annum to various countries (Department of Energy (DoE), 2016).

The consolidation project is located within the Mpumalanga province which is considered to be rich in coal. A number of mining companies have established themselves within this area due to the richest of this resource in the area. It is predicted that 83% of the total amount of coal produced in South Africa is mined in Mpumalanga (Universal Coal, 2016)

It is predicted that the South African Mining industry is the largest provider of jobs with around 460 000 employees and a further 400 000 employed by the suppliers of good and services in the industry. The coal mining industry is responsible for significant levels of direct and indirect employment in South Africa with approximately 87 768 people employed directly in coal mining in 2014.

Sasol Mining has for many years provided coal to its petrochemical operations which is then sold to both the domestic and international markets as well as for export purposes. TCTS has been operating as an underground coal mine since 2010, it is proposed that Trichardtsfontein will begin mining once authorisation has been granted to include the high extraction method of mining as well as the construction and operation of the ventilation shafts. Additional coal will be extracted from the Vaalkop operation once mining commences in 2029.

Sasol's annual contribution to the South African GDP amounts to approximately R 40 billion of which R 22 billion is a direct contribution. Sasol produces approximately 34% of the countries liquid fuel requirements and as least 20% of the countries saleable coal.

Sasol Mining supplies coal to Sasol Synfuels Operation (SSO) who processes the coal to produce petrol, diesel, chemicals and chemical by-products. Additionally a certain amount of coal is exported to European and Asian markets.

7.2 Social Consideration

Sasol Mining contributes substantially to the creation of employment and development of various social initiatives to assist and provide opportunities to Historically Disadvantaged Sasol Mining contributes substantially to the creation of employment and development of various social initiatives to assist and provide opportunities to Historically Disadvantaged South Africans (HDSA)s. It is not predicted that any new job opportunities will be created from the various mines however the mine will have a cumulative impact on the social environment as various mines within Mpumalanga are proposed to reach Life of Mine within the next five years. Through the acquisition of the various reserves and commencement of the mining operation it would be possible to extend the life of the Secunda Synfuels Plant to 2050 as well as to continue supplying coal for export, thus ensuring Job security of the employees at the TCTS operation as well as continued supply of coal for the production of transportation fuels and chemicals.

The conslidated SLPs has been compiled for TCTS, Trichardtsfontein and Vaalkop which outlines the Local Economic Development (LED) programmes set for the surrounding community. The main priority of the LED programmes is to improve the educational facilities within the surrounding communities. As part of its LED planning, Sasol Mining also intends to implement measures to advance procurement from HDSA suppliers and will continually seek to allocate an amount of annual expenditure in services and consumables to suppliers with this status.

Sasol Mining aims to provide training that will contribute to the growth and potential upward mobility of employees. Sasol Mining offers various skills development programs for employees to develop current employee’s skills enhance performance and provide a skills pipeline to address the hard to fill vacancy challenges. Training is divided into the following categories:

- To increase current employee literacy levels;
- To address skills shortages in the mining industry;
- To develop current and future competency levels of employees;
- To meet the unique skills needs of the Sasol Mining and South Africa; and
- To ensure alignment with National Qualifications Forum requirements.

Various learnership programmes have also been set up to provide learners with opportunities to acquire skill sets to enter into the job market and are offered permanent positions at Sasol Mining depending on the need. Sasol Mining has in-house training centres situated in Secunda which forms part of the Global Learning Development. All candidates are drawn from the local communities of the Goven Mbeki, Dipaleseng, Lekwa Municipality and other areas.

7.3 Environmental Consideration

It is envisaged that the consolidation project will result in a negative impact on the physical environment and positive on the social environment as mining continues to develop from TCTS to Trichardtsfontein and Vaalkop. It is noted that the mining rights for all mining areas have previously been granted and therefore these impacts would have been anticipated and considered.

The consolidation project however proposes the change of mining method from bord and pillar to bord and pillar with high extraction mining method and therefore it is envisaged that even though the current environmental state has already been altered by mining activities (TCTS) the use of high extraction mining could have a negative impact to the environment due to the resultant subsidence which is anticipated. It should be noted that rock engineering reports and relevant regulations are adhere to in current Sasol mining area The construction of the ventilation shafts is not anticipated to have a significant negative impact on the environment given the localised extend.

During the EIA phase specialist studies that relate to the physical, biological and socio-economic environmental aspects potentially affected by the consolidation project, were undertaken.

The findings of the studies are summarised in Section 10.1, Part A and the reports are appended to this EIA. The impact assessment (Section 11, Part A) quantified the expected impacts of each project activity. Mitigation measures were also identified for each of the expected impacts and are detailed in Section 5 and 6 (Part B).

8 Item 3(g): Motivation for the Preferred Development Footprint within the Approved Site including a Full Description of the Process followed to reach the Proposed Development Footprint within the Approved Site

In accordance with the EIA Regulations, 2014 (as amended), a full description of the process followed to reach the proposed preferred activity, site and location must be undertaken. Alternatives help identify the most appropriate method of developing a project, taking into account location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the no-go alternative. Alternatives must also take into consideration inputs during the Public Participation Process (PPP), environmental attributes and the impacts and risks identified as per each alternative to help identify the activity with a reduced environmental and/or social impact.

The purpose of this report is to amend and consolidate the Mining Rights and EMPrs pertaining to the TCTS, Trichardtsfontein, into a single Mining Right and EMPr and to compile the Vaalkop EMPr and consolidate it within the same report. Sasol Mining is proposing additional infrastructure in the form of two new ventilation shafts to be constructed at TCTS (East ventilation shaft) and two new ventilation shafts to be constructed at

Trichardtsfontein (South Ventilation Shaft). Additionally Sasol Mining wish to change the mining method approved for Trichardtsfontein from only bord and pillar to bord and pillar mining method with high extraction mining.

As part of the 2008 TCTS EIA/EMPr that was completed for the operation of the mine, alternatives were considered. No alternative for Trichardtsfontein and Vaalkop were considered as no infrastructure was proposed to be constructed and the mine location was dependent on the location of the resource.

The only alternative for this amendment process can be considered for the location of the ventilation shafts. No alternative have been considered for the mining method or mining process as this was considered previously. High extraction mining will only occur in certain areas. It is noted however that no high extraction will be undertaken within 100 metres of a water course or wetland.

8.1 Ventilation Shaft Location Alternatives

The location of the ventilation shafts is dependent on the underground operation and where additional ventilation is required in the underground workings for health and safety purposes. It is noted that the ventilation shafts have been positioned based on health and safety as well as environmental factors. It can be confirmed that the preferred ventilation shaft location is situated outside the 1:100 floodline however it is located within a 500 m buffer of the wetlands and aquatic habitats, is not located on any sensitive environmental features such as threatened habitats, wetlands, archaeological or grave sites, and is far enough away from human habitation to ensure that noise and dust will not affect neighbours. The placing of shaft infrastructure is done carefully to avoid impacts on the few wetlands in the area.

8.2 Previously Considered Project Alternatives

The primary purpose of considering alternatives is to minimise the wastage of a non-renewable resource (coal) while at the same time avoiding, as far as possible, irreversible environmental impacts. Methods for achieving these objectives in the present project included:

- Identification and exclusion of sensitive environmental features; and
- Evaluation of alternative mining methods, infrastructure and mine layouts.

Alternatives were previously investigated for the operation of the TCTS mine which has been discussed below and extracted from the TCTS EIA/EMPr, 2008, compiled by Oryx Environmental. It is noted that no alternatives for Trichardtsfontein was investigated during the EIA phase for that project.

8.2.1 Alternative Land Use

Land use is determined by a number of factors that include climate, resources, population growth, economic activity and topography. Previously agriculture was the land use at TCTS as mining had not yet commenced and provided a viable alternative involving the cultivation of maize as well as grazing activities. If mining activities had not commenced the land use would have remained agricultural as the status quo.

It was proposed that the land use would change to mining however it was noted that as the TCTS project only involved underground mining only a small area would be lost to mining activities for the construction of the required infrastructure. However, as high extraction mining was proposed, subsidence would likely have occurred in these areas and thereby having an impact to the surface operations which would have potentially impact agricultural activities. Where surface drainage is impeded as a result of subsidence it will be re-established by re-contouring of the soils. The undulating topography of the area is conducive to such remedial measures and crop and grazing land will be largely unaffected by mining activities.

Loss of boreholes supplying stock watering will, however, hamper stock farming and such supplies will have to be re-established as part of mining mitigation. Overall farming activities would have been largely unaffected and mining activities would be able to continue.

It was predicted that mining would result in an estimated Gross Domestic product (GDP) contribution to the local economy of the order of R 500 million (based on construction wages plus an estimation of 50% of construction capital costs at 2008 prices) and employment for 500 workers during construction (Which has now been completed). During the operational period of 20 years this figure will be approximately R 419 million per annum and create 1 221 jobs

8.2.2 Shaft and Ventilation Shaft Locations

8.2.2.1 Shaft Location

A number of shaft positions were evaluated around the location of a central operation in the reserves. It was found that geological and other conditions were a limiting factor and resulted in only certain areas being conducive to positioning the shaft. The approximate location of the shaft was moved to the north east of the reserves where geological and environmental conditions were found to be favourable. The preferred shaft location is situated on top of a hill and is well away from the 1:100 floodline of the Piekespruit, is not located on any sensitive environmental features such as threatened habitats, wetlands or archaeological or grave sites, and is far enough away from human habitation to ensure that noise and dust will not affect neighbours. The placing of shaft infrastructure was done carefully to avoid impacts on the few wetlands in the area.

8.2.3 Mining Method

The mine will extract the No. 4-seam, which is located 30 - 215 m below the surface and is approximately 2-5 m thick. The variation is depth is dependent on the mining right area. A high extraction method of mining using bord-and-pillar mining with pillar extraction (high extraction mining) will be used. This method of mining was chosen because the reserves are too deep for open cast mining and too optimize the coal extraction since this is one of the last coal reserves of export quality in the area.

8.2.4 Mineral Processing Method

Coal will only be extracted and processed at TCTS, no coal will be processed at Trichardtsfontein or at Vaalkop. The coal extracted from TCTS is crushed at the mine and transported from the shaft to the existing Twistdraai Export Plant (TEP) by overland conveyor for beneficiation. The Middlings from this process with go to the Sasol Synfuels plant, by means of existing infrastructure.

8.2.5 Transport, Power and Water Supply Routes

Coal will be conveyed by overland conveyor during the operational phase from TCTS to TEP as this option has less environmental impacts than road transport and is more efficient. Of the two routes investigated during the 2008 EIA/EMPr, the route adjacent to the current Syferfontein conveyor was chosen to confine all impacts to one corridor (This conveyor belt has now been fully constructed and is currently operational). The cumulative noise impact of the two conveyors running side by side will be mitigated by the introduction of plastic rollers.

A 132 kVa powerline has been constructed from a substation at Twistdraai Colliery: East shaft to the TCTS along farm boundaries. The alternative of bringing the line from the Twistdraai Export Plant along the Syferfontein conveyor was rejected due to power supply capacity problems at this source.

A service water supply pipeline from Syferfontein Colliery to the west has been constructed in the existing Syferfontein conveyor servitude and a potable water pipeline has been constructed in a new servitude directly from the Rand Water pipeline located approximately 200 m to the north of the shaft. The selected route was the most obvious and do not introduce any new impacts to the area.

8.2.6 No Go Alternative

Mining activities are currently occurring at TCTS which is a fully operational mine. Additionally, a mining right has been obtained to mine Trichardtsfontein and Vaalkop. Therefore, should authorisation not be obtained for the amended and consolidated EMPr the following may occur:

- Mining activities will still be undertaken at TCTS and Trichardtsfontein. However, a health and safety risk is posed as ventilation shafts are required to increase the amount of oxygen being brought underground;
- No mining will be undertaken at Vaalkop as it will not be permitted to operate without an approved EMPr;
- Additionally high extraction mining will not be utilised while mining Trichardtsfontein. Therefore, the risk of subsidence is reduced as long as the highest safety factors is utilised while mining is being undertaken. However, this may mean that the coal

reserve is not fully realised which will lead to a loss in economic revenue which will impact on the economy. Should these pillars be left other potential mining companies may attempt to apply to extract these pillars once mining has ceased.

- Even if these pillars are not mined, once mining activities have ceased, over time these pillars may become weakened through natural weathering processes which can result in cracking and subsidence where pillar strength is reduced which may have an impact on both the environment and health and safety.
- Sasol Mining will also operate under two separate mining rights with two separate EMPrs which may prove to be inefficient in terms of management of the mines.

8.2.6.1 Change in Non-Renewable resource from Coal to Gas

Coal is utilised to power the Sasol operation to generate fuel. An alternative energy source which Sasol Mining could utilise is gas. It is proposed that a gas pipeline will be constructed between Mozambique and South Africa by expending the capacity of the existing 865 km of gas pipeline from the Central Processing Facility (CPF) at Temane in Mozambique to Secunda in South Africa. The consolidation project involves the installation of a pipeline parallel to the existing pipeline, from scraper station 1 (STS1), which is about 128 km from the CPF, over a length of 127 km where it connects back into the main pipeline at scraper station 2. Although this alternative is a viable option for Sasol Mining who are investigating the consolidation project and have secured funds to implement the consolidation project, it is currently not a viable option for this proposed consolidation project. It should also be noted that if Sasol Mining does not mining Trichardtsfontein and Vaalkop, the resource may be exploited by another company.

9 Item 3(g)(ii): Details of the Public Participation Process followed

The Public Participation Process (PPP) was developed to ensure compliance with environmental regulatory requirements and to provide Interested and Affected Parties (I&APs) with an opportunity to evaluate the consolidation project. During this process stakeholders are able to provide inputs and to receive feedback from the environmental specialists and/or proponent. This section provides an overview of the PPP undertaken.

A summary of the PPP activities undertaken during the Amendment Application phase are provided in Table 9-1. Consultation with I&APs during the Impact Assessment Phase was undertaken as follows:

- Telephonic pre-consultation was held with the various land owners as well as adjacent land owners;
- The Amendment Report / BAR was available at Public Libraries and on the Digby Wells website;

- Project announcement materials were emailed and posted to the stakeholder database – an SMS was also sent to stakeholders;
- An advertisement was placed in a local newspaper;
- Site notices were placed at various public places;
- Key stakeholders were consulted telephonically; and
- A Comments and Response Report (CRR) will be compiled to incorporate all comments received during the PPP.

9.1 Stakeholder Identification

To ensure a proper representation of all stakeholders, the following identification methods were used to update the already compiled stakeholder database:

- Verifying the existing stakeholder database for the project site;
- Desktop and online research;
- Stakeholder networking and discussions to source additional stakeholder details; and
- Conducting Windeed searches in and around the project site to verify land ownership and obtain contact details.

Stakeholders identified who are effected by or interested in the consolidation project were grouped into the following broad categories:

- Government: National, Provincial, District, Local authorities;
- Land occupiers: Directly affected and adjacent;
- Communities: Directly affected and adjacent communities;
- Non-Governmental Organisations (NGOs): Environmental organisations, community-based organisations
- Landowners: Directly affected and adjacent landowners; and
- Business: small medium enterprises, mines and formal business organisations.

A detailed description of the various stakeholder categories is provided in further detail in the Public Participation Report (Appendix C) and a full list of stakeholders is categorised and included in the stakeholder database.

9.1.1 Government

The following government departments have been informed and/or consulted:

- South African National Heritage Resources Agency;
- Department of Mineral Resources;
- Department of Environmental Affairs;

- Department of Agriculture , Forestry and Fisheries;
- Regional Office of the Department of Water and Sanitation;
- Mpumalanga Department of Economic Development, Environment and Tourism; now is Department of Agriculture Rural Development Land and Environmental Affairs.
- South African National Roads Agency;
- Govan Mbeki Local Municipality; and
- Gert Sibande District Municipality.

9.1.2 Directly Affected Farms

A list of directly and adjacent landowners have been identified and listed in Appendix A of the Public Participation report (Appendix C).

9.1.3 Communities

The ward councillors for the affected wards were identified as part of the PPP. The councillors were engaged in an effort to identify affected communities and the relevant leadership structures. The following ward councillors located within the GMLM where notified and communicated with on the consolidation project:

- Wards 5;
- Ward 15; and
- Ward 25.

9.1.4 Non – Governmental Organisations

The following NGOs were identified and consulted during the process:

- Wildlife and Environment Society of South Africa (WESSA);
- Working for Wetlands;
- World Wildlife Federation;
- Birdlife South Africa; and
- Chamber of Commerce.

9.1.5 Business

The following businesses or business entities were identified and consulted during the process:

- Chamber of Business;
- Eskom Holdings;
- Telkom SA; and

- Transnet; and
- Sanral.

9.2 Consultation with Stakeholders during Amendment Application Phase

The premise of activities was to ensure that the various legislative requirements for PPP are met and that a single, integrated process was followed. This will limit stakeholder fatigue and ensure that stakeholders are presented with a single view of the full consolidation project and amendment information. PPP activities during the Amendment Application phase has revolved around I&APs providing comments on specialist study findings, recommendations and mitigation measures proposed. These studies and recommendations are included as part of this draft EIA Report.

9.3 Summary of PPP Process

The above-mentioned PPP activities have been summarised in Table 9-1.

Table 9-1: Summary of PPP Activities during the EIA Process

Activity	Details	Reference in Report
	Scoping Phase	
Identification of stakeholders	A stakeholder database was developed which includes I&APs from various sectors of society – this includes directly affected and adjacent landowners, in and around the consolidation project site.	**Appendix C1:** Stakeholder Database
Distribution of the Project announcement materials	A Background Information Letter (BIL), announcement letter with Registration and Comment Form was emailed and posted to stakeholders on 29 January 2018.	**Appendix C2:** BIL, letter with registration and comment sheet
Placement of Advertisement	An English advert for the notification of the Draft Amendment Report / BAR was placed in the **Wednesday, 31 January 2018 to Thursday, 1 March 2018**.	**Appendix C3** Advertisement
Putting up of site notices	Site notices were put up at the project site and around the project area on 30 January 2017.	**Appendix C4:** Site Notice
Placement of Draft Amendment Report	Copies of the Draft Amendment Report / BAR were made available at the Secunda Public Library, Bethal Public Library and and also available on the Digby Wells Website www.digbywells.com (Public Documents)	**N/A**

Activity	Details	Reference in Report
Announcement of Final the Amendment Report / BAR	Announcement of availability of the Amendment Report / BAR will be emailed and posted to the database .SMSs will also be sent to the full database on indicating availability of the Amendment Report / BAR.	**N/A**
Obtained comments from stakeholders	Comments, issues of concern and suggestions received from stakeholders during the Amendment phase are captured in the CRR.	**No comments have been recived todate. The CRR will be updated once comments have been recived during the PPP.**

9.4 Item 3(g)(iii): Summary of Issues raised by I&APs

No comments have been received to date. The report will be updated with any comments received from I&APs.

10 Item 3(g)(iv): The Environmental Attributes associated with the Development Footprint Alternatives

The information contained in this section which highlights the baseline environment of the consolidation project has been obtained from the various EMPrs, literature reviews, previous specialist studies, desktop research and aerial imagery. As the TCTS, Trichardtsfontein and Vaalkop operations are situated next to each other, the information has been consolidated as opposed to providing baseline information for each operation.

Previous as well as new Specialist studies have been completed for the consolidation project. These studies were completed in 2008, 2014 and 2017. The baseline environment has therefore been updated and this information utilised to complete this report.

10.1 Type of Environment affected by the Proposed Activity

A number of specialist studies were undertaken during the consolidation project. The information provided in this section has been obtained from these reports. For the purposes of this EIA report the **consolidation project site** refers to the mining right area which includes TCTS, Trichardtsfontein and Vaalkop operations, whilst the **consolidation project area** refers to the local areas surrounding the consolidation project site.

10.1.1 Climate

The climate in this area generally experiences moderate temperatures with summer months being warm and winter mothers being cold with occasional frost. Summer months are from October to April and winter months are from May to September. The average rainfall is in excess of 600 mm in summer months, with the highest rainfall occurring in January and the lowest rainfall in June.

10.1.1.1 Meteorology

The spatial and annual variability in the wind field for the consolidation project area shows the dominant winds are blowing from North of Northwest (10.4%) and Northwest (9.9%) respectively. Secondary winds were coming from the north (8.9%), northeast (8.6%) and east northeast (8.3%). Calm conditions (wind speeds <0.5 m/s) occurred 6.3% of the time.

There is some diurnal variation in the meteorological data shown in Figure 10-1. The predominant wind direction is northeast and north with 14.9% and 13.4% respectively, north northwest (12.8%) and north (11.6%) in the morning, northwest in the afternoon (16.3%) and northwest (10.2%) in the evening.

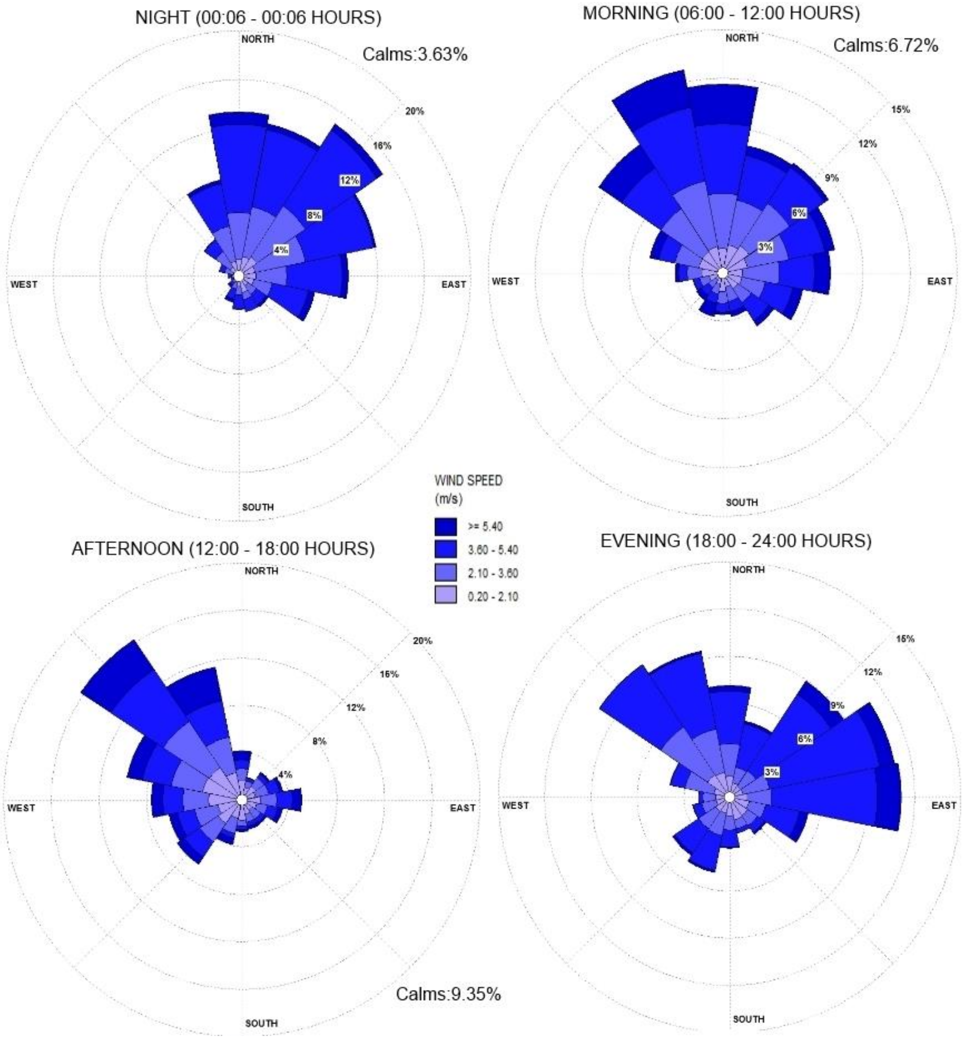

Figure 10-1: Diurnal variations of wind at night-time: 00:00 – 06:00 (top left), morning 06:00 – 12:00 (top right), afternoon 12:00 – 18:00 (bottom left) and evening 18:00 – 00:00 (bottom right)

The seasonal signature show winds from the northwest and north-northwest dominating in autumn, winter and spring, except summer when winds from northeast and east northeast dominated. The wind class frequency distribution per sector is given in Figure 10-2.

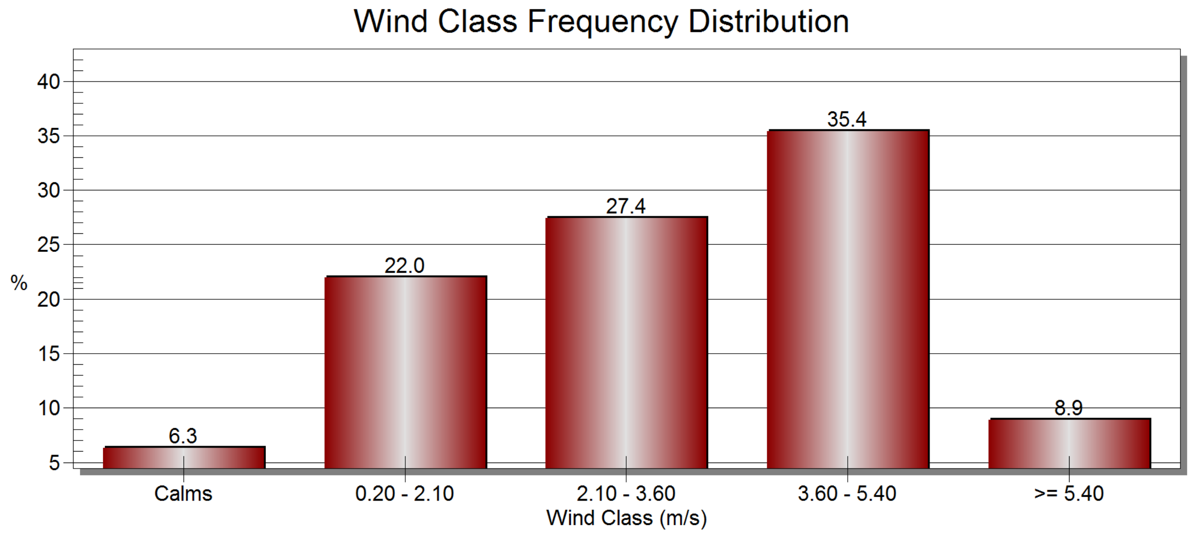

Figure 10-2: Wind Class Frequency Distribution

10.1.1.2 Wind Speed

One of the factors that favour the suspension and resuspension of loose particulates in the atmosphere is the intensity of the wind speed regime. Wind speed greater than 5.4 m/s leads to erosion of loose dust PM and the degree of dispersion across the landscape. Table 10-1 shows that wind speed greater than 5.4 m/s occur every month with increases observed from the months of June to October. Although average wind speed is generally below 5.4 m/s, it can be seen that the potential is there for wind erosion to occur each month. In total, 30 days in a year recorded wind speed greater than 5.4 m/s (~ 3 days in a month).

Table 10-1: Monthly Wind Speed Records

Wind Speed (m/s)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Monthly Max.	8	9	13	11	8	12	10	11	11	15	12	10	11
Monthly Ave	3	3	3	3	3	3	3	3	4	4	4	4	3

10.1.1.3 Temperature

The monthly maximum and average temperature for the consolidation project area is given in Table 10-2. The maximum temperatures were observed from October to February with the month of January recording the highest temperature of 31°C. The monthly averages ranged from 9°C in June to 20°C in December/January/February. The annual average temperature for the consolidation project site is given as 15°C.

Table 10-2: Monthly Temperature Records

Temp(°C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Monthly Max.	31	29	28	25	21	18	17	23	25	29	29	30	25
Monthly Ave	20	20	18	15	12	9	8	12	15	17	19	20	15

10.1.1.4 Precipitation

Table 10-3 presents the average monthly rainfall for the quaternary catchments B11C and B11D. This is based on the averages of monthly rainfall data from the period 1920 to 2009.

Table 10-3: Summary of rainfall data extracted from the WR2012

Month	MAP (mm)	
	B11C	B11D
January	118.8	118.4
February	89.0	88.8
March	76.1	75.9
April	38.5	38.4
May	17.3	17.2
June	7.7	7.6
July	5.8	5.8
August	7.4	7.4
September	25.3	25.2
October	69.6	69.4
November	107.3	107.0
December	110.2	109.8
MAP	**673**	**671**

From the rainfall data above, higher rainfall averages in the B11C quaternary catchment (107.3 mm, 110.2 mm and 118.8 mm) were recorded for the months of November, December and January respectively whilst on the B11D higher rainfall averages occurs on similar months within the B11C quaternary. The lowest average rainfall was recorded in July for both the quaternary catchments. In general, these two catchments receive an average rainfall of 673 mm and 671 mm per annum for B11C and B11D respectively. The monthly evaporation rates were also calculated which determined a total average of 1 345 mm and 1 303 mm per annum for B11C and B11D respectively. It was found that the higher potential evaporation rates are expected during the months of October to March for both quaternaries whilst the low potential evaporation is expected on April until August.

10.1.1.5 Relative Humidity

Relative humidity for the consolidation project area showed that each month, there were days with relative humidity reaching 100%. The monthly average ranged between 65% and 75% respectively. The annual average estimated was 70%.

10.1.2 Air Quality

Receptor locations and distances from the consolidation project area are based on visual observation on Google Earth Imagery. Receptors are located to the southwest and western sections of the consolidation project area. These include Trichardt, Secunda and unnamed informal settlement. The consolidation project area and coal reserve are located within the Highveld East Magisterial District, the Gert Sibande District Municipality and the Govan Mbeki Local Municipality. The consolidation project site is situated within a region that is characterised by coal mining activities and cultivation which includes maize cropping and grazing. Table 10-4 indicated that sensitive receptors to the consolidation project.

Table 10-4: Sensitive Receptors in the Vicinity of the Project Area

Sensitive Receptor	Receptor Type	Average distance from the Ventilation Shafts
Secunda	Residential	12 km
Trichardt	Residential	10 km

Emissions generated from mining activities are often associated with fugitive dust emissions, such as: PM_{10}, $PM_{2.5}$ and dust fallout. Gaseous emissions such as SO_2, NO_2 and CO are mostly from generator sets and mine vehicle fleet used during the operational phase of mining. Emissions from this consolidation project are likely to be associated with upcast from the ventilation shafts into the ambient atmosphere. Surface emission sources will be limited to the tipping from the incline shaft via conveyor to a bunker, coal crusher and from the surface stockpile area located on the western side of the bunker. The bunker is enclosed, as such emissions from tipping is considered negligible (as a spray system is present), to further minimise emissions.

10.1.3 Geology

The consolidation project area's coal reserve falls within the north-eastern part of the Highveld Coalfield. The coalfield is underlain by pre-Karoo rocks, mainly Bushveld Complex and Pretoria Group volcanics. Over the years glaciation events resulted in the deposition of tillite (Dwyka Formation) on the basement rocks over most of the area.

In the Highveld Coalfield the coal is generally found in the Vryheid Formation which occurs at the bottom of the Ecca Group (JMA, 2008).

The Dwyka Formation which is located below the Ecca group, that consists mostly of tillite. The Ecca Group consists predominantly of sandstone, siltstone, shale and coal. The Vryheid Formation in the Ecca Group contains five bituminous coal seams, numbered as No. 1 to No. 5 from bottom to top. The No. 4 seam and to a lesser degree the No. 2 and No. 5 seams are the most economical coal seams in the Highveld Coalfield (JMA, 2008).

Overall, the coal seams follow the paleo-topography of the pre-Karoo rocks. This is especially true for the lower coal seams (No. 1 and No. 2), whereas the upper seams are less influenced by the pre-Karoo topography. In mining areas the paleo-topography will govern the direction of mine water flow (JMA, 2008).

The entire sequence has been extensively intruded by Karoo age dolerite over most of the Highveld Coalfield. Apart from displacement of the sedimentary succession caused by intrusive dolerite sills, the Karoo strata have not been faulted. Both dykes and sills have had a displacement and devolatilised effect on the coal seams in most areas of the coalfield (JMA, 2008).

A typical stratigraphic column through the consolidation project area is shown in Figure 10-3. The stratigraphy of the consolidation project area is comprised of the No. 2, No. 3, No. 4L, No. 4H, No. 5L and the No. 5H coal seams, with sandstone and siltstone as inter-burden. Only No. 4 coal seam is economically viable to mine in the Trichardtsfontein area. The No. 5, No. 3 and No. 2 coal seams are currently considered uneconomical since they are too thin and erratic in distribution.

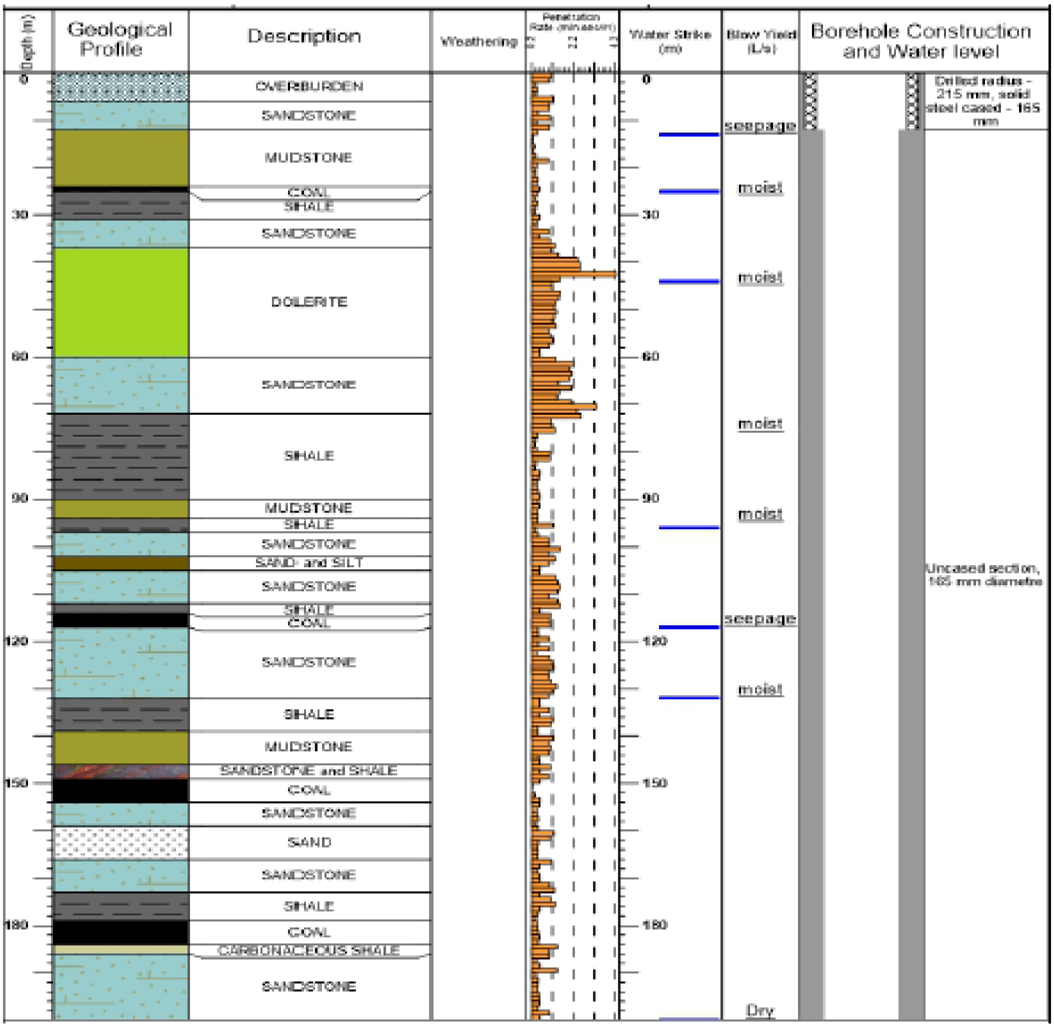

Figure 10-3: Local Geology

A presence of clay in the soil horizon is attributed to in-situ weathering of shallow dolerite sills over the area. The weathering depth is highly variable because of the presence of widespread dolerite sub-outcrops.

Shale is the predominant sedimentary rock in the consolidation project area which comprises of approximately 60% clay minerals, with smaller amounts iron oxides, carbonates and in the case where coal formation is associated with the shale, sulphide minerals can also be present. The general mineral make-up of shale and expected mineralogy in the local geological formations is; chlorite, muscovite, kaolinite, k-feldspar, calcite, dolomite, pyrite and hematite (Digby Wells Trichardtsfontein Groundwater Specialist Study, 2014)

10.1.4 Soil

The soil types for Trichardtsfontein and TCTS are relatively similar and therefore the soil properties of this area has been grouped and discussed together while the soil at Vaalkop has been discussed separately.

10.1.4.1 Soil properties of TCTS and Trichardtsfontein

The information presented in this section has been sourced from Earth Science Solutions, 2008.

10.1.4.1.1 Dominant Soil Forms

The review found that the major soil forms found on the site were Hutton, Clovelly, Griffin, Glenrosa, Mispah, Arcadia, Mayo, Milkwood, Pinedene, Glencoe, Dresden, Avalon, Bloemdal, Westleigh, Rensburg, Bonheim, Kroonstad, Longlands and Katspruit. The soils range from good quality agricultural soils with moderate dryland cropping potential and moderate to good irrigation potential, to shallow, poor quality soils those are at best useful as grazing lands. The free-draining soils on the middle and upper mid-slopes (Clovelly, Hutton, Griffin and Glencoe) are generally derived from the sandstone and shales of the Ecca Group. Dark red and brown soils are associated with the colluvial derived soils that accumulate in the valley bottoms. Dark grey to mottled colour, clay rich colluvium and hydromorphic soils dominate the low lying, gently sloping stream/river and pan environments.

10.1.4.1.2 Soil Chemical and Physical Characteristics

Representative soil samples from the different soil forms were taken and analysed for both chemical and physical parameters. The soil samples submitted were chosen based on the host materials from which they are derived.

- Soil pH ranged between 4.40 and 6.90 (slightly acidic) with a base status ranging from mesotrophic to dystrophic;
- Calcium and Magnesium had moderately good to high levels;
- Potassium, Phosphorus and Sodium had low levels when compared to Calcium and Magnesium;
- Organic carbon ranged between 0.16% to 1.47%, regarded as sufficient for moderate to good agricultural production;
- Levels of Zinc were generally moderate to slightly low;
- The soils in the area showed no visibility signs of being either highly sodic or highly saline;
- There are no indications of either toxic elements or major deficiencies of nutrients that are likely to limit natural plant growth in the soils within the area;
- Topsoil clay percentages range from 12% to 28 % on the sand loams and silty loams;
- Subsoil clay percentages range from 30% to 60%;
- Infiltration rate ranges from 5 to 8 mm/hr; and
- Water holding capacity between 80 to 160 mm/m.

10.1.4.2 Soil properties of Vaalkop

The land type data gathered suggested that the dominant land types on site were Bd4, Ea17 and Ea20. The consolidation project area is dominated by Hutton (Red), Avalon (Yellow-brown), Mispah, Rensburg, Arcadia, Swartland, Katspruit, Glencoe, Kroonstad, Longlands and Westleigh soil forms as shown in Table 10-6. The consolidation project site is dominated by the presence of soils suited to agriculture such as Hutton and Avalon and the remainder of the consolidation project area consists of soils with low agricultural potential and wetland soils. A soil distribution map is presented in Plan 6 in Appendix B and provides a soil delineation profile of the Vaalkop Mining Right area.

Figure 10-4: Examples of soils found on the Vaalkop site (Glencoe, Rensburg, Longlands, Bonheim, Arcadia and Hutton, respectively)

10.1.4.2.1 Soil Chemical and Physical Characteristics for Vaalkop

A total of 16 soil samples were collected from different soil profiles within the Vaalkop Mining Right area. Table 10-5 provides an analysis of the soils.

Table 10-5: Soil Physico-Chemical Properties

Land Ref	Soil Form	pH (KCl)	P (Bray1)	Na	K	Ca	Mg	S	C	Clay	Silt	Sand	Soil Texture
			mg/kg						%				
135	Avalon	5.1	2.4	46.3	8.2	215.3	56.6	5.0	0.6	17	70	13	Silt loam
141	Avalon	4.4	1.9	32.6	7.3	387.5	85.2	8.2	0.3	19	74	7	Silt loam
153	Hutton	5.1	4.5	38.7	7.0	633.8	217.0	7.3	0.6	21	64	15	Silt loam
155	Hutton	4.7	3.2	52.3	9.4	540.9	117.3	9.3	0.4	21	65	14	Silt loam
169	Swartland	5.0	1.2	123.7	25.9	2930.0	1490.4	30.0	1.4	39	30	31	Clay loam
190	Hutton	4.0	2.8	33.2	4.2	1205.0	621.9	12.7	0.2	15	78	7	Silt loam
198	Hutton	5.6	5.2	38.1	6.5	355.4	150.7	3.9	0.2	13	80	7	Silt loam
219	Avalon	4.2	7.3	30.7	9.7	459.0	93.6	6.3	0.4	17	74	9	Silt loam
225	Avalon	4.5	7.2	37.4	6.7	194.0	49.3	4.6	0.4	5	74	21	Silt loam
254	Hutton	6.4	0.5	173.4	170.7	2353.9	1217.5	44.1	0.1	44	40	16	Clay
235	Arcadia	7.1	0.9	106.7	536.9	2507.5	3036.5	61.7	0.8	52	19	29	Clay
483	Avalon	4.4	1.9	77.8	194.8	696.2	830.9	23.2	0.5	16	73	11	Silt loam
316	Glencoe	4.5	1.1	31.6	9.6	437.3	171.5	12.9	0.4	12	73	15	Silt loam
255	Hutton	6.3	36.2	48.0	20.0	738.1	216.4	19.7	0.2	4	86	10	Silt
464	Hutton	4.1	3.2	83.9	6.3	308.7	61.3	15.0	0.4	4	80	16	Silt
820	Kroonstad	5.4	8.2	130.4	10.3	1083.0	243.7	20.2	0.6	24	64	12	Silt loam

A description of the soil chemical profile found in Vaalkop is detailed in the Soil Specialist Study (Appendix I)

10.1.5 Groundwater

A ground water specialist study was undertaken in 2017 to provide an understanding of the baseline groundwater within the three mining right areas referred to as the consolidation project site. This information has been sourced from information obtained in 2017, 2014 and 2008.

10.1.5.1 Aquifers Description

JMA (2008) on a site specific level characterised the following four aquifer systems within the Ecca sedimentary succession:

- Shallow perched aquifer (clayey layer in soft overburden);
- Shallow weathered aquifer (weathered sandstone, siltstone and dolerite);
- Shallow fractured aquifer (mostly shallow fractured dolerite sill); and
- Deep fractured aquifer.

The average depth of the shallow perched aquifer is essentially limited to the soil (soft overburden) horizon.

The presence of a shallow dolerite sill over the area results in a discontinuous shallow weathered aquifer. Dolerite dykes and sills generally tend to form local weathered aquifer boundaries or act as groundwater flow pathways, depending on their degree of weathering.

The top of the shallow weathered aquifer is determined by the average depth to the water level. The bottom of the shallow weathered aquifer is determined by the weathering depth that is highly variable because of the presence of widespread dolerite sub-outcrops.

JMA (2008) conducted drilling and found that the weathered zone is not very deep where dolerite sub-outcrops are present and that the average depth of the shallow fractured aquifer is 22 m, but reaches depths of over 30 m. The dimensions of the shallow fractured aquifer are governed by the presence of the shallow dolerite sill over the area. A majority of the groundwater strikes in the study area are often associated with the shallow fractured dolerite.

The deeper fractured Karoo aquifer is less fractured than the shallow fractured aquifer as such water strikes in the deep fractured aquifer are limited. This translates into the deep fractured aquifer having low hydraulic conductivity.

10.1.5.2 Aquifer Classification

The aquifers of South Africa are defined according to their water supply potential, water quality and local importance for strategic purposes within an aquifer classification scheme and map. The aquifer classification map (Parsons, 1993) identifies the Karoo aquifers in the consolidation project area as predominantly minor systems with moderately-yielding aquifers of variable water quality and moderate vulnerability to some pollutants, but only when continuously discharged or leached.

10.1.5.3 Groundwater Recharge

Hodgson and Krantz (1998) states that recharge within the Olifants River Catchment Water Management Area to the weathered Ecca aquifer is estimated at 1% to 3% of the annual precipitation.

The mean annual precipitation throughout the consolidation project area ranges between 600 – 800 mm/a which results in an estimated recharge range of 6 to 24 mm/a.

10.1.5.4 Aquifer Hydraulic Parameters

Slug test data interpretation conducted on boreholes (HNBH4, HSBH3, PPN1, RNBH1 and RNBH4) is summarized below;

- HBH4 reflected hydraulic conductivity of 0.019 m/d;
- HSBH3 reflected hydraulic conductivity of 1.16 m/d;
- PPN1 reflected hydraulic conductivity of 0.1 m/d;
- RNBH1 is almost dry with no significant conductivity; and
- RNBH4 reflected hydraulic conductivity of 0.16 m/d.

The harmonic mean hydraulic conductivity of the aquifer at Vaalkop is estimated at 0.06 m/d.

The hydraulic conductivity values of the shallow aquifer at Trichardtsfontein were obtained from slug tests conducted in December 2013 by Digby Wells (2014) which concluded hydraulic conductivity of approximately 0.05 m/d.

The harmonic mean hydraulic conductivity of the aquifers at Thubelisha is estimated at 0.013 m/d (JMA, 2008).

Digby Wells (2014) states that the deep fractured aquifer hydraulic conductivity is approximately 0.004 m/d.

10.1.5.5 Groundwater Levels and Flow Directions

Groundwater levels acquired from the hydrocensus vary between 0 and 32 meters below ground level (mbgl), with an average of 5 mbgl. The localised groundwater level depth of 32 mbgl is a result of abstraction for domestic use. With the exclusion of deeper groundwater levels, undisturbed groundwater levels across the site show a strong correlation with topography. The groundwater flow direction at the Olifants River Catchment, where the majority of the consolidation project area is located, is from south-east to north-west shown in Plan 7 in Appendix B. In the Upper Vaal River Catchment where minor parts of the consolidation project area are located the groundwater flow direction is towards the south-west.

10.1.5.6 Groundwater Quality at Vaalkop

The groundwater quality results from the samples collected during the hydrocensus have been compared to the South African National Standards (SANS) 241:2015 Standards for Drinking Water (Table 10-6).

SANS 241:2015 standards are divided into; aesthetic, operation, acute or chronic. Each of these categories has different effects on humans when consumed.

All boreholes are within the SANS standards for drinking water with the exception of PTBH2, ERN1 and RT3. Evaluations indicate the following:

- PTBH2 and RT3 have a nitrate concentration of 14 and 38.7 mg/L respectively, these concentrations exceed standards for aesthetic, acute and chronic effects (11 mg/L). The elevated concentrations of nitrate can be attributed to agricultural impacts; and
- ERN1 has a sulfate concentration of 388 mg/L, the concentration exceeds standards for aesthetic effects (250 mg/L) however it is below standards for acute chronic effects (500 mg/L). The elevated concentrations of sulfate can be attributed to mining related impacts.

Groundwater characterisation was conducted according to the Piper Diagram and the groundwater quality is predominantly identified to be calcium-magnesium-bicarbonate type which is typically encountered in freshly recharged aquifers expected to contain water with relatively short residence time. RP8 and RT18 are characteristic of sodium-bicarbonate which is typical of mixing of high residence and freshly recharged water, with the sodium replacing the calcium and magnesium in solution.

Table 10-6: Baseline water quality as classified based on the SANS 241: 2015 for Vaalkop

Sample ID		pH	EC (mS/m)	TDS (mg/l)	Cl (mg/l)	SO_4 (mg/l)	NO_3 (mg/l)	NH_3 (mg/l)	F (mg/l)	Na (mg/l)
SANS 241:2015 Limits	**Aesthetic**	**-**	**170**	**1200**	**-**	**250**	**-**	**1.5**	**-**	**200**
	Operational	**5 to 9.7**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Chronic health	**-**	**-**	**-**	**300**	**-**	**-**	**-**	**1.5**	**-**
	Acute health	**-**	**-**	**-**	**-**	**500**	**11**	**-**	**-**	**-**
ONBH1	07/04/2017	8.74	67	402.00	39.30	6.38	0.61	0.02	0.52	97.70
TNBH3	07/04/2017	8.71	88	596.00	33.50	170.00	7.42	0.02	0.32	98.60
HSBH1	07/04/2017	8.57	78	508.00	31.60	75.80	1.64	0.02	0.34	40.70
HSBH2	07/04/2017	8.61	70	438.00	12.80	86.10	0.93	0.01	0.27	27.90
RNBH2	07/04/2017	8.76	101	738.00	162.00	56.00	5.91	0.02	0.29	90.90
PTBH2	07/04/2017	7.62	25	236.00	18.90	12.80	14.00	<0.005	<0.26	14.20
RTBH1	07/04/2017	8.56	79	582.00	38.60	111.00	1.35	0.02	<0.26	48.10
PN1	07/04/2017	8.82	67	482.00	16.00	89.70	5.31	0.03	0.31	43.80
PN9	07/04/2017	8.63	40	254.00	31.90	17.40	1.20	0.01	0.32	26.50
HNBH1	07/04/2017	8.58	47	326.00	13.50	3.98	1.48	0.01	<0.26	27.70
ERN1	07/04/2017	8.42	125	1024.00	32.90	388.00	0.24	0.01	0.40	96.50
EN21	07/04/2017	8.86	72	462.00	5.92	91.70	1.55	0.02	<0.26	13.60
EN15	07/04/2017	8.54	72	502.00	14.30	107.00	2.38	0.01	0.31	38.80
ZT1	07/04/2017	8.87	4	2.55	82.40	139.00	5.41	0.01	0.30	62.00
RP3	07/04/2017	8.66	60	2.32	19.60	21.70	0.28	0.02	0.27	55.60
RO1	07/04/2017	8.55	69	512.00	20.20	86.60	6.98	0.02	0.36	51.80
RT18	07/04/2017	9.03	59	398.00	33.10	29.80	0.84	0.05	1.13	135.00
RT3	07/04/2017	8.38	119	918.00	101.00	127.00	38.70	0.01	0.29	43.80
RP8	07/04/2017	9.07	100	610.00	71.00	97.20	0.35	0.02	0.38	265.00

10.1.5.7 Groundwater Quality at Trichardtsfontein

Digby Wells (2014) collected eleven groundwater samples at Trichardtsfontein for groundwater evaluations, the results have been compared against South African National Standards (SANS241:2015) see Table 10-7.

Evaluations indicated the following:

- TRBH6 and TRTBH3 have a nitrate concentration of 21.5 and 11.3 mg/L respectively, these concentrations exceed standards acute effects (11 mg/L);
- TRBH1 and RP-8 have a sodium concentration of 205 and 279 mg/L respectively, exceeding standards for aesthetic effects (200 mg/L); and
- TRBH2, TRBH3, TRTBH11, RP-13, TRBH9, RPBH16D and TRTBH1 are within SANS 241:2015

Groundwater characterisation was conducted and majority of the boreholes were identified to be calcium-magnesium-bicarbonate type representative of freshly recharged aquifers.

Table 10-7: Baseline water quality as classified based on the SANS 241: 2005 - Trichardtsfontein

		pH-Value at 25° C	Conductivity at 25° C in mS/m	Total Dissolved Solids	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Chlorides as Cl	Sulphate as SO_4	Nitrate NO_3 as N	Total Alkalinity as $CaCO_3$	Iron as Fe	Manganese as Mn	Aluminium as Al	Free and Saline Ammonia as N	Fluoride as F
Class I	(Recommended)	5-9.5	<150	<1000	<150	<70	<200	<50	<200	<400	<10	N/S	<0.2	<0.1	<0.3	<1	<1
Class II	(Max. Allowable)	4-5 or 9.5-10	150-370	1000-2400	150-300	70-100	200-400	50-100	200-600	400-600	10-20	N/S	0.2-2	0.1-1	0.3-0.5	1-2	1-1.5
	Duration	No Limit	7 years	7 years	7 years	7 years	7 years	7 years	7 years	7 years	7 years	N/S	7 years	7 years	1 year	None	1 year
Class III	(Not recommended)	<4 or >10	>370	>2400	>300	>100	>400	>100	>600	>600	>20	N/S	>2	>1	>0.5	>2	>1.5
TRBH1	2014-01-13	8.80	86.50	538.00	12.30	7.42	205.00	1.17	17.10	19.30	1.78	437.00	0.00	0.00	0.00	0.53	0.53
TRBH2	2014-01-13	8.20	61.10	340.00	38.10	20.50	74.70	2.70	30.20	11.40	0.90	258.00	0.00	0.00	0.00	0.49	0.30
TRBH3	2014-01-13	7.80	70.10	411.00	54.60	30.30	67.30	13.70	8.90	4.70	0.30	376.00	0.00	0.00	0.00	0.12	0.40
TRTBH11	2014-01-13	7.90	122.00	720.00	106.00	94.40	43.70	1.20	35.10	122.00	5.10	483.00	0.00	0.00	0.00	0.02	0.40
TRBH6	2014-01-13	7.60	95.70	523.00	58.50	61.10	39.70	0.70	76.20	93.30	21.50	160.00	0.00	0.00	0.00	0.01	0.20
TRTBH3	2014-01-13	8.20	99.20	559.00	66.00	70.60	44.20	3.60	66.70	76.80	11.30	297.00	0.00	0.00	0.00	0.02	0.30

		pH-Value at 25° C	Conductivity at 25° C in mS/m	Total Dissolved Solids	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Chlorides as Cl	Sulphate as SO_4	Nitrate NO_3 as N	Total Alkalinity as $CaCO_3$	Iron as Fe	Manganese as Mn	Aluminium as Al	Free and Saline Ammonia as N	Fluoride as F
Class I	(Recommended)	5-9.5	<150	<1000	<150	<70	<200	<50	<200	<400	<10	N/S	<0.2	<0.1	<0.3	<1	<1
Class II	(Max. Allowable)	4-5 or 9.5-10	150-370	1000-2400	150-300	70-100	200-400	50-100	200-600	400-600	10-20	N/S	0.2-2	0.1-1	0.3-0.5	1-2	1-1.5
	Duration	No Limit	7 years	7 years	7 years	7 years	7 years	7 years	7 years	7 years	7 years	N/S	7 years	7 years	1 year	None	1 year
Class III	(Not recommended)	<4 or >10	>370	>2400	>300	>100	>400	>100	>600	>600	>20	N/S	>2	>1	>0.5	>2	>1.5
RP-13	2014-01-13	7.80	25.30	142.00	23.30	12.70	14.10	1.10	9.10	27.00	0.40	86.70	0.00	0.13	0.00	0.07	0.20
TRBH9	2014-01-13	8.00	82.20	497.00	73.20	66.70	25.00	4.60	12.90	60.20	0.60	412.00	0.00	0.00	0.00	0.02	0.30
RPBH16D	2014-01-13	8.50	68.30	407.00	10.80	10.00	128.00	25.50	10.60	44.30	0.70	286.00	0.00	0.00	0.00	0.01	0.30
TRTBH1	2014-01-13	7.90	82.40	469.00	68.50	49.80	46.50	1.70	21.00	66.00	1.50	342.00	0.00	0.00	0.00	0.02	0.40
RP-8	2014-01-13	8.80	114.00	678.00	3.30	0.40	279.00	2.60	60.70	103.00	0.50	371.00	0.00	0.00	0.00	0.02	0.40

10.1.5.8 Groundwater Quality at Thubelisha

Baseline groundwater quality status at Thubelisha was evaluated by JMA Consulting (2008) by comparing eighty boreholes against South African National Standards (SANS241:2005). The findings are summarized below (findings are discussed according to constituents found to be in excess any of the standards):

- No boreholes showed non-compliance with the water quality standards with regards to TDS concentration limits (Class III > 2 400 mg/L), three boreholes coincide with Class II TDS limits (1 000-2 400 mg/L) and seventy-seven were within Class I limits (<1 000 mg/L);
- Three boreholes showed non-compliance with the water quality standards regarding nitrate concentration limits (Class III > 20 mg/L), nine boreholes coincide with Class II TDS limits (10 - 20 mg/L) and sixty-eight were within Class I limits (<20 mg/L);
- Three boreholes showed non-compliance with the water quality standards regarding fluorine concentration limits (Class III > 1.5 mg/L), five boreholes coincide with Class II TDS limits (1 - 1.5 mg/L) and seventy-two were within Class I limits (<1 mg/L);
- No boreholes showed non-compliance with the water quality standards regarding calcium concentration limits (Class III > 300 mg/L), three boreholes coincide with Class II TDS limits (150 - 300 mg/L) and seventy-seven were within Class I limits (<150 mg/L);
- Five boreholes showed non-compliance with the water quality standards regarding magnesium concentration limits (Class III > 100 mg/L), nine boreholes coincide with Class II TDS limits (70 - 100 mg/L) and sixty-six were within Class I limits (<70 mg/L);
- No boreholes showed non-compliance with the water quality standards regarding sodium concentration limits (Class III > 400 mg/L), four boreholes coincide with Class II TDS limits (200 - 400 mg/L) and seventy-six were within Class I limits (<200 mg/L);
- No boreholes showed non-compliance with the water quality standards regarding chlorine concentration limits (Class III > 600 mg/L), two boreholes coincide with Class II TDS limits (200 - 600 mg/L) and seventy-eight were within Class I limits (<200 mg/L);
- Four boreholes showed non-compliance with the water quality standards regarding iron concentration limits (Class III > 2 mg/L), seven boreholes coincide with Class II TDS limits (0.2 - 2 mg/L) and sixty-nine were within Class I limits (<0.2 mg/L); and
- No boreholes showed non-compliance with the water quality standards regarding manganese concentration limits (Class III > 1 mg/L), seven boreholes coincide with Class II TDS limits (0.1 - 1 mg/L) and seventy-three were within Class I limits (<0.1 mg/L).

Groundwater was characterised as predominantly calcium-magnesium-bicarbonate type, indicating the presence of freshly recharged aquifers, with localized agricultural influences present at some locations.

10.1.6 Surface Water

Surface water baseline information for the consolidation project area / site was obtained from a literature survey, fieldwork conducted from January – October 2007, and modelling of various hydrological parameters, such as Mean Annual Runoff (MAR) and Dry Weather Flows (DWF) were computed using the WRSM2000 synthetic streamflow generation model. Flood peaks for various recurrence intervals were computed using the Rational Method, the Standard Design Flood Method, Unit Hydrograph Method and the TR137 method (Oryx Environmental, 2008b).

The surface water attributes of the affected catchments, namely the MAR in million cubic metres (Mm^3), MAP (mm) and MAE (mm) are summarised in Table 10-8 (WRC, 2012).

Table 10-8: Summary of the surface water attributes of the B11C and B11D quaternary catchments

Quaternary Catchment	Total Area (km^2)	MAP (mm)	MAR (Mm^3)	MAE (mm)
B11C	371	673	21.55	1550
B11D	537	671	26.41	1600

The Vaalkop Project area is approximately 86 km^2 in total, however, only limited areas will be mined by high extraction method while the rest of the area will be mined by bord-and-pillar mining method. TCTS mining area had a total area of 72 km^2 with which only 25 km^2 (30%) of that area was mined through high extraction method. The same percentage has been assumed for the Vaalkop area to try and quantify the loss in mean annual runoff due to stooping.

Therefore, the total area to be stooped will amount to approximately 30 km^2. The percentage loss in MAR for this quaternary catchment due to stooping will amount to approximately 8% of the total MAR and will be 0.8% on the Witbank catchment which has an area of 3627 km^2, as shown in Table 10-9.

Table 10-9 Loss in MAR due to Proposed Infrastructure

Quaternary Catchment	Total Area (km^2)	MAR ($m^3 * 10^6$)	Infrastructure Area (km^2)	Percentage decrease in MAR (%)	Loss in MAR ($m^3 * 10^6$)
B11C	371	21.55	30.00	8.09	1.743

10.1.6.1 Water Quality

Surface water monitoring information was obtained from monitoring undertaken in 2007 and 2011 at TCTS. Digby Wells undertook a site visit March 2017 to collect water samples from the streams within and around the consolidation project area, 11 samples were collected (six new sites and five TCTS existing sites).

The results of the surface water quality analysis are presented in Table 10-10 and discussed in further detail in Section 10.1.6.1.1 and Section 10.1.6.1.2. Plan 8 indicates the locations of the surface water monitoring points. The water quality results were benchmarked with the Olifants Resource Water Quality Objectives (RWQO) to determine the baseline or current water quality status of the consolidation project area.

The predominant water use around the consolidation project area is agriculture (irrigation) and for that reason the results were also benchmarked against the South African Water Quality Guidelines for Agricultural Use: Irrigation (DWAF, 1996).

10.1.6.1.1 TCTS Monitoring Results

The TCTS monitoring results was summarised as follows:

- pH:
  - The pH values ranged from 7 to 9 which was within acceptable limits of the South African Target Water Quality range for domestic use (6 - 9) (DWAF, 1996);
  - The elevated reading of pH 9 for sampling site R6 is above the recommended levels. Sampling sites R5, R7, and R11 were above the recommended pH levels for industrial (6.5 - 8.0).and irrigation use (6.5 - 8.4);
  - Compared to the interim RWQO for MU1, the measured pH levels were mostly between the lower pH objective of 6.5 and the upper pH objective of 8.4, with the exception of sampling points R5, R7, R10 and R11; and
  - No specific trend was observed between the results of the analyses conducted in 2007 and 2011/2012, (J&W, 2009).
- Electrical Conductivity (EC):
  - The EC levels observed in 2007 was generally close to potable water limits of 70 mS/m, with nine sites between 21.1 and 67.2 mS/m. This indicates a relatively un-impacted environment. However, sampling sites R5 and R11 showed slightly elevated EC values of 100 mS/m and 90.8 mS/m respectively;
  - Compared to the interim RWQO for EC in MU1 of the Witbank Dam catchment, the objective of 35 mS/m was exceeded at all sampling occasions at sampling points R3, R5, R6, R7, R10 and R11. The objective is exceeded on some occasions at sampling points R4, R8 and R9;

- The impacts observed at sampling points R5, R6 and R7 could be attributed to upstream mining activities. Land uses upstream of sampling points R10 and R11 are limited to agricultural activities and the source of elevated EC levels are uncertain; and
- In general, the EC levels measured in 2011/2012 were higher than those measured in 2007 indicating increased salt concentrations.

- Sulphate:
  - The sulphate levels in 2007 for the sampling sites ranged between 11 and 79 mg/ℓ, which were found to be well below the domestic acceptable target of 200 mg/ℓ; and
  - The interim RWQO of 30 mg/ℓ for sulphate for MU1 of the Witbank Dam catchment was exceeded on most occasions at all sampling sites. A significant increase in sulphate levels was observed at R3, R5, R8, R10 and R11 between the 2007 and 2011/2012 sampling indicating an impact from upstream activities.
- Calcium:
  - Five of the sample sites (R3, R5, R7, R10 and R11) monitored in 2007 showed calcium levels above the recommended target of 24 mg/ℓ for domestic use, with a mean concentration for all sites of 32.9 mg/ℓ. All sites were well within the levels required for livestock watering (0 – 1000 mg/ℓ); and
  - The interim RWQO of 24 mg/ℓ, the objective was exceeded at sampling sites R3, R5, R6, R7, R8, R10 and R11 on all sampling occasions. The objective was exceeded at R1, R8 and R9 on some occasions. No specific trend is observed between the results of the 2007 and 2011/2012 sampling.
- Iron:
  - Most sites sampled in 2007 exceeded the recommended levels for iron of 0.1 mg/ℓ for domestic use and 0.3 mg/ℓ for industrial use. The average for all sites was 1.10 mg/ℓ the highest level of 5.52 mg/ℓ measured at site R9, which was within the acceptable levels for livestock watering (0 – 10 mg/ℓ) and slightly above the range for irrigation (0 – 5 mg/ℓ); and
  - The interim RWQO for MU1 was exceeded on a limited number of occasions at R2, R8 and R9.
- Manganese:
  - The manganese values (2007) were all within the guideline limits for domestic, industrial and aquatic water uses, with the exception of site R2; and
  - The interim objective for manganese within MU1 was exceeded on a limited number of occasions at some of the monitoring points during the 2007 sampling.

- Magnesium:
  - Magnesium levels (2007) were generally below the recommended limit of 30 mg/ℓ for domestic use, with the average of 34.5 mg/ℓ. Sites R7, R10 and R11 had slightly raised levels of 50 mg/ℓ, 34 mg/ℓ and 74 mg/ℓ respectively. Site R5 had the highest value at 111 mg/ℓ (J&W, 2009); and
  - When compared to the interim RWQO of 15 mg/ℓ, the objective was exceeded on all monitoring occasions during 2007 and 2011/2012 at R3, R5, R6, R7, R10 and R11 and on some occasions at R8 and R9.
- Aluminium:
  - The interim objective for aluminium of 0.02 mg/ℓ is exceeded on most occasions at all of the monitoring points.

In conclusion, the water quality in the area has been impacted due to existing land uses (mining and farming) and the interim RWQO for a number of constituents are exceeded. MU1 of the Witbank Dam catchment represents the head waters of the catchment. No further contribution to the deteriorating water quality as a result of activities at TCTS should be allowed.

10.1.6.1.2 Vaalkop and Trichardtsfontein (2017) Monitoring Results

The 2017 water quality results were benchmarked with the Olifants RWQO and the South African Water Quality Guidelines for Agricultural Use: Irrigation to determine the baseline or current water quality status of the consolidation project area. The water quality results can be summarised as follows:

- Elevated level (basic) pH which exceeds the Olifants RWQO of (6.5 - 8.4) was observed at monitoring point SASSW1;
- All other monitoring points except for Site A, R14403W and T14403W also have shown a basic pH. However, these were still within the Olifants RWQO. The north eastern part of the consolidation project area is predominantly comprised of cultivated land. Most Highveld soils are naturally acidic, and for that reason, farmers mostly add lime to their soils. Runoff from these soils is likely the cause of elevated level of pH;
- In all the monitoring points, EC exceeded the target water quality range (<40 mS/m) of the SAWQG Irrigation standards. There is no set EC/TDS limit or standard for the Olifants catchment;
- Also, elevated levels of Chlorides which exceeds the Olifants RWQO (5 ug/l or 0.005 mg/l) were observed in all the monitoring sites. Chloride inputs to surface waters can arise from irrigation return flows, sewage effluent discharges and discharges various industrial processes (SAWQG); and

- Elevated Ammonia levels exceeding the Olifants RWQO (0.1 mg/l) were observed at monitoring point SASSW03, SASSW04, SASSW05 and R14403W. This may be associated with organic decomposition from mostly animal waste in the streams, since there is no sewage discharge in the affected streams.

Table 10-10: Water Quality Results benchmarked against the Olifants RWQO and SWQG: Irrigation use guidelines

Sample ID		pH	EC (mS/m)	TDS (mg/l)	Cl (mg/l)	SO_4 (mg/l)	NO_3 (mg/l)	NH_4 (mg/l)	PO_4	F (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	TSS (mg/l)	Fe (mg/l)
Olifants RWQO		**6.5 - 8.4**	**111**	**N/A**	**0.005**	**500**	**4**	**0.1**	**0.125**	**3**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
SWQG: Agriculture Use: Irrigation (Target water quality)		**<6.5 - >8.4**	**40**	**N/A**	**140**	**N/A**	**N/A**	**N/A**	**N/A**	**2**	**N/A**	**N/A**	**70**	**N/A**	**5**
SASSW01	10/03/2017	8.5	60.2	408.0	23.7	58.7	0.35	0.07	0.04	0.8	46.8	30.3	42.3	15.0	-0.004
SASSW02	10/03/2017	8.4	41.8	262.0	17.7	33.4	0.37	0.05	0.03	0.7	29.6	23.6	22.1	21.0	-0.004
SASSW03	10/03/2017	8.3	71.7	444.0	21.1	59.5	0.20	0.34	0.03	3.1	62.9	49.1	29.4	2226.0	-0.004
SASSW04	10/03/2017	8.1	54.9	366.0	29.2	76.4	-0.19	0.67	0.03	0.7	38.9	26.4	31.9	805.0	0.464
SASSW05	10/03/2017	8.1	71.1	464.0	83.1	8.4	0.24	1.00	-0.01	0.5	66.5	37.6	28.8	468.0	3.370
SASSW06	10/03/2017	8.1	41.9	252.0	7.4	43.1	0.25	0.1	0.0	0.4	31.4	28.7	13.8	7.0	-0.004
SASSW07	10/03/2017	8.3	41.7	208.0	13.1	33.7	0.39	0.0	0.0	0.5	33.1	22.6	18.4	15.0	-0.004
R 11	10/03/2017	8.18	92.4	550	10.7	123	0.383	0.042	0.192	0.591	75.8	73.5	24.8	606	-0.004
Site A	10/03/2017	7.81	42.5	246	13.5	31.8	0.422	0.058	0.077	0.536	36.4	24.6	13.5	140	-0.004
R14402W	10/03/2017	8.29	74.1	464	17.2	89.3	0.625	0.055	0.072	0.67	49.2	49.7	43.7	10	-0.004
R14403W	10/03/2017	7.79	34.7	254	9.69	37.2	0.334	0.147	0.163	0.613	20.8	20.2	19.9	42	-0.004
T14003W	10/03/2017	7.62	19.7	154	6.54	18.2	0.285	0.058	0.057	0.516	10.6	8.65	13.1	65	0.079

10.1.7 Wetlands

The wetlands baseline was compiled utilising the following information sources:

- Wetland Assessment Study: Twistdraai Colliery: Thubelisha Shaft (TCTS) Project' (Wetland Consulting Services, 2007);
- Ecological Wetland Assessment for the Proposed Trichardtsfontein Mining Project (Digby Wells, 2014); and
- On-site verification completed for the Vaalkop mining area by the wetland specialists at Digby Wells in 2017.

The National Freshwater Ecosystem Priority Areas (NFEPA) provides information on wetland and river ecosystems for integrating into freshwater ecosystem and biodiversity planning and decision-making processes. Plan 9 in Appendix B demonstrates the distribution of NFEPA wetlands within the consolidation project area. The wetland types that dominate the landscape are floodplain wetlands, channelled valley bottoms and seeps. In addition, there are some depression wetlands within the consolidation project area. The largest wetland present is associated with the Steenkoolspruit that runs through the consolidation project area.

The entire consolidation project area is characterised by extensive wetlands, amounting to 6 080.1 ha (26% of consolidation project area). The HGM units on site include channelled valley bottoms, un-channelled valley bottoms, floodplains, hillslope seeps, depressions and artificial wetlands. The consolidated HGM unit areas are tabulated in Table 10-11. Consolidated wetland delineation for all mining right areas can be seen in Plan 10 in Appendix B.

Additionally, these wetlands are identified as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESA) according to the Mpumalanga Biodiversity Sector Plan (2013). These classifications are reiterated by the Mining and Biodiversity Guideline Report (2013). Within this report, the wetlands are designated as having the highest biodiversity importance status in support of the national biodiversity strategic goals.

The Mine Plan indicates that approximately 3406.2 ha of wetlands; most of these highlighted as being at highest risk from mining within the Mining and Biodiversity Guideline Report (2013), and is proposed to be undermined.

All wetland information has been sourced from the Wetland Consulting Services (2007) and Digby Wells (2014). The majority of the wetlands are PES C (moderately modified), followed by PES D and PES B (Table 10-12; Plan 11 in Appendix B).

Table 10-13 details the areas for the different EIS categories, with an EIS of B being the most prevalent. EIS are also illustrated in and Plan 12 in Appendix B.

Table 10-11: Summary of the Wetland HGM Units

HGM unit	TCTS (ha)	Vaalkop (ha)	Total (ha)
Channelled Valley Bottom	1 472.6	777.7	2 250.3
Un-channelled Valley Bottom	338.0	266.4	604.4
Floodplain	269.2	611	880.2
Hillslope seeps	986.4	1 230.8	2 217.2
Depression	0	117.1	117.1
Artificial	10.6	0.3	10.9
Total Wetlands (ha)	**3 076.8**	**3 003.2**	**6 080.1**

Table 10-12: Summary of the PES for the entire Project Area

PES Score	Description	TCTS (ha)	Vaalkop (ha)	Total (ha)
B	Largely natural	1 088.6	38.9	1 127.5
C	Moderately modified	1 111.7	938.8	2 050.5
C/D	Moderately to Largely modified	13.1	426.7	439.8
D	Largely modified	121.8	1 588.6	1 710.4
E	Severely modified	0	7.4	7.4

Table 10-13: Summary of the EIS for the entire Project Area

EIS	Description	TCTS (ha)	Vaalkop (ha)	Total (ha)
B	High	1 743.7	2 047.6	3 791.3
C	Moderate	446.4	950.3	1 396.7
D	Low/marginal	28.4	0	28.4

The dominant land use of the area is agro-pastoral including large areas of cropland and natural grassland for grazing and grass-bailing. The wetlands have been altered from their natural state as the area has been largely transformed by agricultural activities, roads, railway lines, dams etc.

Wetlands have been impact from the following activities:

- Croplands have replaced much of the naturally occurring vegetation and this has impacted the ability of wetlands to maintain biodiversity. Alternative farm practices such as the digging of deep trenches to drain wetlands were also observed.
- Cattle farming which has resulted in overgrazing in many areas, trampling, and erosion and has resulted in impaired water quality of the wetlands associated with the site. These activities cause increased sedimentation of the systems due to exposed substrate. Sedimentation alters the natural hydrological and geomorphological functioning of the wetlands and may have an impact on aquatic life. The impaired water quality may also result from additional loading of phosphates and nitrates.
- Dams were abundant and have impacted severely on the wetland integrity of the site, causing headcut erosion upstream and in-stream erosion downstream.
- This disturbance has also led to the establishment of alien and invasive plant species, particularly *Populus x canescens* (Grey Poplar), *Eucalyptus camaldulensis* (Red River Gum) in the wetter areas and *Tagetes minuta* (Khaki Bush) and *Bidens pilosa* (Black Jack), further limiting the ability of the hydromorphic grasslands to function.
- Many wetlands are impacted on by roads cutting through them.
- The presence of mining in the area (Anglo American, Exxaro etc.) urban developments and industrial infrastructure (such as powerlines) affect the ecological integrity of the wetlands and deter avifaunal populations.

The wetlands are important ecosystems within the consolidation project area, and include most of the wetland habitat types (HGM units). The ecological functioning of these ecosystems is directly linked to their position in the landscape as well as their ecological condition. Wetlands of the Mpumalanga Province and Highveld region within the Grassland biome represent important ecosystems providing many services and goods to people (MPTA, 2014); however, this does lead often to over exploitation of these systems which compromises their ecological integrity. Although the application of the WET-Ecoservices tool was beyond the scope of this Wetland Assessment, a few of the wetland ecosystem services noted on site are described below:

- Water supply for human use is an important service provided by these wetlands. Multiple farm dams are present in channelled valley bottoms, whilst pans collect water for livestock and provide water for water abstraction;
- Channelled valley bottoms aid in streamflow regulation, nutrient assimilation, and sediment trapping. Un-channelled valley bottoms also provide the aforementioned services, with the addition of slowing down of flood waters. These functions are strongly linked to the absence of a channel as water is spread throughout the wetland unit. Seeps sustain streamflow during the dry season as they are slowly fed

with sub-surface flow that moves laterally into the valley floor and river systems. Due to the diffuse nature of water movement through seep systems, sediment trapping and nutrient assimilation is an important water quality enhancement benefit. Within their immediate catchment, pans play important roles such as sediment trapping, nutrient assimilation and carbon storage;

- Wetlands provide habitat for a variety of aquatic and terrestrial fauna and flora species. The gentle slopes of the seeps provide habitat for important species of the area such as African Grass Owl and Marsh Owl, both of which were observed on site. Floodplain and channelled valley bottoms provide habitat for aquatic species as well as birds (Blue Korhaan, Pied and Giant Kingfishers were observed utilising these wetlands), and mammals (spoor of the Cape Clawless Otter and Water Mongoose were observed) that feed off aquatic species. Pans provide unique habitat in the landscape for species. Greater Flamingos, which are a Species of Special Concern, were seen in a pan near the consolidation project area; and
- Agriculture, cultural and aesthetic benefits.

10.1.8 Flora and Fauna

The consolidation project area falls within the Eastern Highveld Grassland and Soweto Highveld Grassland as described by Mucina and Rutherford (2006) in the Grassland Biome. Thirty percent of the biome has been irreversibly transformed and only 1.9% is formally conserved. As a result, the National Biodiversity Strategy and Action Plan has identified the grasslands biome as one of the spatial priorities for conservation action (SANBI, 2012).

10.1.8.1 Flora

The majority of the consolidation project site has undergone transformation due to cultivation for maize and the presence of pastures with alien vegetation also present. Livestock were also observed throughout most of the site and evidence of overgrazing was recorded in grassland areas; showing a dominance of increaser species and some erosion. Despite these impacts, areas that were left intact showed a high diversity of grasses and forbs, particularly members of the Asteraceae family and the *Helichrysum* genus.

The natural areas associated with the consolidation project area are discussed in more detail in the sections below. The disturbed grassland areas included former cultivated fields that had been colonised by alien plants and pioneer species. The primary land uses and vegetation habitats identified for the consolidation project area are listed in Table 10-14, Table 10-15 and Table 10-16 and the vegetation delineation are shown in Plan 13, Plan 14 and Plan 15 in Appendix B for the various mining right areas.

Table 10-14: Vegetation Habitats (and other land use) and Approximate Areas (Vaalkop)

Vaalkop		
Vegetation type	**Area Hectares**	**% of total**
Grassland	3 206.5	40.9
Agriculture	4 029.0	51.4
Wetlands	516.8	6.6
Rocky Ridges	6.5	0.1
Alien Vegetation	59.1	0.8
Pan	27.8	0.4
Total	**7 845.7**	**100.0**

Table 10-15: Vegetation Habitats (and other land use) and Approximate Areas for Trichardtsfontein

Trichardtsfontein		
Class Name	**Area Hectares**	**% of total**
Grassland	1 260.9	52.56%
Agriculture	687.3	28.65%
Wetlands	450.6	18.78%
Total	**2 398.8**	100%

Table 10-16: Vegetation Habitats (and other land use) and Approximate Areas for Thubelisha

Thubelisha		
Class Name	**Area Hectares**	**% of total**
Grassland	9 039.5	62.47%
Agriculture	4 306.6	29.76%
Wetlands	1 097.0	7.58%
Alien Vegetation	25.9	0.18%
Total	**14 469.1**	100%

A summary of the flora found within the consolidation project area has been compiled and discussed in Table 10-17, the information informing this table has been sourced from the Digby Wells Fauna and Flora study, 2017, the TCTS EIA/EMPr, 2008 and EkoInfo CC Environmental & Wildlife Management Consultancy, 2008.

Table 10-17: Description of Flora found within the Project Area

Habitat	Description of habitat and flora	
Riparian Habitat	The consolidation project are has a number of wetlands which are located within the consolidation project area more specifically on the Vaalkop Mining Right area. The remainder of the area is characterised by extensive hillslope seeps that drain into the floodplains and valley bottom wetlands. Where standing water was present; *Typha capensis* (Common Bulrush), *Imperata cylindrica* (Cottonwool Grass) and *Arundinella nepalensis* (River Grass) had colonised. A single Red Data listed plant species was recorded in this habitat, namely: *Eucomis autumnalis* (Pineapple Flower), listed as Declining. In addition, *Crinum bulbispermum* (River Lily), which is dominant in this vegetation unit, is provincially protected (according to Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998): Schedule 11). Alien plant species that had colonised this vegetation unit included: *Acacia mearnsii* (Black Wattle), *Salix babylonica* (Babylon Willow) and *Cirsium vulgare* (Scotch Thistle).	
		

Habitat	Description of habitat and flora
Rocky Grassland	The rocky grassland was comprised of relatively short grass (<1.8 cm) and a high diversity of epileptic (growing on rock surface) forb species. Rocky outcrops occurred primarily along riparian zones and were typified by shrubs such as: *Diospyros lycioides* (Bluebush); *Gnidia kraussiana* and *Searsia dentata* (Nana Berry); and characteristic species such as*: Leonotis leonurus* (Lion's Ear), *Psammotropha myriantha* and *Haemanthus humilis* (Rabbit's Ear). Examples of common plant species identified in the *Gnidia – Diospyros* Rocky Grassland. Alien plant invasion was limited in this habitat, which represented the most intact vegetation of all units delineated for the study area. Alien plants included: *Tagetes minuta* (Khakibos) and *Bidens pilosa* (Blackjacks). A single SSC plant was recorded on site, namely: *Haemanthus humilis* (Rabbit's Ear), a provincially protected plant species.
Eragrostis - dominated Grassland	This Eragrostis-dominated Grassland covered the majority of the natural areas. *Eragrostis gummiflua* (Gum Grass), unfavoured by cattle, was dominant and additional *Eragrostis* species were prevalent, including: *Eragrostis curvula* (Lovegrass)*, Eragrostis racemosa* (Narrow Heart Love Grass) and *Eragrostis chloromelas* (Curly Leaf)*.* Additional grass species included *Aristida congesta* subsp. *congesta* (Spreading Three-awn), *Hyparrhenia hirta* (Common Thatching Grass)*, Themeda triandra* (Red Grass), *Agrostis lachnantha* (Bent Grass) and *Imperata cylindrica* (Cottonwool Grass) along hillslope seeps. Common and characteristic forbs and succulents included: *Aloe ecklonis* (Grass Aloe), *Chironia palustris* (Transvaal Chironia), *Haplocarpha scaposa* (False Gerbera), *Helichrysum oligocephala*, *Wahlenbergia* spp., and *Verbena brasiliensis* (Brazilian Vervain). Alien plant invasion was moderate in certain areas adjacent to cultivated fields and along roadsides, including species such as: *Datura stramonium* (Downy Thorn Apple)*, Solanum sysimbriifolium* (Sticky Nightshade) and *Verbena brasiliensis* (Brazilian Vervain). A single plant SSC was recorded on site, namely: *Aloe ecklonis* (Grass Aloe); provincially protected (Mpumalanga Nature Conservation, Act No. 10 of 1998 – Schedule 12).

Habitat	Description of habitat and flora	
		
Ephemeral Pans	Pans represented unique environments on site and were typically not colonised by plant species, except for the seepage areas around them. Pans are depressions without outflow. Common and characteristic plant species found to colonise pan edges included: *Cyperus semitrifidus*; *Juncus effusus* (Common Rush), *Persicaria lapatholia* and *Agrostis lachnantha* (Bent Grass). No Red Data or any protected plant species were recorded in this habitat.	

Habitat	Description of habitat and flora	
		
Plant Species of Special Concern	The following plant SSC that were recorded in the regional lists, as well as those recorded on site. A list of important species were recorded or known to occur within the consolidation project site: ▪ *Aloe ecklonis* (LC) – Recorded on site; ▪ *Aspidoglossum xanthosphaerum* (VU); ▪ *Crinum bulbispermum* (Declining) - Recorded on site; ▪ *Gladiolus crassifolius* (LC); ▪ *Gladiolus robertsoniae* (NT); ▪ *Eucomis autumnalis* (Declining) – Recorded on site; ▪ *Haemanthus humilis subsp. Hirsutus* (Critically Endangered) – Recorded on site; ▪ *Hypoxis hemerocallidea* (Declining); ▪ *Pachycarpus suaveolens* (VU); ▪ *Nerine gracilis* (VU); ▪ *Zantedeschia pentlandii* (VU); ▪ *Disa clavicornis* (Endangered); ▪ *Disa zuluensis* (Endangered);	

Habitat	Description of habitat and flora
	▪ *Erica rivularis* (Endangered); ▪ *Gerbera aurantiaca* (Endangered); ▪ *Gladiolus cataractarum* (Endangered);and ▪ *Pachycarpus suaveolens* (Endangered). *Aspidoglossum xanthosphaerum* is unlikely to occur since this species has only been recorded in four locations in montane grassland. *Khadia carolinensis* is likely to occur and has been recorded by Digby Wells in the greater study region before, but was not encountered in plant sampling plots. The *Satyrium* species was recorded just outside of the study boundary and suitable habitat is found on site.
Alien Plant Species	A total of 17 alien plant species (AIP) were recorded within the consolidation project area (Table 7.3 within the Fauna and Flora Specialist Report Appendix J); seven of these have been assigned alien plant categories according to CARA and NEM:BA with a total of five being a category 1. These species have established due to disturbance of the soil, largely due to cultivation in the area, as well as trampling by livestock. Small alien bushclumps have been delineated in the vegetation delineation of the consolidation project area. It is a requirement in terms of NEM:BA that these species are managed to prevent the spread of these invasive species.

10.1.8.2 Fauna

The information informing the fauna section has been sourced from the Digby Wells fauna Flora study, 2017, the TCTS EIA/EMPr, 2008 and EkoInfo CC Environmental & Wildlife Management Consultancy, 2008.

10.1.8.2.1 Mammals

Actual sightings, spoor, calls, dung and nesting sites, as well as active sampling by means of motion detection cameras and Sherman traps, were used to establish the presence of mammals within the consolidation project area. A full list of mammals identified in the consolidation project area is included in the Fauna and Flora Specialist Study Appendix D completed by Digby Wells (Appendix J). The mammals recorded were found within a variety of the vegetation communities. An assessment based on actual records indicates the presence of 18 mammalian species that were previously collected from the area, but not necessarily still present in the area.

Four of these species are regarded as species of special concern; African Clawless Otter (*Aonyx capensis*) being Red Data species protected under IUCN. Serval (*Felis serval*) is protected according to the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998). South African Hedgehog (*Atelerix frontalis*) and the Black-footed Cat (*Felis nigripes*) which are listed as rare (Friedmann Y and Daly B 2004).

10.1.8.2.2 Avifauna

A total of 67 species were identified during the survey. It is generally accepted that vegetation structure, rather than the actual plant species, influences bird species distribution and abundance (in Harrison et al.; 1997). The Southern Bald Ibis, Martin's and Swallows are anticipated to occur within the rocky outcrops of the consolidation project site. Greater Flamingo (*Phoenicopterus roseus*) (Least Concern) was observed in the pans and wetlands found onsite.

The wetlands within the consolidation project site are an important habitat for common water birds such as: Blue Korhaan (NT) (*Eupodotis. caerulescens)*, Sacred Ibis *(Threskiornis aethiopicus)*, Redknobbed Coot *(Fulica cristata)*, Grey Heron *(Ardea cinerea),* Purple Heron *(Ardea purpurea),* Egyptian Goose *(Alopochen aegyptiacus),* Cape Shoveler *(Anas smithii),* Spurwinged Goose *(Plectropterus gambensis),* Yellowbilled Duck *(Anas undulata),* Cattle Egret *(Bubulcus ibis)* and Three banded Plover *(Charadrius tricollaris)* and the adjacent grasslands provide potential habitat (*Imperata* cylindrica) for the Vulnerable African Grass Owl *(Tyto capensis* (according to the national Red Data list).

Uncommon bird species found in the consolidation project site include the Great Crested Grebe, Goliath Heron, Great White Egret, African Black Duck (riverine), Maccoa Duck, Ethiopian Snipe, Whiskered Tern and Marsh Owl (the last-mentioned also occurs in moist grasslands).

During the site visits a number of typical Mpumalanga Grassland species were observed. These areas also included the road infrastructure, farm boundary and isolated patches throughout the property and included species such as Black Shouldered Kite *(Elanus axillaris),* Neddicky *(Cisticola fulvicapilla),* Redeyed Dove *(Streptopelia semitorquata)*, Laughing Dove *(Spilopelia senegalensis),* Helmeted Guineafowl *(Numida meleagris),* Cape Turtle Dove *(Streptopelia capicola),* Common Fiscal *(Lanius collaris),* Cape Sparrow *(Passer melanurus),* Swainsons Spurfowl *(Pternistis swainsonii)* and large numbers of exotic Feral Pigeons *(Columba livia domestica)*.

Blue Korhaan (*Eupodotis caerulescens)* was recorded during this survey, and is found on high grassveld, usually above 1 500 m (del Hoyo *et al.* 1996), where it inhabits open, fairly short grassland and a mixture of grassland and karoo dwarf-shrubland within 1 km of water, with termite mounds and few or no trees (del Hoyo *et al.* 1996, Taylor *et al.* 2015).

The agricultural fields of the property harbour a number of typical highveld endemics. These included several widow, weaver and bishop species (within the wetter areas). A number of African Quailfinch's *(Ortygospiza fuscocrissa)* were observed within the fields – these species generally feed on the seeds of the wetter grass species and are renowned wetland indicators. African Pipit *(Anthus cinnamomeus)* and Cape Longclaw *(Macronyx capensis)* were observed throughout the property, although there is enough nesting habitat in the surrounding area for the more endangered lark species it is noted that the existing mining activities, increased traffic loads and earth movement have negatively impacted on the breeding of all lark and pipit species on the property, however once rehabilitation is concluded this is usually not a permanent impact.

The grassland area is also ideal habitat for Quail and Button-quail species although these species are highly nomadic and were not identified during the site investigation. The data from the Co-ordinated Road Count project (CAR) of the Avian Demography Unit shows that the wetlands in the Mpumalanga Highveld are extensively used by Spurwinged Goose *(Plectropterus gambensis),* Black-headed Heron *(Ardea melanocephala)* and Grey Crowned Crane *(Balearica regulorum)*.

Table 10-18: Red Data Species Recorded in by SABAP2 that could potentially occur on Vaalkop, Trichardtsfontein and Thubelisha Mining areas

Common Name	Species Name	Status	Habitat requirements
White-bellied Korhaan	*Eupodotis senegalensis*	SA Red Data: VU IUCN: NT NEM:BA, TOPS: MTPA: Protected	Often in the interface between grassland and savanna. Avoids severely grazed and recently burnt sites. Could potentially be present in patches of tall grass.

Common Name	Species Name	Status	Habitat requirements
Blue Korhaan (recorded)	*Eupodotis caerulescens*	SA Red Data: LC IUCN: NT NEM:BA, TOPS: MTPA: Protected	Between grassland and savanna.
Secretary bird	*Sagittarius serpentarius*	SA Red Data: VU IUCN: VU NEM:BA, TOPS: MTPA: Protected	Prefer open grassland, densities lower in maize growing areas. Occasional presence confirmed by locals.
Blue Crane	*Anthropoides paradiseus*	SA Red Data: VU IUCN: VU NEM:BA, TOPS: Protected MTPA: Protected	Short grassland, pastures, stubble lands and wetlands. Unlikely to occur in the study area due to largely unsuitable fragmented habitat, extensive disturbance, and habitat transformation.
Black Stork	*Ciconia nigra*	SA Red Data: VU IUCN: LC NEM:BA, TOPS: Protected MTPA B: Protected	Occurs as a nomad at lakes, rivers, wetlands. Unlikely to be seen on site unless flying overhead.
African Grass Owl (recorded)	*Tyto capensis*	SA Red Data: VU IUCN: LC NEM:BA, TOPS: Protected MTPA: Protected	Roosts on the ground near marshes and grassland. It is likely that this species is found on the consolidation project area.
African Marsh Harrier	*Circus ranivorus*	SA Red Data: EN IUCN: LC NEM:BA, TOPS: Protected MTPA: Protected	Large permanent wetlands with dense reed beds. Sometimes forages over smaller wetlands and grassland. Wetland habitat present on the study site too small and fragmented to support this species.

Common Name	Species Name	Status	Habitat requirements
Yellow-billed Stork	*Mycteria ibis*	SA Red Data: EN IUCN: LC NEM:BA, TOPS: Protected MTPA: Protected	Dams, large mashes, swamps, estuaries, margins of lakes and seasonal wetlands. Unlikely to occur in the study area due to limited suitable habitat.
Botha's Lark	*Certhilauda semitorquata*	SA Red Data: EN IUCN: EN NEM:BA, TOPS: Protected MTPA: Protected	An uncommon and restricted species was only observed via SABAP1. In the region it would prefer shorter grazed grasslands. Unlikely to occur in the study area due to lack of suitable habitat and preferred range.
Lesser Kestrel	*Falco naumanni*	SA Red Data: LC IUCN: LC NEM:BA, TOPS: Protected MTPA: Protected	Grassland and agricultural lands. Likely to be present in summer on the consolidation project site (Palearctic migrant).

10.1.8.2.3 Herpetofauna

Three amphibians were encountered during this field survey by means of active searching. All species identified on site are listed in Table 10-19. The species listed as encountered below were all encountered within the wetlands habitat types.

Table 10-19: Amphibian Species Recorded in the Vaalkop Project Area

Scientific Name	English Name	IUCN (2014.3)	NEM:BA TOPS List (2007)	Mpumalanga Protected (1998)
Afrana angolensis	Common River Frog	-	-	-
Cacosternum boettgeri	Common Caco	-	-	-
Strongylopus fasciatus	Striped Stream Frog	-	-	-

Two species of reptile, a Rinkhals (*Hemachatus haemachatus*) and Brown House Snake (*Lamprophis fuliginosus*) were identified during the field survey through opportunistic observations (Table 10-20). No IUCN protected species were encountered; however 10 species were recorded that is protected according to Mpumalanga protected species list (1998).

Table 10-20: Reptile Species Recorded on Vaalkop

Scientific Name	English Name	IUCN (2014.3)	NEM:BA TOPS List (2007)	Mpumalanga Protected (1998)
*Bitis arietans***	Puff Adder	Not Listed	Not Listed	Protected
Cordylus vittifer	Common Girdled Lizard	Not Listed	Not Listed	Protected
*Hemachatus haemachatus***	Rinkhals	Not Listed	Not Listed	Protected
*Lamprophis fuliginosus***	Brown House Snake	Not Listed	Not Listed	Protected
Pachydactylus affinus	Transvaal gecko	Not Listed	Not Listed	Protected
Psammophylax rhombeatus	Spotted or Rhombic Skaapsteker	Not Listed	Not Listed	Protected

- Recorded this assessment by DWE

** - Recorded via personal communication with local people

The Montane Dwarf Burrowing Skink (*Scelotes mirus)*, a South African endemic, has also been recorded. Other rare reptiles may be found which include the rare Many-Spotted Snake (*Amplorhinus multimaculatus)*, Berg Adder (*Bitis Atropos)*, Thin-tailed Legless Skink (*Acontias gracilicauda)*, Breyer's Long-tailed Seps (*Tetradactylus breyeri)*, Black-spotted Dwarf Gecko (*Lygodactylus nigropunctatus)* and Spotted Dwarf Gecko (*L. ocellatus)*, as well as Rough-haired Golden Mole (*Chrysospalax villosus)*.

10.1.8.2.4 Macro-Invertebrates

Five butterfly species were observed within the consolidation project site, these included the, Spotted Jonker *(Byblia ilythia)*, African Monarch *(Danaus chrysippus)*, Brown-veined White *(Belenois aurota),* Broad Bordered Grass Yellow *(Eurema brigitta)* and the Citrus Swallowtail *(Papilio demodocus).* All the species were located within grassland or the riparian areas adjacent to the farm. No butterfly species observed were considered to be Species of Special Concern. However according to SANBI, it is possible that the Near Threatened Marsh Sylph *(Metisella meninx)* can be located on the site. It is endemic to the wet vleis of highland grassland in northern KwaZulu-Natal, Mpumalanga, Gauteng, the northern part of the Orange Free State and the extreme east of the North West Province; they preferred *Leersia hexandra* dominated grassland. It has become extinct in many areas close to Johannesburg due to building developments.

Wasp Robber Flies *(Philodicus sp)* were located in the grasslands. The name "robber flies" reflects their notoriously aggressive predatory habits; they feed mainly or exclusively on other insects where they generally catch their prey in flight (Weaving, 2004). Adults are generally medium to large in size, with an average body length of 1 to 1.5 cm but with a range of 3 cm to more than 5 cm in length. The shape is generally elongated, due to the conformation of the long tapering abdomen; however there are also compact species with broad abdomens (Picker and Griffiths, 2004).

Dung beetles *(Scarabeus sp)* were located throughout the property and wherever cattle faeces were evident. These beetles eat dung excreted by herbivores and omnivores, and prefer that produced by the former. Many of them also feed on mushrooms and decaying leaves and fruits. All the species belong to the superfamily *Scarabaeoidea*, most of them to the subfamilies *Scarabaeinae* and *Aphodiinae* of the family *Scarabaeidae* (scarab beetles).

10.1.9 Aquatic Ecology

10.1.9.1 Water Quality

The land use in upper reaches of the Piekespruit and Steenkoolspruit consisted mainly of agricultural activities comprised of cultivation and livestock. Thus, knowing this and observing the runoff from the farming activities during the site visit, it is most likely that these agricultural activities are resulting in the higher than normal conductivity and pH values recorded. It is also possible that the geology of the consolidation project area may be playing a role in these high values but further investigation into this is required to make any concise conclusions.

10.1.9.2 The Intermediate Habitat Integrity Assessment (IHIA)

The IHIA was completed for the SQR's in the consolidation project area categorised by DWA (2016), namely Trichardtspruit (B11D-01481), Debeerspruit (B11C-01503), Piekespruit Tributary (B11C-01542), Piekespruit (B11C-01527) and Steenkoolspruit (B11C-01449). The IHIA was also completed for the two uncategorised tributaries (DWA, 2016) in the consolidation project area, namely the Debeerspruit Tributary and the Steenkoolspruit Tributary. The results for each IHIA are provided in Table 10-21.

Table 10-21: Intermediate Habitat Integrity Assessment

SQR's in the project area	IHIA Score	Observation
Trichardtspruit (T1) (B11D-01481)	Category E or seriously modified	▪ Major impacts appear to be related to flow modification, caused by the release of water from the Trichardtsfontein Dam and mining activities (including a river diversion) ▪ Ultimately the change in flow has led to a number of related impacts such as channel modification, bed modification and bank erosion

SQR's in the project area	IHIA Score	Observation
		▪ Farming and mining relating impacts along the SQR have led to the subsequent loss of natural/indigenous vegetation
Debeerspruit (D1) (B11C-01503)	Category C or moderately modified	▪ The upper reaches of the SQR appear to be in a fairly healthy state ▪ Farm dams, including an extremely large dam located approximately in the middle of the reach has further inundated this non-perennial system ▪ This has also led to flow, bed and channel modification along the reach
Debeerspruit (D2) Tributary	Category C or moderately modified	▪ The major modifications are as a result of the number of impoundments existing along the tributary ▪ These impoundments have further led to channel, bed and flow modification ▪ The impacts also have been compounded by the presence of livestock along the tributary which has possibly resulting in the large amount of algae observed at the Debeerspruit sites
Piekespruit (P1) Tributary (B11C-01542)	Category C or moderately modified	▪ It appears that only one small farm dam has been built in the upper reaches of the SQR and as a result flow, bed and channel modifications have not been as severe as observed along the other SQR's in the consolidation project area ▪ The river system also appears to be naturally slow flowing ▪ The largest modification appears to be as a result of livestock along the reach which has possibly compounded the effects of bank erosion. Lastly, physical vegetation removal can be observed along the reach, especially noted in the lower section of the SQR, due to farming encroachment into the riparian zones of the river
Upper Piekespruit (P2) (B11C-01527)	Category C or moderately modified	▪ Modifications along this reach consist mainly of impoundments built in the upper sections resulting in modifications to the SQR's flow, channel and bank stability ▪ The riparian habitat appears to be in a fairly intact state with the exception of farming activities affecting sections ▪ Large amounts of algae were also observed

SQR's in the project area	IHIA Score	Observation
Steenkoolspruit (S1) (B11C-01449)	Category C or moderately modified	▪ Major impacts appear to be related to a few farm dams situated in the upper reaches of the SQR as well as large amounts of erosion observed throughout the SQR ▪ Large amounts of algae were also observed at the site which is possibly a result of livestock being present
Steenkoolspruit Tributary (S2)	Category C or moderately modified	▪ The presence of the large impoundment, located approximately in the middle of the tributary, appears to have a larger impact due to the tributary's short length (approximately 8 km) ▪ Large numbers of livestock were also observed

10.1.9.3 Macroinvertebrates

Water levels were sufficient at all of the selected sites, with the exception of S2, during both the low and high flow surveys for macroinvertebrate sampling. The IHAS results indicate that the majority of the sampled macroinvertebrate habitat ranged from fair to good with the sampled habitat at site T1 being classified as good due to the abundance of stones sampled in current. The majority of the biotopes sampled at the sites were rated as fair with the exception of sites P1 and P2 being rated as poor.

The results of the SASS5 assessments completed for the study are presented in Table 10-22 and Table 10-23.

Table 10-22: SASS5 Results of the High Flow Survey (March 2017)

Site	T1	D1	D2	P1	P2	P3	P4	S1
SASS5	72	87	81	92	83	99	106	76
Taxa	15	18	19	19	18	21	22	17
ASPT	4.8	4.8	4.3	4.8	4.6	4.7	4.8	4.5
Category	C/B	B	C	B	B	B	B	C

Table 10-23: SASS5 Results of the Low Flow Survey (June 2017)

Site	T1	D1	D2	P1	P2	P3	P4	S1
SASS5	66	54	61	94	55	75	72	98
Taxa	13	14	14	22	13	17	17	21
ASPT	5.1	3.9	4.4	4.3	4.2	4.4	4.2	4.7
Category	B	D	D	B	D	C	C	B

The results of the SASS5 assessment indicate fairly healthy macroinvertebrate assemblages, especially during the high flow survey. The lowest categorisations (category C) during the high flow survey were recorded at D2 and S1 with the macroinvertebrate assemblage at T1 falling on the borderline between category C and B.

The overall results during the low flow survey decreased. This is normally expected due to the lower water levels generally occurring during the low flow season. The more sensitive macroinvertebrates usually are absent due to these conditions and as a result lower SASS5 scores are expected. However, the score recorded at S1 increased during the low flow survey. The cause of this increase was attributed to the presence of three previously absent families of Odonata (Dragonflies and Damselflies). These families were sampled in a section of aquatic vegetation that was not available for sampling during the high flow survey.

Typical SASS5 scores in the rivers show the presence of largely tolerant taxa adapted to marginal and instream vegetation and slow flowing water. Taxa specifically adapted to stones in current or flowing conditions were absent from the sites assessed, with the exception of the macroinvertebrate assemblages observed at T1. The MIRAI will provide further insight into the conditions in the assessed river system.

The MIRAI was conducted for the SQRs of concern as well as for the Debeerspruit Tributary. The results are explained below.

Table 10-24: Macroinvertebrate Assessment Index

Site	T1	D1	D2	P1	P2	S1
Flow modification	43.1	59.5	59.7	61.1	56.7	61.0
Habitat	49.0	59.8	58.6	57.3	59.4	61.9
Water Quality	49.1	54.9	58.2	60.7	52.8	54.7
Ecological Score	**47.0**	**58.1**	**58.9**	**59.7**	**56.4**	**59.3**
Invertebrate Category	**D**	**C/D**	**C/D**	**C/D**	**D**	**C/D**

10.1.9.4 Fish Response Assessment Index

The presence/absence of the expected fish species recorded during the surveys is presented in Table 10-25 below.

Table 10-25: Fish species presence/absence

Species	T1	D1	D2	P1	P2	P3	P4	S1
High Flow Survey (March 2017)								
Enteromius anoplus	•	✓	✓	✓	✓	✓	✓	✓

Species	T1	D1	D2	P1	P2	P3	P4	S1
Enteromius neefi	N/A	•	•	•	•	•	•	•
Enteromius paludinosus	•	✓	✓	•	✓	✓	✓	✓
Clarias gariepinus	•	•	✓	•	•	✓	•	•
Labeo umbratus	•	•	✓	•	•	✓	•	•
Labeobarbus polylepis	•	•	•	•	•	•	•	N/A
Pseudocrenilabrus philander	•	✓	✓	•	✓	•	✓	✓
Tilapia sparmani	•	✓	•	•	•	✓	✓	✓
Total number of species	0	4	5	1	3	5	4	4
Low Flow Survey (June 2017)								
Enteromius anoplus	•	✓	✓	✓	✓	✓	✓	✓
Enteromius neefi	N/A	•	•	•	•	•	•	•
Enteromius paludinosus	•	✓	•	•	•	✓	✓	•
Clarias gariepinus	•	•	•	•	•	•	•	•
Labeo umbratus	•	•	✓	•	•	✓	•	•
Labeobarbus polylepis	•	•	•	•	•	•	•	N/A
Pseudocrenilabrus philander	•	✓	•	•	•	•	✓	✓
Tilapia sparmani	•	✓	•	•	•	✓	✓	✓
Total number of species	0	4	2	1	1	4	4	3
*N/A depicts fish species which are not expected at the relevant site								

No fish species were sampled at site T1, but are expected to be present in the system further downstream (Nepid Consultants, 2008). The fish species varied throughout the remaining sites with the dominant species being *Enteromius anoplus*, which was sampled at all of the sites (except T1) during both the low and high flow surveys.

Table 10-26: Fish Response Assessment Index

Site	T1	D1	D2	P1	P2	S1
Automated FRAI Score (%)	Not Calculated	54.5	49.6	38.8	54.5	51.7
Adjusted FRAI Score (%)	Not Calculated	62.7	62.3	50.9	65.6	63.1
Ecostatus	Not Calculated	C	C	D	C	C

10.1.9.5 Present Ecological Status

The results of the ecological classification and PES for the river reaches considered are provided below.

Table 10-27: The Present Ecological Status of the river reach for Trichardtspruit (B11D-01481)

Category	Score	Ecological category
Riparian Habitat Ecological Category	36.6	E
Fish Ecological Category (T1)	N/A	E
Fish Ecological Category (T2)	N/A	D
Macroinvertebrate Ecological Category	47.0	D
Ecostatus		**D/E**

Considering the determined ecological categories and the categories obtained from the study conducted by Nepid Consultants (2008), the ecostatus for the SQR is category D/E or largely to seriously modified. It is important to note that this categorisation speaks mainly to the upper reaches of the SQR.

Macroinvertebrates with fairly high sensitivity scores (*Hydropsychidae*) were collected at the monitoring site T1. However, it appears that they were present in the system due to the high flow from the Trichardtsfontein Dam and not due to good ecosystem functioning, as indicated by the modified MIRAI categorisation (category D). The riparian ecological category indicates far more degraded conditions. This is especially noted downstream

Table 10-28: The Present Ecological Status of the river reach for Debeerspruit (B11C-01503)

Category	Score	Ecological category
Riparian Habitat Ecological Category	61.1	C
Fish Ecological Category	62.7	C
Macroinvertebrate Ecological Category	59.7	C/D
Ecostatus		**C**

The overall PES for the Debeerspruit was determined to be in a moderately modified state (category C). This modified state appears to be a result of the combination of the modified ecological indicators observed in the river. The fish and macroinvertebrate assemblages appear to be degraded due to the compounded effect of fairly poor water quality and habitat modification.

Table 10-29: The Present Ecological Status of the river reach for Debeerspruit Tributary (Site D2)

Category	Score	Ecological category
Riparian Habitat Ecological Category	60.2	**C**
Fish Ecological Category	62.3	**C**
Macroinvertebrate Ecological Category	58.9	**C/D**
Ecostatus		**C**

The overall PES for the Debeerspruit was determined to be in a moderately modified state (category C). Impacts observed in the Debeerspruit were similar to those observed in the Debeerspruit Tributary. The higher scores recorded for the riparian habitat and fish ecological categories were able to categorise the overall PES as category C (moderately modified) instead of C/D (moderately to seriously modified) as determined for the macroinvertebrates.

Table 10-30: The Present Ecological Status of the river reach for Piekespruit Tributary (B11C-01542)

Category	Score	Ecological category
Riparian Habitat Ecological Category	**80.4**	**B**
Fish Ecological Category	**65.6**	**C**
Macroinvertebrate Ecological Category	**59.7**	**C/D**
Ecostatus		**C**

The PES for the Piekespruit Tributary was determined to be category C or moderately modified. This modified state is a result of the modified fish and macroinvertebrate assemblages recorded at site P3.

Table 10-31: The Present Ecological Status of the river reach for Upper Piekespruit (B11C-01527)

Category	Score	Ecological category
Riparian Habitat Ecological Category	67.4	**C**
Fish Ecological Category	50.9	**D**

Category	Score	Ecological category
Macroinvertebrate Ecological Category	56.4	**D**
Ecostatus		**C/D**

The PES for the Piekespruit was determined to be category C/D or moderately to largely modified. This modified state is a result of the modified fish and macroinvertebrate assemblages recorded at sites P1 and P2 which is most likely due to habitat and water quality impacts relating to the associated farming activities.

Table 10-32: The Present Ecological Status of the river reach for Steenkoolspruit Tributary

Category	Score	Ecological category
Riparian Habitat Ecological Category	68.0	**C**
Fish Ecological Category	N/A	**N/A**
Macroinvertebrate Ecological Category	N/A	**N/A**
Ecostatus		**C**

The PES determined for the Steenkoolspruit Tributary was based solely on the IHIA. Macroinvertebrate and fish sampling were not possible due to the low conditions of the monitoring site (S2). Therefore, it is assumed that the ecostatus of the Steenkoolspruit Tributary is category C or in a moderately modified state. Modifications appear to be directly associated with agricultural activities taking place in proximity to the tributary. This was especially noted with the number of livestock present, even at the monitoring site during sampling.

Table 10-33: The Present Ecological Status of the river reach for Steenkoolspruit (B11C-01449)

Category	Score	Ecological category
Riparian Habitat Ecological Category	67.7	**C**
Fish Ecological Category	63.1	**C**
Macroinvertebrate Ecological Category	59.3	**C/D**
Ecostatus		**C**

The PES for the Steenkoolspruit was calculated as category C or moderately modified. This modified status can be attributed to impacted habitat (instream and riparian) which appears to be due to farming activities taking place in proximity to the SQR. The modified habitat and overall poor water quality has resulted in modified macroinvertebrate and fish assemblages, as observed at site S1, which has further resulted in the modified PES categorisation.

10.1.10 Noise

The information utilised to compile the baseline noise assessment for the consolidation project was obtained from the Noise impact assessment completed for the proposed ventilation shafts as well as the historic noise assessment which was completed in 2008 for TCTS.

Noise monitoring was also undertaken in the locations where the ventilation shafts are proposed to be constructed. Table 10-34 provides an indication of where the noise monitoring was undertaken as well as Table 10-35 provides the results of the noise levels within this area.

Table 10-34: Noise Measurement Locations

Site ID	Farm/location	Category of Receiver	GPS Coordinates
N1	Rooipoort 143 IS Ptn 3	Rural	26°29'18.74"S & 29°16'20.02"E
N2	Rooipoort 144 IS Ptn 8	Rural	26°28'53.60"S & 29°17'57.60"E
N3	Zeekoegat 145 IS Ptn 1	Rural	26°28'8.08"S & 29°19'37.23"E
N4	Palmietfontein 110 IS Ptn 18	Rural	26°27'53.83"S & 29°20'34.39"E

Table 10-35: Results of Baseline Noise Measurements

Sample ID	SANS rating limit guidelines			Measurement details		
	Type of district	Period	Typical rating level dBA	L_{Aeql} dBA	Maximum/Minimum dBA	Date
N1	Rural	Daytime	45	56	74 / 48	29/06/2017
		Night time	35	53	64 / 47	29/06/2017
N2	Rural	Daytime	45	50	78 / 36	26/06/2017
		Night time	35	45	55 / 38	26/06/2017
N3	Rural	Daytime	45	57	84 / 32	28/06/2017
		Night time	35	42	63 / 31	28/06/2017
N4	Rural	Daytime	45	51	82 / 35	27/06/2017
		Night time	35	45	61 / 29	27/06/2017

Sample ID	SANS rating limit guidelines			Measurement details		
	Type of district	Period	Typical rating level dBA	L_{Aeql} dBA	Maximum/Minimum dBA	Date
	Indicates L_{Aeql} levels above either the daytime rating limit or the night time rating limit					

It was found that existing ambient levels vary considerably over the consolidation project site, from as low as 34 dBA, up to 72 dBA during daytime. It is noted that the high noise levels could be associated to the following:

- N17 main road;
- The existing Syferfontein conveyor;
- In-house farm workshop activities;
- Brickworks operations;
- Engineering works on the premises;
- Nearby water pump continuously running; and
- Sounds from the TCTS Mine was audible from this monitoring location, however was not significantly influencing the baseline noise level.

During night time survey hours it was found that noise levels showed less variation over the study area with a typical value of 42 to 53 dBA. What was particularly noticeable in the noise survey was that industrial and mining activity noise at most locations was inaudible during daytime, while emerging as dominant sources of noise at night.

The exceptions were those locations situated in the immediate proximity of the Syferfontein conveyor, where the conveyor is audible and dominant during daytime as well.

The noise levels during night time hours were influenced by the following:

- Frequent vehicle traffic on the nearby national road (N17);
- Nearby water pump continuously running;
- Insect sounds from the *Gryllidae* and *Cicada* as well as sounds from amphibians dominated throughout the night time period;
- Sounds from the TCTS Mine was audible from this monitoring location, however was not significantly influencing the baseline noise level;
- Birdsong from the bird species caged on the premises; and
- Kosmosrant residential area.

10.1.11 Visual

Overall the consolidation project area is rural. On the western side of the consolidation project area the Sasol Secunda industrial complex of stacks and cooling towers is a significant presence in the distance. Directly adjacent to the consolidation project area is the town of Trichardt. The main public route through the area is the N17, from Kinross to Bethal.

The views from this road are primarily of farmlands with a few significant visual intrusions such as the Syferfontein and Thubelisha conveyors and transfer stations on the western side of the property and the Sasol Synfuels Complex mentioned above. The Thubelisha shaft can also be seen from the N17.

10.1.12 Social

The social baseline environment of the proposed study area has been discussed in the sections below. The baseline profile focuses on the socio-economic characteristics of the site-specific, primary and secondary study areas. The information presented is largely based on the results of the 2011 Census, supplemented by relevant information from other data sources such as the IDP for the GSDM (Socio-economic) and GMLM (2017-2022), as well as the GMLM's SDF. Both the qualitative data obtained through consultation with local stakeholders by means of interviews, and the data obtained during the investigative site visit have also been incorporated into this section in order to present a consolidated profile of each of the Mining Right areas.

10.1.12.1 Gert Sibande District Municipality

The GSDM is one of three districts in Mpumalanga. It covers a geographical area of approximately 32 100 km^2, which is approximately 42% of the province's ground area. The district is bordered by Swaziland to the east, the Nkangala DM to the north and the Ehlanzeni DM to the north-northeast. Gauteng lies to the west, the Free State to the southwest and KwaZulu-Natal to the southeast. The district's main seat is located in Ermelo with satellite offices in Carolina, Balfour and Piet Retief.

10.1.12.2 Govan Mbeki Local Municipality

The GMLM is one of seven local municipalities in the GSDM and is located in the western quadrant of the district. It covers a geographical area of approximately 2 960 km^2 (approximately 9.2% of the district's land surface), which makes it the second smallest municipality in the district. The municipality's main seat is Secunda.

10.1.12.3 Primary Study Area

The consolidation project is located within Wards 5, 15 and 25 of the GMLM. The sections below provides a detailed description of the Primary Study Area

10.1.12.3.1 Population Demographics

The Primary Study Area covers approximately 1 700 km^2 and has a total population of roughly 32 400, of which most reside in Ward 25 (39.6%), followed by Ward 15 (31.9%) and Ward 5 (28.5%). The average population density is around 19.1 persons per km^2, with the highest population density in Ward 25 (64/km^2) and the lowest in Ward 15 (10/km^2). More than half (53.3%) of the consolidation project area's population is male, with the highest concentration (55.7%) found in Ward 5. Except for Ward 15, the predominant population group in the consolidation project area is White (an average of 54.4%). In line with the racial profile of the consolidation project area, Afrikaans is the language most spoken at home (53.7%) – more so in Wards 5 and 25.

On average, more than two thirds (68.1%) of the consolidation project area's population is within the economically active age group (18-64), with the largest concentration of this age group in Ward 5 (72.1%). Close on a third (29.8%) of Ward 15's population are children (aged <18).

10.1.12.3.2 Education

On average, close to a third (30.9%) of the consolidation project area's adult population obtained Grade 12. The highest concentration of adults who had no schooling is found in Ward 15 (12.6%). Both Wards 5 and 25 have a significant portion (28.5% and 26.3% respectively) of the adult population who completed a post-matric qualification, ranging from a certificate with Grade 12 to diplomas post PhD-degree. The IDP (2017-2022) provides no information on the number or state of schools in the consolidation project area. Other wards (i.e. Wards 9, 14, 16, 19, 20, 22 and 32) all list the upgrade and/or construction of school(s) as priority community development needs that require urgent attention.

Figure 10-5 provides and overview of Education (Grouped) per Ward in the consolidation project area.

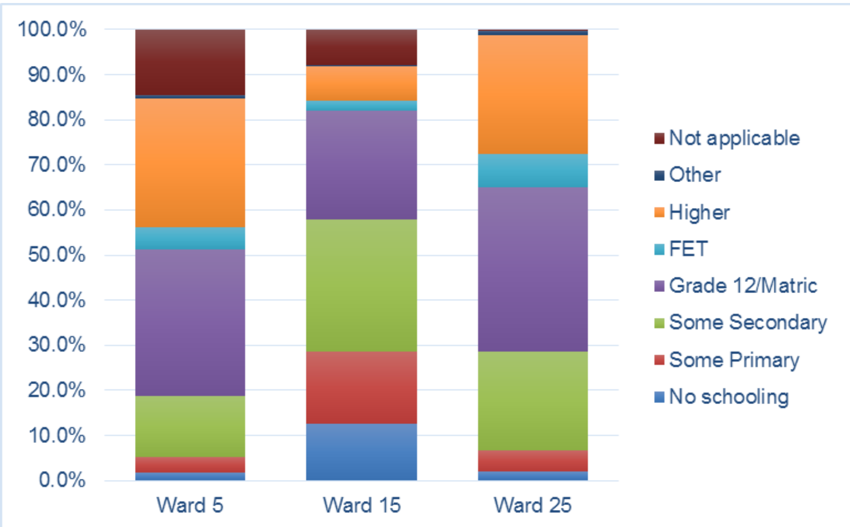

Figure 10-5: Overview of Education (Grouped) per Ward in the Project Area

10.1.12.3.3 Household Services

The consolidation project area consists of approximately 9 000 households at an average occupancy rate of 3.6 persons per household. Of the 9 000 households, approximately 800 were hovels – the largest number of these (approx. 620) were located in Ward 15. On average, a third of houses (approximately 39.8%) in the consolidation project area are rented, with as high as 47.7% in Ward 25. Ward 15 has the largest segment of houses that are owned and fully paid off (20.7%) along with a significant number of houses that are occupied rent free (26.7% against Ward 5's 6.2% and Ward 25's 9.1%).

On average, 83.1% of all households had piped water supplied by a regional/local water scheme (most often the local municipality). However, Ward 15 still had a large proportion of households who relied on a borehole (15.8%) or a roaming water tanker (11.5%) as their primary water source. Although the majority of households on average (85%) have access to toilet facilities on par with RDP standards (any flush system connected to either a sewerage system or septic tank), slightly more than a third (34.5%) of households in Ward 15 only have access to a system below RDP standards (no flush system, VIP without ventilation or bucket system).

10.1.12.3.4 Type of dwelling

Nearly three-quarters of households in both municipalities live in formal dwellings. The remainder in the GSDM is split between traditional (10%) housing and informal dwellings (17%). The GMLM has a significantly larger proportion of informal dwellings (28%), which is likely an indicator of the influx of job-seekers and lower wage employees into the local municipality, where job opportunities are more prevalent than across the district (also see Section 4.7.1)

Informal settlements are most prevalent in Lebohang, eMzinoni/Milan Park and eMbalenhle where there are 500, 3 150 and 4 000 un-serviced shacks respectively (GMLM IDP 2012-2015). Several smaller informal settlements are scattered on the farms comprising the study area. A number of low cost housing projects are under way, which will provide approximately 13 440 stands. The shortage of affordable housing is also evidenced by the growing number of informal settlements throughout and site-specific and primary study area. These settlements include stand-alone settlements such as Holfontein, and smaller settlements on farms, where farm owners are allowing settlers to stay on their farm, as well as informal extensions of formal townships such as in eMbalenhle.

10.1.12.3.5 Planned residential developments

Terra Nova Township

Terra Nova Township, located just north of Trichardt, is a proclaimed township owned by Tornicorp (Pty) Ltd, and will consist of four extensions (Terra Nova Extension 1-4). The first phase of the development comprising 159 townhouses, have been sold out, and bulk services for this development have been partially installed. Currently people are already residing in the Cosmos extension of the township (see Figure 10-6). The DMR has already granted consent for the Township in terms of Section 53(1) of the MPRDA, 2002 (Act No 28 of 2002) and agreements are in place between the Township Owner and the Mineral Rights Holder, not to undermine the area under the Township footprint.

Figure 10-6: Occupied Cosmos View Complex in Terra Nova

Trichardtsfontein Extension 8

This development is situated on the north western edge of the proposed mining right area on portions 21 and 22 of Trichardtsfontein 140 IS. A township application has been submitted for the development, but it is currently being appealed. The developer intends to develop the section to the north of the N17 roadway into a residential area, while the southern edge will be reserved for light industrial and business uses.

The property includes an intersection on the N17, which as indicated in the Municipal SDF, can in future connect to Secunda, possibly forming a major entrance to the Town. Another entrance to Trichardt is also possible from this intersection. It could be argued that the aforementioned features significantly increase the potential value of the land, assuming that township approval is granted. It is noteworthy that as with the other proposed development, the developer has already incurred substantial financial costs in setting up the township application, and will experience a financial loss of investment if residential development is restricted.

Figure 10-7: N 17 intersection at Trichardtsfontein Extension 8

TARU Township

A Section 53 consent (which is also under appeal) has been issued by the DMR for the development of the Township, which would comprise Portions 16, 52 and 53 of Trichardtsfontein 140-IS. The Township is situated towards the western edge of the mining right area, and is currently awaiting final approval.

It is envisaged that the TARU Township will comprise mixed uses, consisting of a variety of zonings and densities. Approximately 1 500 to 1 700 residential opportunities can be provided for in the Township.

At this stage no services have been installed on the site for the purposes of the Township, however the Township will partly make use of the existing infrastructure such as the sewer works, water network, and existing substations for electricity.

Secunda Extension 8

The proposed township is to be located towards the north-western border of Trichardt, and north-east of Secunda. The owners of the property have done a preliminary Township Development Plan to develop 700+ residential opportunities on the property. The property is serviced by the main road connecting Trichardt and Secunda. The existing railway line forms the Eastern boundary of the property. There is also a main water line from Rand Water Works running alongside the railway line providing adequate access to the provision of water for any development on the property. The developers have not yet formally applied for a township. Like several of the other proposed residential developments, the developers ultimately intend to provide housing options for the medium to upper socio-economic class.

Figure 10-8: Proposed site for the Secunda Extension 8 Township

10.1.13 Cultural Heritage

The area is underlain by lithologies with palaeontological sensitivity. Additionally, identified tangible heritage resources demonstrate that the consolidation project site under consideration comprise a cultural landscape affiliated with the Later Farming Community (LFC) and historical period.

The current natural environment, the aforementioned various time periods and associated heritage resources are briefly discussed below.

10.1.13.1 Palaeontological context

The consolidation project area is predominantly underlain by lithologies associated with the Karoo Supergroup. The consolidation project site is associated with Karoo dolerites and the Vryheid Formation (Rubidge, 2008; Rubidge, 2013a; Rubidge, 2013b).

The Karoo dolerites are intrusive diatremes classified as plutonic igneous rocks. This geological suite is void of any fossiliferous material and has no palaeo-sensitivity (SAHRA, 2013a; Rubidge, 2013a; Rubidge, 2013b).

The Vryheid Formation is the primary potential fossiliferous rock underlying the consolidation project site. It corresponds to the basal unit of the Ecca Group deposited in a deltic environment at ~180 Ma. This formation is inherently associated with shales, sandstones, mudstones and coal (Bamford, 2016).

Coal is formed by the compression and heat alteration of plant matter. Through this formation process, the coal is altered to the point that any potential plant fossil remains are unrecognisable. The shales found between the coal horizons and to a lesser degree the sandstone surface outcrops, however, have the potential to preserve good examples of plant fossils (Bamford, 2014; Bamford, 2016). Based on this, the Vryheid Formation is designated with very-high palaeo-sensitivity (SAHRA, 2013b).

Fossil plants in general resemble modern plants. Examples of fossilised plants in the consolidation project site are shown in Figure 10-9. Common fossil plants that may be expected in the Vryheid Formation include:

- Glossopteris leaves, roots and inflorescences; and
- Calamites stems.

Fossil mammal-like reptiles and mammals are known to be associated with coal deposits. These are seldom, if ever, preserved with plant fossils (Bamford, 2012; Bamford, 2016).

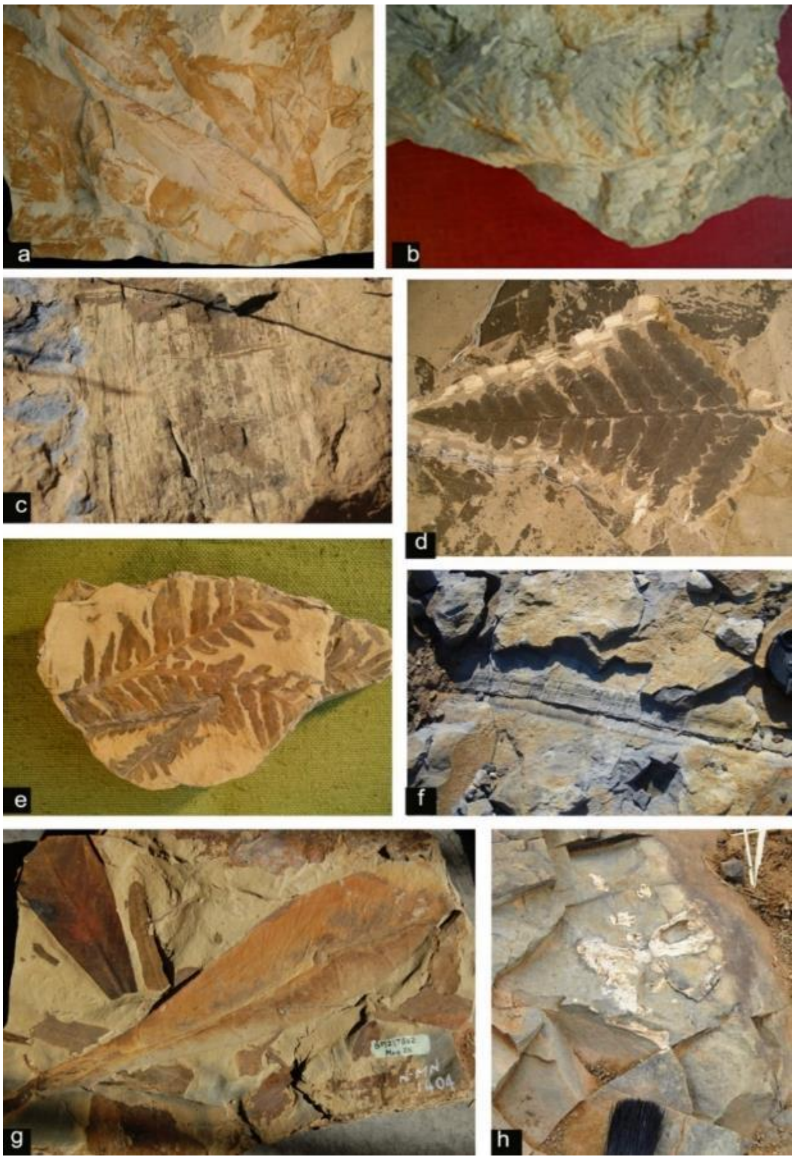

Figure 10-9: Composite of possible Karoo-aged fossil plants that may be identified within the site-specific study area (Bamford, 2016)

10.1.13.2 Late Farming Community Period

Late Farming Community (LFC) resources identified in previously completed assessments account for 24% (10 records) (Figure 10-10) of the recorded heritage resources within the consolidation project site (van Schalkwyk, 2003b; Karodia & Nel, 2014a). The assessors recorded these resources as follows:

- Low density surface scatters (1 record);
- Ash deposit (1 record);
- Structural remains (6 records); and
- Stone walled settlements (2 records).

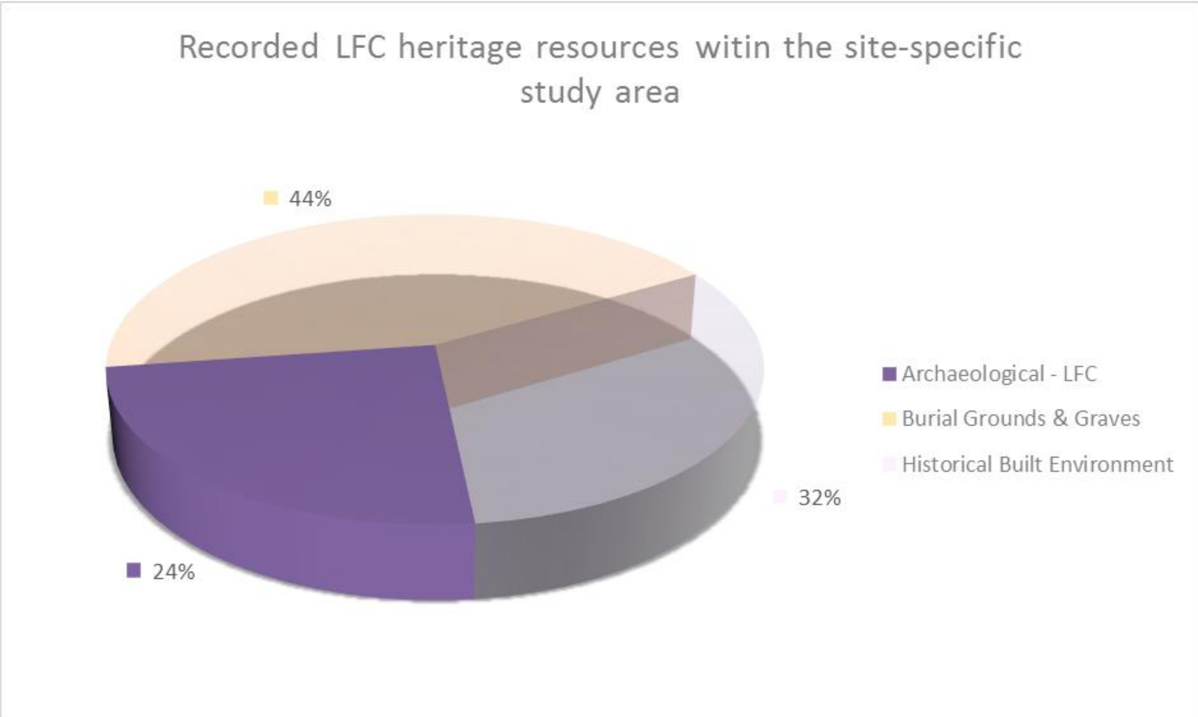

Figure 10-10: Recorded LFC heritage resources within the site-specific study area

Furthermore, a review of aerial imagery confirmed that previously unrecorded stone walled settlements occur within the site-specific study area. These appear to occur within proximity to water courses, and conform to “Type V” settlement patterns.

10.1.13.3 Historic Period

The historical period of the site-specific study area is dominated by burial grounds and graves, and historical built environment resources. These resources account for 44% and 32% respectively of the identified resources recorded in earlier assessments (Karodia & Nel, 2014a) (Figure 10-10). The information provided is site-specific and based on the results of previous studies and informal consultation with Mr Quinlan-Fleet, the occupier of the farm Yzervarkfontein 140 IS.

On 24 January 2017, during the pre-disturbance survey Mr Quinlan-Fleet commented that the original farmstead on Yzervarkfontein 140 IS played in a role in what is assumed to have been the 150th commemoration of the 1838-1841 Great Trek. Mr. Quinlan-Fleet maintains that a branch from a *Eucalyptus* tree that stood in the original werf was cut and used as a torch with which to light other 150th celebration torches nationwide. No reference to any event on the farm Yzervarkfontein 140 IS was noted in the reviewed sources *Federasie van Afrikaanse Kultuurvereniginge* and *Afrikanervolkswag*. The research did reveal however, the farm and Erasmus family had significant associations with the aforementioned Battle of Bakenlaagte.

Daniel Jacobus Erasmus settled Yzervarkfontein 140 IS in 1872. His son, Lourens Johannes Erasmus died on 25 October 1901 in skirmishes with the British during the preceding events to the Battle of Bakenlaagte.

The series of events began with the march of Colonel Benson's column from Middelburg to Bethal on 20 October 1901. The column marched unfettered to Roodebloem and made camp on 22 October 1901 where they were spied by Commandant Grobler's scouts. The Boer Bethal Commando and other nearby commandos gathered and took up arms in an old kraal on top of a bare hill on the eastern border of Yzervarkfontein 140 IS on 25 October 1901. From this vantage point, the Boers noted that the column split in two, one moving towards the Mooifontein farm to their south, the second toward a hill with cannons. The Boers attacked the British to thwart their advancement. The rear guard of Benson's column made a final stand on the farm K-Stad 79 IS however, the concentrated fire from the Boers finally drove them back to Rensburghoop. During this final stand, Lourens Erasmus was fatally wounded. His remains are buried with his father on the farm Yzervarkfontein 140 IS.

The wounded British soldiers were taken to the residence of Gielie Hamman, the father-in-law of Commandant Grobler, where the residence was set up as a field hospital. The facilities, unfortunately, were insufficient for the treatment and a message was sent to Benson to collect his wounded the following day. After collecting his wounded on 26 October 1901, Benson returned to camp on Roodebloem after which he broke camp and retreated on 28 October 1901. In his retreat, all the women, children and elderly left on the farms were captured and the buildings set alight. Benson and his column finally halted on the farm Syferfontein on 29 October 1901 where he reported he will be moving to Bakenlaagte towards Brugspruit the following day. The Battle of Bakenlaagte, occurring some 18 km north-west from the site-specific study area which has been discussed in further detail in the heritage specialist report (Appendix H).

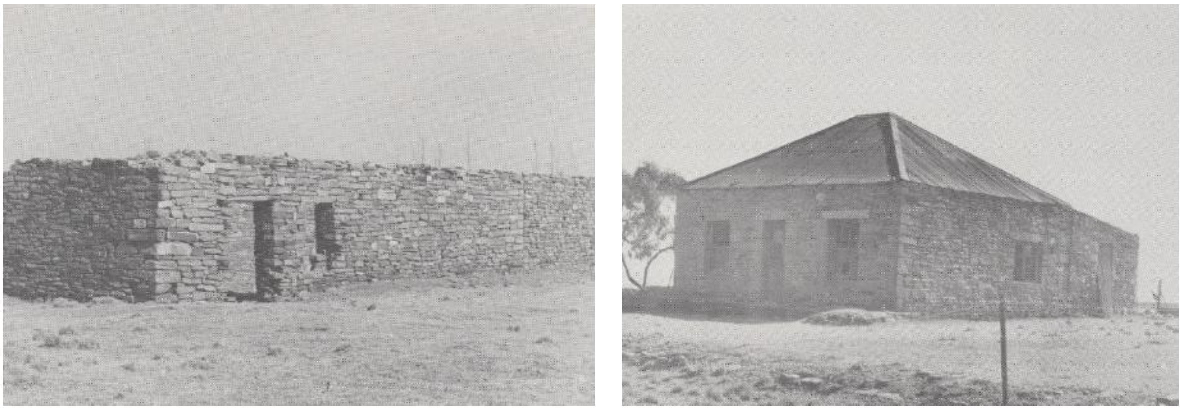

Figure 10-11: Ruins of D. Erasmus house burnt during the war and new dwelling built after the war on the farm Yzervarkfontein 140 IS

Figure 10-12: Ruins of D. Erasmus house presently. Recorded as Ste-001 and Ste-002

More broadly, the towns considered in this section include Trichardt and Secunda. Trichardt originated as a small Dutch Reform Church settlement on the farm Trigaardtsfontein sometime after the Boers settled in the area. The settlement, and presumably the farm, were named after the son of *Voortrekker* Louis Trichardt, Carolus Johannes Trichardt. On the 1899 Jeppes Map of the Transvaal, a postal agent and the meeting point between an established postal route and the main road to Bethal are on the farm Trigaardtsfontein. By 1902, several additional routes through the settlement are recorded, as well as the Peel and Laings Store. Trichardt was officially proclaimed a town in 1906 (Raper, 1987; Pistorius, 2008b).

Secunda town, established in the 1970s, is intrinsically linked with the history of Sasol Mining. Derived from the Latin *secundus* meaning 'second', Sasol established Secunda to service their second extraction refinery after Sasol 1 at Sasolburg. The company was formed as a parastatal entity in the 1950s and recognised as the world's first "oil from coal" company. Absent oil reserves in South Africa and mounting international sanctions due to Apartheid initiated the government to produce oil from coal to reduce the country's reliance on oil imports and ward off a looming oil crisis (Schirmer, 2007).

Sasol 1 and Sasol 2 both being important in supplying fuel to South Africa made the refineries specific targets to destabilise the Apartheid government. *Umkhonto we Sizwe* (MK) member Patrick Chamusso was falsely accused of plotting to sabotage the Sasol 2 plant in the 1980s. Tortured by the government and eventually released, he spent several months in Angola receiving military training. Upon his return, he successfully planted two explosives within the Sasol 2 Plant, one within the water storage facility which detonated, and the second in the main reactor petrol pump that was found and disarmed. He was captured in October 1981 and sentenced to 24 years on Robben Island. After his release from prison in 1991 with all other political prisoners, his life and struggle were depicted in the biographical film "Catch a Fire".

10.2 Description of the Current Land Uses

The land use and land capability have been investigated and are discussed below.

10.2.1 Land Capability for the Project Site

Land capability within the consolidation project site is determined by assessing a combination of soil, terrain and climate features. The dominant land capability classes are Class II (Intensive cultivation, 5 571.96 ha), Class III (Moderate cultivation, 1 161.50 ha) and Class IV (Light cultivation/intensive grazing, 16 583.34 ha). Plan 16 in Appendix B provides a map of the land capability of the consolidation project site.

10.2.1.1 Class II: Intensive Cultivation

Class II land capability coincides with the Hutton soils. These soils are well drained, easily managed and have high agricultural potential. Land in Class II has some limitations that reduce the choice of plants or require moderate conservation practices. It may be used for cultivated crops, but with less latitude in the choice of crops or management practices than Class I.

10.2.1.2 Class III: Moderate Cultivation

Land in Class III has more severe limitations that reduce the choice of plants or require special conservation practices or both. Land may be used for cultivated crops, but has more restrictions than Class II. When used for cultivated crops, the conservation practices are usually more difficult to apply and to maintain. The number of practical alternatives for average farmers is less than that for soils in Class II. Limitations restrict, singly or in combination, the amount of clean cultivation, time of planting, tillage, harvesting and choice of crops.

10.2.1.3 Class IV: Light Cultivation/Intensive Grazing

Land in Class IV has severe limitations that restrict the choice of plants, require very careful management or both; it may be used for cultivated areas, but more careful management is required than for Class III and conservation practices are more difficult to apply and maintain; restrictions to land use are greater than those in Class III. Use for cultivated crops in Class IV is limited as a result of the effects of one or more permanent features such as:

- Steep slopes;
- Shallow soils;
- Low-water holding capacity; and
- Moderately adverse climate and severe susceptibility to water or wind erosion.

10.2.2 Land Use

The most dominant land uses as shown in Plan 17 in Appendix B are followed cultivated areas (maize and soya beans), grassland and low shrubland (grazing), mine areas, urban areas and water bodies.

The land use is classified as follows:

- Cultivated areas (8059.82 ha);
- Grassland and low shrubland (12 388.60 ha);
- Thicket/Dense bush (206.14 ha);
- Mine areas (229.57 ha);
- Urban Areas (62.43 ha); and
- Water bodies (1 615.96 ha).

Commercial agricultural is the most dominant land use in the District while the petrochemical industry is the main contributor to municipal output. Mining, particularly coal mining, is also an important land use, with Secunda being the most active business area in the municipality. The expansion of industrial activity, while promoting economic growth, has led to the encroachment of agricultural land.

Similarly, the most dominant land use within the mining right area is agricultural activities, with several commercial maize farms located within the consolidation project site (see Figure 10-13). Soya is also commonly cultivated. The land is to a lesser extent used to graze livestock; particularly cattle (see Figure 10-14).

Figure 10-13: Commercial maize farm

Figure 10-14: Cattle grazing

The Trichardtsfontein Dam is situated towards the eastern border of the consolidation project site. The dam facilitates several land and water uses. Firstly, a relatively small community permanently resides at the dam renting stands from the Department of Water Affairs. Another section of the dam is used by sailing and angling clubs. The dam also offers a tourism/recreational attraction in that it serves as both camping and fishing grounds.

Several business properties are also located within the proposed mining right area (e.g. Secunda Nursery, Agata Eiendomme CC, Barka Eiendomme (Pty) Ltd and Gosler Prop (Pty) Ltd.). Another major land use includes the Terra Nova residential development, which is situated just north of Trichardt.

10.2.3 Land tenure and ownership

The Restitution of Land Rights Act, 1994 (Act No. 22 of 1994) allows individuals or groups to claim land, from which they were previously dispossessed after 19 June 1913 under the apartheid regime. Claimants were given until 31 December 1998 to register a claim in terms of the Restitution of Land Rights Act. During this period approximately 80 000 claims were lodged throughout South Africa.

The Regional Land Claims Commissioner is responsible to verify the rightful claimant, validity of the claim, identify the beneficiaries and determine the extent of the land claim. This is the research stage of the claim. Once this has been completed, the claim is gazetted and therefore development on the land is at risk the claim is settled. This therefore has development implications for existing land owners and surface or mineral rights holders as further development on land, which has a land claim is a risk.

During field investigations it was alluded to by the municipal representatives that there is a high probability of a land claim on a portion of the farm Trichardtsfontein 140 IS. The validity of this claim is still pending and in the ‘research’ stage and therefore has not been gazetted.

According to the SDF (2013) the GMLM owns a limited amount of land in the area surrounding Trichardt. The majority of the study area is under private ownership.

10.3 Description of Specific Environmental Features and Infrastructure on the Site

10.3.1 Rivers and Wetlands

10.3.1.1 River

The consolidation project area is situated in the headwaters of the Trichardtspruit, Steenkoolspruit, Krapfonteinspruit, Debeerspruit and Piekespruit catchments. These catchments form part of the Witbank Dam catchment, and are within quaternary catchments B11C and B11D of the Olifants Water Management Area (WMA) (Revised National Water Resource Strategy, 2012).

The western portion of the mining area (within B11D) drains into the Trichardtspruit, while the central and eastern portions (within B11C) drain into Debeerspruit, and Piekespruit, both of which are tributaries of the Steenkoolspruit. The Trichardtspruit joins the Dwars-in-die-Wegspruit, which in turn joins the Steenkoolspruit. The Steenkoolspruit drains into the Olifants River, which flows through the Witbank and Loskop Dams, then through the central part of the Kruger National Park and into Mozambique.

In areas where high extraction mining (stooping) takes place, subsidence will occur, this will cause containment or ponding of runoff during rainfall events and thereby loss of runoff catchment yield onto the natural streams.

10.3.1.2 Wetlands

The TCTS and Trichardtsfontein areas are characterised by multiple wetland systems, totalling 3 076.8 ha (~18% of the TCTS area) with an additional 311.3 ha (~10% of the TCTS area) covered by dams. The wetlands have been impacted on and no pristine wetlands were found within the TCTS and Trichardtsfontein area.

The Vaalkop mining area is characterised by multiple wetland systems, totalling 3 003.2 ha which amounts to 38% of the Vaalkop Project area. There are two major floodplain systems, which drain into one another to the west of the consolidation project area. There is also a large channelled valley bottom system which drains into the northern floodplain system. The remainder of the area is characterised by extensive hillslope seeps that drain into the floodplains and valley bottom wetlands.

Examples of impact which have negatively impacted on wetlands are discussed below.

- Crops: destruction of natural vegetation, construction of dams;
- Cattle: Grazing, creation of pastures and trampling;
- Roads, railway lines;
- Proximity to towns; and
- Mining activities.

10.3.1.3 Aquatic Ecology

The consolidation project area falls within the B11C and B11D quaternary catchments. Rivers located within the consolidation project site include:

- Trichardtspruit;
- Debeerspruit;
- Piekespruit; and
- Steenkoolspruit.

It is important to note that a number of unnamed tributaries of the above mentioned reaches are also found. These tributaries included:

- Debeerspruit Tributary;
- Piekespruit Tributary; and
- Steenkoolspruit Tributary.

The categorisations for the assessed reaches ranged from largely modified (category D) to moderately modified (category C). This was largely attributed to the existing impacts within the catchment area, comprised mainly of cultivation and livestock as well as other mining operations in the B11D quaternary catchment. These activities were believed to facilitate elevated pH and conductivity values within the assessed systems, which have possibly led to the loss of a number of fish and macroinvertebrate taxa.

10.3.2 Terrestrial Landscape and Habitat

The consolidation project area occurs in the Eastern Highveld Grassland and Soweto Highveld Grassland regional vegetation types (Mucina and Rutherford, 2012), with Vaalkop characterised by the former and TCTS and Trichardtsfontein characterised by the latter.

The dominant land use of the area is agro-pastoral including large areas of cropland and natural grassland for grazing and grass-bailing. The flora has been altered from their natural state as the area has been largely transformed by agricultural activities.

An ecological sensitivity map for the Vaalkop mining area has been compiled for the consolidation project area (Plan 18 in Appendix B). It was determined that the riparian and pan vegetation units which are found within the consolidation project area were allocated a very high sensitivity since wetlands are regarded as important habitats that should be conserved due to the presence of plant SSC and habitat diversity. Further to this, a portion of Grassland on Vaalkop was assigned high ecological sensitivity due to the presence of plant SSC and high species diversity. High sensitivity was assigned to the Rocky Grassland and moderate sensitivity was assigned to the remaining natural areas. Areas that were cultivated, disturbed or built up were allocated a low ecological sensitivity.

10.3.3 Cultural Heritage

A total of sixteen heritage resources were identified within the Vaalkop Mining Right Area as listed in Table 10-36. A total of 31 heritage resources were identified within the TCTS and Trichardtsfontein Mining Right area which has been listed in Table 10-37. However, a total of 72 heritage resources are known to occur within the entire consolidation project site which has been listed in

Table 10-38. The heritage assessment specific to both the consolidation project site and consolidation project area has been discussed in Section 10.1.13.

Table 10-36: Heritage Resources Located Within the Vaalkop Mining Right Area

Site Name	Latitude	Longitude	Description
BGG-001	-26.352745	29.424597	Historic farmstead cemetery on the farm Yzervarkfontein associated with the Erasmus family. The cemetery comprises four graves with granite surface dressing. The identifiable inscriptions include: - Lourens J Erasmus 11-06-1864 25-10-1901

Site Name	Latitude	Longitude	Description
			- (*Illegible*)obus Erasmus 5-4-1830 30-4-1913 - Daniel Jacobus Erasmus 1-7-1876 4-12-1969 - Zacharia Gertruida Erasmus 11-2-1886 7-8-1971.
BGG-002	-26.346692	29.415093	Historic burial ground comprising of a single grave on the farm Yzervarkfontein associated with the Erasmus family. The grave has granite surface dressing. Identifiable inscriptions on the tombstone include: - Rasmus Elardus Erasmus 20-02-1866 23-07-1923.
BGG-003	-26.347572	29.413972	Historic burial ground of farm labourers. Comprises at least 32 graves all with stone dressing. Two graves identified with concrete tombstones. Discernible dates recorded are 1954 and 1970. No family names were recorded on any of the identified graves.
BGG-004	-26.344666	29.410225	Historic burial ground of farm labourers. Comprises at least 20 graves all with stone dressing. No tombstones or identifying features were noted to determine age or Next-of-Kin.
BGG-005	-26.374613	29.380643	Historic burial ground comprising of a single grave associated with the Meyer family. The grave has granite tombstone. Identifiable inscriptions on the tombstone include: - Carolus Johannus Meyer 1-1-1915 13-12-1937.
BGG-006	-26.405619	29.365389	Historic farmstead cemetery associated with the Steynberg family. The cemetery comprises three graves with granite surface dressing. The identifiable inscriptions include: - Johannes L Steynberg 17-2-1876 22-6-1953 - Magdalena S Steynberg (geb. Hammann) 14-10-1973 22 - Deborah Getruida 13-11-1907 31-12-1925
BGG-007	-26.41108	29.364116	Historic burial ground of farm labourers. Comprises at least 17 graves all with stone dressing. No tombstones or identifying features were noted to determine age or Next-of-Kin.
BGG-008	-26.427597	29.382056	Historic farmstead cemetery associated with the Zwennis family. The cemetery comprises two graves with granite surface dressing. The identifiable inscriptions include:

Site Name	Latitude	Longitude	Description
			- Johan Peter Wilhelm Zwennis (Hammann) 26-11-1888 18-6-1949 - MFF Zwennis 14-1-1904 1-9-1936
Ft-001	-26.338225	29.393733	Remnants of partial stone walling. The walls were collapsed, and possibly pillaged through time. No diagnostic stonewalling patterns could be determined to classify or associate with known farming community period groups.
Ft-002	-26.40107	29.353424	Large square stonewalling at the base of a hill. Presumed to be historic in nature associated with farming activities.
Ste-001	-26.354007	29.424759	Historic structure associated with the Erasmus family. Recorded as the original dwelling of Danie Erasmus burnt by the British during the Second Anglo-Boer War, presumed during skirmishes associated with the Battle of Bakenlaagte. Structure is abandoned and currently in a state of decay. Only outer perimeter walls of the structure remain. Structure constructed from sandstone.
Ste-002	-26.353354	29.42394	Historic structure associated with the Erasmus family. Recorded as the second dwelling of Danie Erasmus established after the Second Anglo-Boer War. Structure is abandoned and currently in a state of decay. Outer and interior walls remain, with tin roof still intact. No doors or windows remain. Structure constructed from sandstone.
Ste-003	-26.419025	29.372624	Historic farmhouse currently occupied by farm labourers.
Ste-004	-26.42931	29.384048	Historic structure associated with farmstead. Comprises of a single structure built of sandstone. Outer perimeter walling remains, and has no roof. The structure is currently in disuse and state of decay.
Wf-001	-26.415314	29.417591	Historic werf with ruins of original built structures. Comprises three structures, one large abandoned shed / workshop and another outbuilding. A single structure presumed to be the original outhouse / outside toilet for the farmstead is situated adjacent to the current farmhouse. The historic structures are currently in disuse and in state of decay. No

Site Name	Latitude	Longitude	Description
			significant architectural features identified to age the structures.
Wf-002	-26.404374	29.36436	Historic werf ruin. Comprises several structures including farmhouse and outbuildings. The historic structures are currently in disuse and in state of decay. No significant architectural features identified to age the structures.

Table 10-37: Heritage Resources Located Within the TCTS and Trichardtsfontein Mining Right Area (Heritage Impact Assessment, Schalkwyk, 2007)

Name	Latitude	Longitude	Description
Grave	-26.44778	29.26889	One grave with headstone and inscription dating to 1928. This feature is located amongst the circular stone structures possibly dating to the Late Iron Age. The LIA walling probably dates to the last 200 years and can possibly be related to the Sotho/Tswana.
Cemetery	-26.44750	29.27028	Four graves marked with cairns. Just east of that, there are a number of circular stone structures that might be the foundations of old houses. These probably date to the early part of the century and can be related to the graves.
Stone Walling	-26.44611	29.27306	Circular structures of stone. Possibly the foundations of houses dating to the middle part of this century.
Cemetery	-26.44111	29.27528	Informal cemetery containing about 50 graves, of which five have headstones.
Stone Structure	-26.44278	29.27583	Circular stone structures of stone. Possibly the foundations of houses dating to the middle part of this century. These can probably be related to the graves in site 4.
Stone Walling	-26.44556	29.27083	Circular structures of stone, typical of Late Iron Age structures. The LIA walling probably dates to the last 200 years and can possibly be related to the Sotho/Tswana speaking people.

Name	Latitude	Longitude	Description
Stone Walling	-26.44944	29.26139	Circular structure of stone, typical of Late Iron Age structures. The LIA walling probably dates to the last 200 years and can possibly be related to the Sotho/ Tswana speaking peoples.
Homestead	-26.45250	29.26111	Old homestead, with a number of other structures, possibly labourer houses, in the vicinity. Not much information would be gained from this structure.
Stone Walling	-26.44528	29.26306	Circular structure of stone, typical of Late Iron Age structures. The LIA walling probably dates to the last 200 years and can possibly be related to the Sotho/Tswana speaking people.
Cemetery	-26.47139	29.24528	Informal cemetery (although part of an old fence is still in place) containing about four graves marked with cairns.
Cemetery	-26.46556	29.31556	Informal cemetery with about five graves. One of these have a headstone dating to 1980.
Grinding Stone	-26.45250	29.32472	Concentration of rocks that include a lower grindstone.
Labourer Homestead	-26.46972	29.33611	Remains of houses occupied by farm labourers.
Grave	-26.46806	29.30833	One grave with headstone, with a low wall of stone built around it.
Labourer Homestead	-26.46806	29.30667	Remains of houses occupied by farm labourers.
Stone Walling	-26.45778	29.25000	
Cemetery	-26.45639	29.27639	Informal cemetery with about five graves, one of which has a headstone.
Farmstead	-26.45722	29.27861	Old farmstead with outbuildings. Currently occupied by farm labourers. It seems to be older than 50 years and is therefore protected by the National Monuments Act.
Stone Walled Site	-26.45656	29.36539	Site with extensive stone walling.
Midden Site	-26.45311	29.37537	Five concentrations of soil with high ash content. Small sections of stone walling to one side. Grindstone in vicinity.
Cemetery	-26.44694	29.21417	Informal cemetery containing about 10 graves, of which three have headstones. Inscriptions are

Name	Latitude	Longitude	Description
			basically illegible.
Homestead	-26.44694	29.21583	Ruins of old structure, possibly homestead.
Cemetery	-26.44500	29.22139	Possible graves, marked by cairns.
Farmstead	-26.45250	29.22194	Remains of old farmstead, possibility of graves in the area.
Cemetery	-26.44528	29.23472	Informal cemetery with about 80 graves. Most are marked with cairns and eight have headstones.
Stone walled site	-26.45239	29.23136	Circular structures of stone, typical of Late Iron Age structures. The LIA walling probably dates to the last 200 years and can possibly be related to the Sotho/Tswana speaking people.
Stone Walled Site	-26.44796	29.26854	Circular structures of stone, typical of Late Iron Age structures. The LIA walling probably dates to the last 200 years and can possibly be related to the Sotho/Tswana speaking people.
Cemetery	-26.48030	29.37107	Approximately 20 graves of farm labourers, most without names.
Cemetery	-26.48188	29.36942	Informal cemetery with about 30 graves. Most are marked with cairns and a few have headstones.
Farmstead	-26.45502	29.35725	Old farmhouse. Stylistically it dates to the 1920s, but can even be older.
Dairy complex	-26.50071	29.29839	Old barns, sheds and stables, built in same style and bricks.

Table 10-38: Heritage Resources known to occur within the Project Site

Heritage Resource	Number of heritage resources
Archaeological Finds	15
Burial Grounds and graves	30
Historical Buildings	27
Total	**72**

10.3.4 Infrastructure

The infrastructure layout plan for the consolidation project is included in Plan 3, Appendix B. A more detailed depiction of the TCTS infrastructure plan is provided in Plan 3 A in Appendix B. The infrastructure already constructed to undertake the mining activities for the consolidation project are mainly situated at TCTS, however it is proposed that two additional shafts will be located at Trichardtsfontein however no infrastructure will be located at Vaalkop.

The following infrastructure has *already been authorised and constructed* at TCTS:

- A service water pre-treatment plant;
- Offices, stores parking and change house and workshop;
- Bulk fuel storage and substation;
- Service water storage reservoir, sewage treatment plant;
- A ventilation shaft and fans; and
- Clean/dirty water separation canals, berms and dirty water dams.

The following infrastructure is proposed to be constructed:

- Four ventilation Shafts; and
- Access / service Roads to ventilation shafts.

10.4 Environmental and Current Land Use Map

Refer to the environmental and current land use map Plan 17 in Appendix B. Current land use is described in Section 10.2.

11 Item 3(g)(v): Impacts and Risks Identified including the Nature, Significance, Consequence, Extent, Duration and Probability

This section aims to rate the significance of the identified potential impacts pre-mitigation and post-mitigation. The potential impacts identified in this section are a result of both the environment in which the consolidation project activities takes place, as well as the actual activities. The potential impacts are discussed per aspect and per each phase of the project i.e. the Construction Phase (referring to the construction of the ventilation shafts), Operational and Decommissioning/Post Closure Phases where applicable.

TCTS mine is currently in operation. Most of the impacts will be associated with the operation of the TCTS, Trichardtsfontein and Vaalkop reserves. Therefore the impacts associated with the construction phase are specific to the construction of the two ventilation shafts on TCTS (East ventilation shaft) and the two ventilation shafts on Trichardtsfontein (South ventilation shaft).

It must be noted that the mining method will be by bord-and-pillar with stooping (high extraction) at a depth of 30 – 215 m. Stooping will occur outside of the 1:100 flood lines, rivers, riparian areas and developed areas.

The actions relating to authorised and new (ventilation shafts) mining activities which have been assessed in this document, are listed below:

- Construction Phase:
  - Site clearance and topsoil removal prior to the commencement of physical construction of the ventilation shaft; and
  - Construction of the ventilation shaft.
- Operational Phase:
  - Operation of the ventilation shaft;
  - Mining related Activities;
  - Crushing and Screening of the Coal; and
  - Underground mining which could potential result in subsidence through high extraction.
- Rehabilitation and Decommissioning Phase
  - Removal of infrastructure;
  - Sealing of the Shaft; and
  - Rehabilitation and vegetation establishment.

A list of unplanned events that may happen at the consolidation project site have been identified and the proposed mitigation plan are listed in Part B Table 10-1.

11.1 Air Quality Impact Assessment

The impacts associated with the consolidation project were evaluated. A discernment model was run for the mining operation as well as the proposed new activities. The results of the model have been described below.

11.1.1 PM_{10} Predicted Impacts

PM_{10} attributed to the proposed operation of the ventilation shafts and associated facilities is presented in Plan 19 in Appendix B. It is anticipated that exceedance of the South African standards of 75 µg/m³ will occur however it will be confirmed to within the consolidation project site. However, exceedances will occur to the south of the consolidation project site.

In terms of spatial impact, much of the area impacted is within the licence area. Therefore, predicted concentrations at the selected receptors are below the South African standard. Once mitigation measures were applied, the zone of exceedances was minimised further.

11.1.2 $PM_{2.5}$ Predicted Impacts

PM2.5 attributed to the consolidation project site is presented in Table 5.1 of the Air Quality report in Appendix E. This isopleth plot of ground level concentrations (GLC) without mitigation measures does not exceed the µg/m³ at the consolidation project boundary. Exceedances were within the consolidation project boundary. If mitigation measure were to be applied, the predicted GLC will become negligible.

11.1.3 Dust Deposition

The predicted dust deposition rates anticipated from the operation of the ventilation shafts and associated facilities show that dust levels will be lower than the residential and non-residential limits of 600 mg/m^2/day and 1 200 mg/m^2/day within the consolidation project boundary (Plan 20 in Appendix B). The predicted dust deposition rates at the mine boundary are below 1 200 mg/m^2/day recommended standard for industrial areas. This pollutant will not present a concern during the operational phase of the consolidation project.

Major contributions are coming from tipping from the incline conveyor, crusher and wind erosion of the stockpile to the west of the bunker respectively. The dust deposition rates predicted at the sensitive receptors are below the recommended standard of 600 mg/m^2/day and within compliance.

11.1.4 Predicted NO_2, SO_2 and CO Concentrations

The hourly and annual South African standards for NO_2 are 200 µg/m^3 and 40 µg/m^3 respectively. The predicted hourly concentration can lead to exceedance of the standard in the vicinity of the ventilation shafts, with potential to go beyond the southern portion of the consolidation project boundary without mitigation measures.

The hourly and 24-hours South African standard for SO_2 of 350 µg/m^3 and the 125 µg/m^3 are predicted to be exceeded in the vicinity of the ventilation shaft and some metres away. Emissions over the short averaging periods can present a problem. However, over a longer averaging period, emissions are observed to be lower and in compliance with the standard. The GLC predicted at the at the consolidation project boundary, and at selected sensitive receptors are generally lower and within compliance.

The 1-hour and 8-hours CO South African standards of 30 000 µg/m^3 (30 mg/m^3) and 10 000 µg/m$_3$ (10 mg/m$_3$) are used in this report. The predicted carbon monoxide concentrations were very low and below the standard within the mine and restricted to the vicinity of the ventilation shafts.

11.1.5 Impact Assessment

An air quality impact assessment has been undertaken to assess the impact the mining activity will have on the air quality.

11.1.5.1 Construction Phase

The construction phase includes the construction of the ventilation shafts. Table 11-1 identified the following activities that may impact on the ambient air quality of the area i.e. increasing particulate matter loading in the atmosphere.

Table 11-1: Interactions and Impacts of Construction Phase

Interaction	Impact
Site Clearing	▪ Dust emissions due to the generation of airborne dust; and ▪ Soiling of surfaces due to fall out dust.
Construction of ventilation shaft	

The removal of vegetation using a range of construction equipment prior to the development of the ventilation shaft and ventilation raises will lead to the generation of fugitive dust comprising Total Suspended Particulates (TSP), PM_{10} and $PM_{2.5}$. The sinking of the shaft will generation fugitive dust.

This activity is short-term and area impacted is considered minimal. Impacts on the atmospheric environment will cease once the construction phase ends. The significance rating for the construction phase for air quality is considered to be negligible and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.1.5.2 Operational Phase

As part of the Operational Phase of the consolidation project which involves the operation of the ventilation shafts and the mining of TCTS, Trichardtsfontein and Vaalkop, the following activities are identified (Table 11-2) that may impact on the ambient air quality of the area i.e. increasing the concentration of pollutants in the atmosphere:

- Tipping to the bunker;
- Crushing at the bunker; and
- Operation of the ventilation shaft.

Table 11-2: Interactions and Impacts of Tipping and Ventilation Shaft

Interaction	Impact
▪ Tipping ▪ Crushing	Reduction in air quality due to the emission of particulate matter.
▪ Ventilation shaft	Reduction in air quality due to the emission of particulates and gaseous pollutants.

The mining process will involve the hoisting of materials from underground to surface via the incline shaft to the crusher where it is then transported to the bunker. The mining process will involve the ventilation of pollutants generated underground via the ventilation shaft upcast to the ambient environment.

The impact on ambient air quality is limited. The significance rating for the operational phase for air quality is considered to be negligible and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.1.5.3 Decommissioning Phase

As part of the Decommissioning Phase, the following activities listed in Table 11-3 are identified that may impact on the ambient air quality of the area i.e. increasing particulate matter concentration in the atmosphere.

Table 11-3: Interactions and Impacts of Decommissioning and Removal of Infrastructure

Interaction	Impact
Sealing of shaft and rehabilitation	Dust emissions and reduction in air quality.

The dismantling of mine infrastructure, removal of rubble and sealing of the ventilation shaft leads to the generation of dust. The subsequent rehabilitation of the consolidation project area including sealing of shafts will involve the use of heavy machinery and vehicles similar to the construction phase. This will result in the release of fugitive dust containing TSP, PM_{10} and $PM_{2.5}$.

The significance rating for the decommissioning phase for air quality is considered to be negligible and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.2 Noise Impact Assessment

The impacts associated with the consolidation project were evaluated. A noise model was compiled for the proposed construction and operation of the ventilation shafts. Further noise impacts were investigated during the TCTS EIA/EMPr report compiled in 2008 and has been included in this impact assessment. The noise specialist study for TCTS was compiled by Acusolv.

11.2.1 Construction Phase

The construction phase includes the construction of the ventilation shafts. Table 11-4 identified the following activities that may impact on the noise quality of the area.

Table 11-4: Interactions and Impacts of Construction Phase on Noise

Interaction	Impact
▪ Site clearing, including the removal of topsoil and vegetation; and ▪ Construction of ventilation shafts.	Increase in noise levels.

The construction noise dispersion model is indicated on Plan 2 (within the noise specialist report (Appendix F)). The results indicate that the expected noise levels during the construction activities are unlikely to cause a noise disturbance in terms of the National Noise Control Regulations at the nearest receptors. The reason for this is that the construction noise is unlikely to increase the ambient noise levels by more than 6 dBA.

The significance rating for the construction phase for noise is considered to be negligible and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.2.2 Operational Phase

The operational phase includes the operation of the ventilation shafts as well as the mining activities at TCTS. Table 11-5 identified the following activities that may impact on the noise quality of the area. It must be noted that no noise impact from the underground mining of Trichardtsfontein and Vaalkop is anticipated as infrastructure is proposed to be constructed other than the ventilation shafts which have been assessed separately.

Table 11-5: Interactions and Impacts of Operational Phase on Noise

Interaction	Impact
▪ Operation of ventilation shafts	Increase in noise levels
▪ Operation of the TCTS mine with associated infrastructure	Increase in noise levels

11.2.2.1 Noise impact from operation of Ventilation Shafts

The operational noise dispersion models for the day and night time scenarios are indicated on Plan 3 and Plan 4 (within the noise specialist report (Appendix F)). The daytime results indicate that the expected noise during the operation of the ventilation shafts is unlikely to cause a noise disturbance in terms of the National Noise Control Regulations at any receptor surrounding the proposed ventilation shaft locations. The reason is that the likely noise from the daytime operations will not increase the ambient noise level at 7 dBA or more above the current ambient sound levels.

The significance rating for the operational of the ventilation shafts for noise is considered to be negligible and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.2.2.2 Noise impact from operation of TCTS

The noise study completed in 2008 indicated that the noise impacts were anticipated to be relatively high with the commencement of the operation of the TCTS mine. This was considered to be due to the cumulative impacts of the existing noise climate, the operation of the Syferfontein complex specifically the conveyor belt as well as the conveyor belt which transports coal from TCTS to TEP and the increase in noise from the TCTS mine.

However when considered in isolation, the noise associated with the operation of the TCTS is considered to be a minor impact. The significance rating for the operation of the TCTS Mine for noise is considered to be minor and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.2.3 Decommissioning Phase

Table 11-6 identified the following activities that may impact on the noise quality of the area during decommissioning. The decommissioning activities will mainly involve rehabilitation of the shaft by capping as well as demolition of surface infrastructure.

Table 11-6: Interactions and Impacts of Decommissioning Phase on Noise

Interaction	Impact
▪ Decommissioning of the TCTS mine with associated infrastructure	Increase in noise levels

The significance rating for the decommissioning of the ventilation shafts for noise is considered to be negligible and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.3 Social Impact Assessment

As construction activities for the TCTS has been completed, and there is limited construction associated with Trichardtsfontein and Vaalkop; with the exception of the installation of the vent shaft on TCTS and Trichardtsfontein; impacts presented below address the changes to operational and decommissioning activities only, as no social impact are anticipated during the construction phase of the ventilation shafts.

11.3.1 Operational Phase

Table 11-7 identified the following activities that may impact on the social environment of the area. It must be noted as the main operation is located at TCTS, while Trichardtsfontein and Vaalkop will be undermined.

Table 11-7: Interactions and Impacts of Operational Phase on Social

Interaction	Impact
▪ Sustained employment during operation	Employment availability in the area
▪ Conflict / competition between newcomers and incumbent population	Raise in conflict levels in the area negatively impact on the social environment
▪ Potential financial implications for property developers	Loss in property price negatively impact on the social environment
▪ Community development induced by LED and CSI	Positive impact associated with community upliftment
▪ Potential subsidence induced impacts	Health and Safety impact negatively impact on the social environment

11.3.1.1 Sustained employment during operation

The consolidation of the three Mining Right areas, as proposed by Sasol Mining, will utilise the existing workforce to mine the Trichardtsfontein and Vaalkop areas, once mining at TCTS is complete. This phased approach to the consolidated project (i.e. mining Trichardtsfontein and then Vaalkop) will provide continuous employment opportunities for the current workforce.

The proposed life of mine at the Trichardtsfontein operation is estimated at 17 years, whilst the mining of the Vaalkop area will only begin in 2029. This extended operational period can have a major, long term, positive impact for employees and their dependents. A large proportion of the mine's permanent operational workforce is sourced from the local labour sending area, which is defined as communities within the GMLM. The proposed continuous mining into Trichardtsfontein and Vaalkop will likely see existing employees retiring, opening opportunities for replacement employees. The proposed training programmes presented in the SLP increases the opportunity for local communities to take advantage of such opportunities. It is, however recognised, that some positions will require scarce skills, which will not be readily available in the labour sending area and may be recruited from elsewhere in the GSDM or Country.

The operational phase of the consolidated mining operation will likely give rise to indirect employment opportunities. These could include jobs in the informal sector (for instance, in terms of food stalls for the convenience of workers), and in the formal sector (for instance, by sourcing goods and service from enterprises in the local municipal area where possible). Table 11-8 provides the impact rating for this social impact associated with the operational phase.

Table 11-8: Sustained employment during operation

Dimension	Rating	Motivation	Significance
Impact Description: Job creation during operation			
Prior to mitigation/ management			
Duration	Project Life (5)	Life of mine will be extended into the mining of Trichardtsfontein and Vaalkop (stating in 2029).	Minor (positive) – 52
Extent	Regional (4)	A considerable number of positions are filled by persons living in the local municipal area; and some from elsewhere in the district.	
Intensity	Moderately sensitive (4)	No new jobs will be created, however, current employees will benefit from the extended operating life.	
Probability	Probable (4)	Current workers (based on institutional knowledge) would remain employed by Sasol Mining. Similarly, there is no proposed downscaling during mining at Vaalkop.	
Nature	Positive		
Mitigation/ Management actions			
▪ Where feasible, promote the creation of employment opportunities for women and youth; ▪ Sasol Mining procurement and/or contracts department (or similar) to establish a monitoring system to ensure that the subcontractors honour the specified local employment policy. This can be stipulated in contractor agreements; ▪ If required, the local resident status of applicants should be verified in consultation with community representatives and local government. Ensure that existing employees have access to pertinent skills training and are able to improve their professional proficiencies throughout their employment with Sasol. This will assist with self-improvement and provide an opportunity for employees to achieve professional's goals; and ▪ In addition, it is recommended that local employment opportunities that may arise be maximised as far as possible, by intensifying efforts in the SLP, which are aimed at developing scarce skills.			
Post- mitigation			
Duration	Project Life (5)	Life of mine will be extend into the mining of Trichardtsfontein and Vaalkop (stating in 2029)	Moderate (positive) – 75

Dimension	Rating	Motivation	Significance
Extent	Regional (4)	A considerable number of positions are filled by persons living in the local municipal area; and some from elsewhere in the district	
Intensity	Great Improvement (6)	Mitigation will maximise local job creation for unintended/unplanned positions.	
Probability	Likely (5)	Mitigation will maximise probability that local recruitment targets are achieved and local benefits optimised	
Nature	Positive		

11.3.1.2 Contribution to GDP

The consolidation project will also contribute to growth and diversification of the economy during the operational phase through, royalty and tax payments, economic diversification and procurement activities. It is expected that the benefits of the consolidation project will extend beyond members of the mine's workforce to suppliers through the procurement of products and services. In terms of current legislation, the mine and its contractors should consider the use of HDSA companies in their procurement practices. Sasol Mining procurement strategy will adhere to the stipulations of the MPRDA and Mining Charter and will aim to achieve the HDSA procurement targets. The strategy will increase opportunities for HDSA suppliers which will in turn be conducive to economic growth in the consolidation project area.

Table 11-9 provides the impact rating for this social impact associated with the operational phase.

Table 11-9: Economic Growth and contribution to GDP

Dimension	Rating	Motivation	Significance
Impact Description: Economic Growth will result in a positive contribution to GDP			
Prior to mitigation/ management			
Duration	Project Life (5)	Economic growth will be experienced during Life of Mine.	Minor (positive) – 52
Extent	Regional (4)	Royalties and taxes will aid regional development; contribution to regional infrastructure projects (if any) - culmination of positive economic effects will stimulate regional economic growth, mining will diversify current economic	

Dimension	Rating	Motivation	Significance
		profile.	
Intensity	Low - positive (2)	Effects on regional economy will not be as pronounced.	
Probability	Probable (4)	Sasol Mining is obliged by law to pay royalties and taxes, and some economic multiplier effects will spill-over into regional economic development.	
Nature	Positive		
Mitigation/ Management actions			
- Recruitment to be coordinated by Sasol Mining in accordance with recruitment policy; - Promotion of female and youth employment; and - Effective implementation of training and skills development initiatives.			
Post- mitigation			
Duration	Project Life (5)	Life of mine will be extend into the mining of Trichardtsfontein and Vaalkop (stating in 2029)	Moderate (positive) – 75
Extent	Regional (4)	A considerable number of positions are filled by persons living in the local municipal area; and some from elsewhere in the district	
Intensity	Great Improvement (6)	Mitigation will maximise local job creation for unintended/unplanned positions.	
Probability	Likely (5)	Mitigation will maximise probability that local recruitment targets are achieved and local benefits optimised	
Nature	Positive		

11.3.1.3 Conflict / competition between newcomers and incumbent population

A proportion of the mine workforce were sourced from within the local (primary) study area, while others (mostly semi and highly skilled) have been sourced from elsewhere in the province and within the rest out South Africa. As with any mining operation in South Africa, there exists an inherent risk of conflict between the mining company and the surrounding host communities. It is therefore feasible to consider the likelihood that conflict might arise, particularly around the allocation of employment and associated opportunities. One possible reason for such conflict would be the perception among locals that “outsiders” are taking up jobs that could have gone to unemployed members of the local community. As per the findings of the field investigations in 2014, stakeholders indicated that the local population have in the past reacted negatively (and even violently) towards migrants (e.g. cases of xenophobia have been recorded in areas such as Embalenhle). The fact that the current operations at TCTS and Trichardtsfontein have not experienced significant conflict or protest indicates that the current engagement, employment and procurement practices are effective; however, it does not reduce the severity of the impact. The significance rating for conflict/ competition between newcomers and incumbent population during the operation phase of the mine is considered to be minor and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.3.1.4 Potential financial implications for property developers

The mining activities may result in negative financial impacts for residential developers, specifically in proximity to the active mining areas. Currently several residential developments are planned on the surface area overlapping with the proposed underground mine for Trichardtsfontein. It is unknown if similar developments have been planned around the Vaalkop or TCTS mining area.

It was confirmed that the companies and landowners driving these developments, have invested large amount of funds. The proposed extension of mining operations into Vaalkop will further increase the likelihood that residential development in the area will be sought-after. Similarly, the change in mining method to high extraction mining, increases the risk for surface subsidence, and reduces the attractiveness to potential buyers of residential development.

In the case that township developments are approved, thus requiring co-existence with the underground mine, it will be unlikely that the development will reach its full potential value, as lower values might be attributed by the buying public to stands or houses built on an undermined area. This will mostly stem from distorted public perception. The significance rating for the potential financial implications for property developers during the operation phase of the mine is considered to be minor and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.3.1.5 Community development induced by Local Economic Development (LED) and Corporate Social Investment (CSI)

The consolidation of the various SLPs associated with each Mining Right has been undertaken and was submitted to the DMR on 22 June 2016. This has opened up opportunity for a more widely spread distribution of consolidation project benefits, through LED and CSI initiatives.

The effective implementation of the SLPs has the potential to facilitate and catalyse socio-economic development within the consolidation project affected communities, as several of these communities (e.g. Holfontein informal township, Kinross, Evander and people residing in rural communities) have a relatively low socio-economic base. These initiatives – especially if implemented in consultation with those of other developmental role-players (such as government, other mines, the petrochemical sector and development organisations) – can create an increased contribution towards socio-economic development, sustainable jobs and income stability within the consolidation project area.

Successful implementation of the SLPs will contribute to maximising the benefits of the consolidation project for Trichardt and surrounding communities, as well as towards counteracting any negative impacts that these communities may experience as a result of the consolidation project operations. It is also recognised that, unless LED consolidation project s are designed to be sustainable beyond the life of the mine, they can also have negative long-term impacts by increasing economic dependency on the mine. Table 11-10 provides the impact rating for this social impact associated with the operational phase.

Table 11-10: Community development induced by LED and CSI

Dimension	Rating	Motivation	Significance
Impact Description: Community development induced by Local Economic Development (LED) and Corporate Social Investment (CSI)			
Prior to mitigation/ management			
Duration	Project Life (5)	LED and CSI activities are planned for the life of mine	Minor (positive) – 36
Extent	Local (3)	Will be beneficial to communities in the primary and local study area	
Intensity	Very low - positive (1)	Rural community currently experiences high poverty and low literacy levels; without targeted implementation of programmes these communities won't optimally benefit	
Probability	Probable (4)	Without adequate stakeholder involvement, LED and CSI projects are unlikely to be on target and sustainable	
Nature	Positive		
Mitigation/ Management actions			
▪ The details of Sasol Mining's' proposed LED programmes must be designed and implemented in consultation with both community representatives and municipal management to ensure that the actual needs of communities are met; and ▪ All LED projects must include a monitoring and evaluation plan, to ensure that the effectiveness of each project is tracked and aligned to its intended objectives. Identified areas for improvement should be incorporated into the following years planning			
Post- mitigation			
Duration	Beyond project life (6)	If sustainably managed and effectively marketed, development benefits should extend beyond the life of the	Moderate (positive) – 84

Dimension	Rating	Motivation	Significance
		mine	
Extent	Local (3)	Will be beneficial to communities in the primary and local study area	
Intensity	High - positive (5)	Recommended measures will enhance stakeholder involvement and increase effectiveness of programmes, increasing the intensity considerably	
Probability	Highly probable (6)	Recommended measures will improve likelihood of benefits reaching those with a low socio-economic base.	
Nature	Positive		

11.3.1.6 Potential subsidence induced impacts

Underground mining resulting in surface subsidence, has the potential to impact negatively on pre-exiting surface land uses due to the use of high extraction mining method. Although it is proposed that stooping will occur outside of the 1:100 floodlines and developed areas, the change in mining method (i.e. high extraction mining) increases the risks associated with surface subsidence. The nature of this risk to development areas will be better quantified through geotechnical investigations.

It should be noted that from a technical point of view, the consolidation project, through the inclusion of high extraction mining, is unlikely to result in property damage. However, high extraction mining will inherently increase the risk of some form of subsidence; in that if it does occur, will affect surface land uses. For the purposes of this assessment, however, motivated by the limited human settlement on the proposed mining areas, the risk is deemed to be of such that any displacement and consequential resettlement impacts are unlikely to manifest. The significance rating for the potential for subsidence to occur which will impact on the social environment during the operation phase of the mine is considered to be negligible and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.3.1.7 Theft

Farmers are concerned about an increase in the theft of livestock and farm products by farm labourers to sell to the mineworkers who will provide a market for agricultural products. Increased theft of livestock and farm products constitutes a probable moderate negative impact in the local area over the short term.

Table 11-11 provides the impact rating for this social impact associated with the operational phase.

Table 11-11: Theft associated with increased activity from the mine around the farming areas

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Impact Description: Theft of cattle, farming equipment and other valuables within the project site associated with increased activity from the mine</td></tr>
<tr><td colspan="4">Prior to mitigation/ management</td></tr>
<tr><td>Duration</td><td>Project Life (6)</td><td>Theft will be experienced during Life of Mine and potential extend after LoM</td><td rowspan="5">Moderate (negative) – 75</td></tr>
<tr><td>Extent</td><td>Limited (3)</td><td>Theft will be experience mostly around the mining areas due to increased number of people in the areas.</td></tr>
<tr><td>Intensity</td><td>Moderate to high (6)</td><td>The total loss of revenue from theft can be significant if no mitigation measures are implemented</td></tr>
<tr><td>Probability</td><td>Likely (5)</td><td>Should no precautions be implemented it is probably that theft will occur.</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
<tr><td colspan="4">Mitigation/ Management actions</td></tr>
<tr><td colspan="4">▪ Ensure theft is prohibited at the mine and warn workers of the consequence of stealing;
▪ Transporting workers to and from site after their shifts;
▪ Security must be established around the mine to deter potential theft around the area;
▪ Advise workers not to buy anything from farm workers; and
▪ All communication with farmers will be undertaken through the Sasol Mineral Rights Department (SMRD).</td></tr>
<tr><td colspan="4">Post- mitigation</td></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>Theft can be experienced during Life of Mine.</td><td rowspan="5">Negligible (negative) – 27</td></tr>
<tr><td>Extent</td><td>Limited (2)</td><td>Theft can be limited to only the consolidation project site</td></tr>
<tr><td>Intensity</td><td>Minor Loss (2)</td><td>With preventative measures enforced the theft can be reduced to only petty incidences.</td></tr>
<tr><td>Probability</td><td>Unlikely (3)</td><td>The probability of theft occurring is unlikely</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
</table>

11.3.1.8 Operation-related health and safety impacts

It is expected that during its operational life the proposed mine can give rise to a number of negative health and safety impacts. These impacts may result from changes in air quality and noise, as well as traffic volumes. The health and safety risk of the consolidation project during its operational phase are expected to be minimal and limited to traffic related risk. The remainder of the impact confined almost exclusively to plant personnel, as proposed operations will ultimately result in several situations where accidents can occur. The significance rating for the social impact during the operation phase of the mine is considered to be minor and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.3.2 Decommissioning Phase

The eventual termination of the Mine's operating life would inevitably result in several socio-economic consequences. It should be noted that any predictions concerning the characteristics of the receiving socio-economic environment at the time of decommissioning are subject to a large margin of error, thus significantly reducing the accuracy of impact assessment. Several socio-economic impacts could arise when the Mine is decommissioned and should therefore form part of the scope of study when the EIA for decommissioning of the consolidation project is planned.

Most socio-economic impacts related to decommissioning are related to dependencies created by the consolidation project throughout its operations. A summary of the socio-economic impacts for the decommissioning phase are provided in Table 11-12. A more detailed description of this impact and potential mitigation measures are provided below in Table 11-13.

Table 11-12: Socio-Economic Impacts Associated with the Decommissioning Phase

Interaction	Impact
Activities triggering impact: ▪ Employment and operational expenditure; and ▪ Dismantling of major equipment and infrastructure.	Dependency on mine for sustaining the local economy

Table 11-13: Dependency on Mine for Sustaining Local Economy

Dimension	Rating	Motivation	Significance
Impact Description: Dependency on Mine for sustaining local economy			
Pre-Mitigation			
Duration	Long term (4)	Effects of retrenchments/ decommissioning will be long-lasting	Moderate (negative) -84

Dimension	Rating	Motivation	Significance
Extent	Regional (4)	Will most severely affect employees and service providers from the local municipal area	
Intensity	Very high - (-6)	Local economy may become increasingly dependent on mining	
Probability	Highly probable (6)	The consolidation project will come to an end, and retrenchments are certain due to the finite duration of operational phase	
Mitigation:			
- Develop alternative and sustainable livelihoods for instance through LED programmes listed in the Mine's SLP; - During the life of mine workers are given the opportunity to better and formalise their skills in order to aid their attempts to find alternative employment; - The Mine's SLP should provide strategies and measures that reduce job loss through redeployment at other operations; - Where feasible alternatives to save jobs/avoid downscaling should be investigated beforehand, including LED, potential redeployment at other operation; - In addition to this it is vital that at all times but particularly towards the end of mine life that issues around retrenchment are dealt with in a transparent manner. All workers must know where they stand with regard to employment, what processes will be followed in the event of retrenchment and what services are available to them in this regard. - Proactively assess and manage the social and economic impacts on individuals, regions and economies where; retrenchment and/or closure of the mine are certain. In particular through promoting economic diversification, portable skills development and local economic development where possible; - Ensure open discussions with relevant government departments to ensure the closure process is correctly followed; and - Rehabilitation must be undertaken in accordance with rehabilitation plan.			
Post-Mitigation			
Duration	Medium term (3)	Successful mitigation will reduce the duration of the impact	Minor - negative (-40)
Extent	Regional (4)	Will most severely affect employees and service providers from the local municipal area	
Intensity	Moderate loss - negative (-3)	Mitigation will slightly reduce the impact of retrenchment; however job losses will still have major implications for a large number of people and their dependants.	
Probability	Probable (4)	Mitigation will reduce the probability of impact occurring to the severity predicted	

11.4 Heritage Impact Assessment

The heritage impact assessment was obtained the Heritage Impact Assessment (HIA) completed by Schalkwyk, 2007 as well as from the HIA completed by Digby Wells, 2017. It is noted that as TCTS has already been constructed no construction impacts have been identified as it is assumed that no further impact to heritage resource will occur. No additionally infrastructure will be constructed other than the proposed ventilation shafts.

According to the Digby Wells Heritage Specialist Study (Appendix H) completed in 2017. The study assessed the impacts associated with the new activities proposed as part of this consolidation project which has not been assed previously and includes:

- The construction of two ventilation shafts within the TCTS and Trichardtsfontein Mining Right areas; and
- Inclusion of high-extraction mining methodologies in addition to the approved bord and pillar mining method.

Additionally, Schalkwyk, 2007 also assed the impacts associated with the mining activities for TCTS which the heritage specialist studies, 2017 also considers.

Based on the distribution of known heritage resources, none occur within or in proximity to the development of the proposed ventilation shafts on TCTS and Trichardtsfontein. Therefore no direct impacts to heritage resources from the construction and operation of the ventilations shafts have been envisaged.

The proposed mining methodologies will all occur at sub-surface levels, with no mining occurring on the surface. These methodologies avoid potential direct impacts commonly associated with open pit mining operations. The inclusion of high-extraction mining however, does increase the risk of subsidence during operation and decommissioning phases. This risk is intrinsically coupled with the depth to coal. In this instance, high extraction in areas with a depth to coal of between 30 – 50 m is considered to result in subsidence. No identified heritage resources occur within these areas, including a 15 m buffer.

The risk of subsidence, both high and low has been discussed in Section 10.2.1.

11.5 Soils Impact Assessment

The impact associated for the consolidation project has been evaluated based on the Digby Wells Soils Specialist Study, 2017 as well as the Earth Science Solutions Report, 2008 compiled for the TCTS EIA/EMPr, 2008.

11.5.1 Construction Phase

The construction phase includes the construction of the ventilation shafts only as TCTS has already been constructed and no further structures are proposed to be established on Vaalkop and Trichardtsfontein. Table 11-14 identified the following activities that may impact on the soils and land capability in the area.

Table 11-14: Interactions and Impacts of Construction Phase on Soil

Interaction	Impact
▪ Clearing of the footprint area and the construction of ventilation shafts; and ▪ Clearing and construction of access and service roads	▪ Potential Impacts for the Loss of Soils as a Resource: Erosion and Compaction; and ▪ Potential Impacts for the loss of Land Capability and Land Use

11.5.1.1 Soils (Erosion and Compaction)

During the establishment phase site clearing is necessary for the preparation surface infrastructure development (ventilation shafts) where vegetation will be removed along with topsoil. When soil is removed, the physical properties are changed and the soils' chemical properties will deteriorate unless properly managed. When organic matter has been removed either by the clearing of an area for development or by erosion; the soils' fertility is reduced or soil acidity will be increased.

Vehicles will drive on the soil surface during the establishment phase, thereby causing compaction of the soils. This reduces infiltration rates and ability for plant roots to penetrate the compacted soil.

Soils should be handled with care from the establishment phase through to the decommissioning phase.

11.5.1.2 Land Capability and Land Use

Land capability loss is anticipated to be restricted to the vicinity of the ventilation shafts and the access roads. There is no loss in land capability and land use; as only a very small area (3.5 ha) will be impacted and the land will be able maintain its current land use and land capability.

11.5.1.3 Impact Assessment

The significance rating for the construction phase for soil, land capability and land use is considered to be minor and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.5.2 Operational Phase

During the operational phase, the following activities listed in Table 11-15 are expected to take place that will impact on the soils and land capability.

Table 11-15: Interactions and Impacts of Operational Phase on Soil

Interaction	Impact
▪ Subsidence of the surface after high extraction mining; ▪ Loading of the coal brought to the surface to the conveyor at the shaft and the conveying of the coal to the processing plant; ▪ Stockpiling of coal before transporting to plant; and ▪ Dust suppression along access and conveyer routes.	▪ Surface cracking at zones of expansion and contraction; ▪ Subsidence; and ▪ Ponding due to changes to topography and surface hydrology.

Figure 11-1 in the Soil, Land Use and Land Capability Specialist Study Report (Appendix I) indicates the subsidence risk for the delineated soils. Areas of 30 – 50 mining depth will have a definite risk of subsidence. Soils that will be definitely impacted are Avalon, Katspruit, Hutton, Glencore, Mispah and Longlands. Areas of 50 – 100 mining depth will have a high risk of subsidence. Areas of 100 m or more will have a low risk of subsidence. Definite risk of subsidence on soils will be 178.92 ha of land; high risk will be 1 649.83 ha of land and low risk will be 979.34 ha.

Bord and pillar method with high extraction mining can result in subsidence; in areas where the depth of mining is shallow and the roof support is weak. The significance of the impacts on the soils on the site differs according to the soil forms found:

- Free draining red and yellow brown soils; and
- Black and dark brown clay rich soils.

Bord and pillar with high extraction method of mining will have a negative impact on soils especially wetland soils as they will lose water and have a potential for collapse. Underground mining could potentially cause significant surface subsidence. This may significantly restrict post-mining land capability and agricultural productivity, for example if the subsided areas result in ponds/waterlogging conditions, sinkholes and/or cracking of the surface. The operational impacts described are rate in Table 11-16 and Table 11-17. The full impact assessment has been attached as Appendix D.

Table 11-16: Potential impacts for the maintenance of roads, topsoil stockpiles and land capability

Dimension	Rating	Motivation	Significance
Impact Description: Topsoil losses can occur during the operational phase as a result of rainwater runoff and wind erosion from roads and soil stockpiles where steep slopes are present. Compaction of soils during operational phase will occur.			

Dimension	Rating	Motivation	Significance
Prior to Mitigation/Management			
Duration	5	Roads will be used and soils will be stockpiled during this phase for the length of this operation therefore posing an impact on soils if not mitigated accordingly	Moderate (negative) - 91
Extent	3	Loss of topsoil will only occur within consolidation project area	
Intensity	5	Loss of usable topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	7	Compaction and erosion of soil if mitigations are not implemented will definitely occur	
Nature	Negative		
Mitigation/Management Actions			
▪ Topsoil stockpiles are to be kept to a maximum height of 3 m at a 2:5:1 slope angle and away from drainages lines and surface water; ▪ Only the designated access routes are to be used; and ▪ If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place.			
Post-Mitigation			
Duration	4	Roads will be used and soils will be stockpiled during this phase for the length of this operation therefore posing an impact on soils if not mitigated accordingly	Negligible (negative) - 27
Extent	2	With mitigation the impact should be limited to the extent to where the stockpiles will be located.	
Intensity	3	With mitigation this should significantly be reduced.	
Probability	3	With mitigation the likelihood of the impact occurring is limited.	
Nature	Negative		

Table 11-17: Potential impacts of operational phase on soils, land capability and land use (30 – 100 m below ground level)

Dimension	Rating		Significance
Impact Description: Collapsed underground mine roof could potentially cause significant surface subsidence. This may restrict post mining land capability and agricultural productivity. Surface cracking and subsidence will occur due to large areas that could be affected by the high extraction. Due to this land capability will potentially alter reducing the capability to wilderness.			
Prior to Mitigation/Management			
Duration	7	As a result of the mining method it is expected that the impact would be beyond the project life without mitigation adopted.	Major (-133)
Extent	5	Without mitigation the impact is expected to occur within the region.	
Intensity	7	Serious impacts to the land capability and land use will occur as a result of mining (30 – 100) and adopting no mitigation as a result of potential subsidence.	
Probability	7	The impact is on soils will definitely occur.	
Nature	Negative		
Mitigation/Management Actions			
▪ Rehabilitation of cracks once identified and areas where vegetation is affected by ponding, where practicable ; ▪ Subsided areas can be backfilled and re-shaped to match the original topography to mitigate ponding and waterlogging conditions depending on the degree of the collapse and available soil material, where practicable; ▪ Planning for free drainage of ponded areas, where practicable; ▪ Monitoring of undermined areas to assess the effects of subsidence at surface. Annual surface surveys will be undertaken over mined out areas to establish the degree of subsidence; and ▪ Failing these mitigation measures, the only other alternative will be to compensate the farmers for loss of productive land.			
Post-Mitigation			
Duration	6	With mitigation the duration would be limited to the project life	Moderate (-96)
Extent	4	With mitigation the duration of the impact would be limited to the project area.	
Intensity	6	Even with mitigation being adopted there will be a serious loss of agricultural productivity	
Probability	6	It is expected that the impact is likely to occur.	
Nature	Negative		

11.5.3 Decommissioning Phase

The major impacts to consider in the decommissioning and rehabilitation of the site will be the loss of topsoil as a resource through erosion and compaction. When the decommissioning and removal of infrastructure takes, vehicles will drive on the surface compacting it and this reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. Vegetation cover will be reduced and increases runoff potential, therefore increased runoff potential leads to increased erosion hazards. During the decommissioning and rehabilitation phase, the infrastructure areas will be rehabilitated as per the rehabilitation guideline (See Rehabilitation Report Appendix O).

When topsoil is compacted or eroded, the soil profile loses effective rooting depth, water holding capacity and fertility. Movement of vehicles on the soil surface causes compaction, which reduces the vegetation's ability to grow and as a result erosion could be cause. The loss of topsoil as a resource is a serious impact as the natural regeneration of millimetres of topsoil takes hundreds of years.

The infrastructure areas need to be rehabilitated and as a result the impact may be reduced if mitigation measures are implemented. After the infrastructure removal and rehabilitated, the areas must be assessed for compaction and possible erosion risk and corrected immediately. Also subsidence and cracking of soils must be monitored closely. The significance rating for the decommissioning phase for soil, land capability and land use is considered to be minor and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.6 Fauna and Flora Impact Assessment

Sensitivity delineation for flora was undertaken for the TCTS, Trichardtsfontein and Vaalkop mining areas shown in Plan 13, Plan 14 and Plan 15 in Appendix B. The impacts discussed below are based on impacts previously identified for the mining of TCTS and Trichardtsfontein. Additionally impacts have also been discussed as a result of the decision to convert to high extraction mining and to construct two new vent shafts. The high extraction impacts are also applicable to the Vaalkop project area; however no infrastructure is expected there currently so construction phase impacts are therefore not applicable.

As indicated in Figure 5-7 in the Fauna and Flora Specialist Study (Appendix J), the risk of subsidence is rated in areas having a definite to high probability, the areas where these occurrences are going to happen is marked on the map, where these definite and high risk occur in association with areas where highly sensitive vegetation types occur, it is marked under the first tab (purple).

11.6.1 Construction Phase

Construction will only take place on the areas earmarked for the ventilation shafts, both these shafts are located within existing agricultural areas that has no natural vegetation remaining.

During the construction phase (construction of ventilation shafts), cultivated areas (3.5 ha), will be cleared. The impact of loss of cultivated fields is neutral. It is not anticipated that any plant Species of Special Concern (SSC) will be lost. Alien plant infestation is a threat and must be controlled through appropriate management plans.

Table 11-18: Interactions and Impacts

Interaction	Impact
Site clearing	Loss of agricultural areas, alien plant infestation

The site clearing activity will not have an impact on the habitats that have been rated as having a high or very high sensitivity rating. The extent of the impact is limited to a small area and will not have considerable negative impacts on overarching biodiversity of the consolidation project site. The significance rating for the construction phase for fauna and flora is considered to be minor and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.6.2 Operational Phase

During the operational phase, underground mining will take place on Vaalkop, Trichardtsfontein and TCTS. No planned loss of habitat or flora and fauna species is expected. The only impact considered at this stage is subsidence that may occur and impact sensitive landscapes.

Table 11-19: Interactions and Impacts

Interaction	Impact
Subsidence	Impact on fauna and flora (sensitive landscapes) depending on where subsidence occurs.

The underground mining will occur from a depth of 30 m. Sensitive habitat such as wetlands will be affected due to subsidence in areas where subsidence is rated a definite, this will have an impact on both plants and animals that depend on these sensitive ecosystems. For example grass owls present in the area utilized wetlands which may be lost or negatively impacted upon by subsidence.

High extraction mining and shallower mining activities will have greater negative impacts as the surface is at great risker from destabilisation, resulting in possible subsidence if appropriate mitigation measures are not carried out. Significant rating for fauna and flora during the operational phase is discussed in Table 11-20.

Table 11-20: Potential Risks of the Operational Phase – Subsidence

Dimension	Rating	Motivation	Significance
Activity and Interaction 1: High Extraction Underground Mining			
Impact Description: No direct loss of fauna, flora or sensitive ecosystems will occur, except if subsidence occurs. However, undermining of sensitive areas/landscapes leading to changes that will negatively affect the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mine varies from 30 to 215 m.			
Prior to Mitigation/Management			
Duration	Permanent (7)	Undermining of sensitive landscapes where depth of coal is 30 to 50 m below surface will lead to subsidence, which in turn will have an irreversible impact to the functioning of sensitive ecosystems. The mining will also be a permanent change to the riparian areas in the form of dewatering. Lowering of the water table could result in depletion of aquifers. Failure of the pillars or total extraction could lead to subsidence.	112 Major Negative
Extent	Local (3)	The remaining natural areas (grassland, wetlands are regarded as sensitive according to field work results and the Mpumalanga sector plan.	
Intensity	Irreplaceable loss of highly sensitive environments (6)	These rivers and riparian areas are important for the ecological services they provide to society; particularly due to the high level of cumulative loss of riparian functioning in the area. Many sensitive and protected fauna and flora species depend on the natural ecosystems present. Undermining of these areas may lead to the loss of some of these areas and this is seen as an irreplaceable loss of these highly sensitive systems. Subsidence will have a very negative impact if it occurs.	
Probability	Definite (7)	Where the depth of coal is 30 – 50 meters subsidence will occur.	
Mitigation/Management Actions			
▪ The highest safety factor possible must be used. ▪ Mining should not occur above 100 m below rivers and riparian areas. ▪ Monitoring should take place for excessive inflow into the underground workings.			
Post-Mitigation			

Dimension	Rating	Motivation	Significance
Duration	Permanent (7)	Although mitigation measures may lessen the impact somewhat, the mining will be a permanent change to the hydrology setting and groundwater functioning (decant etc).	105 Moderate Negative
Extent	Local (3)	The impacts may be managed to be contained within the development area and not to have negative impacts of a municipal scale.	
Intensity	Serious damage to sensitive environments (5)	Even with mitigation, the residual impact will still have serious damaging effects on the natural functioning of the sensitive wetland ecosystems.	
Probability	Definite (7)	Where the depth of coal is 30 – 50 meters subsidence will occur.	

11.6.3 Decommissioning Phase

During this phase all mining has stopped and infrastructure will be removed, in this case the ventilation shafts and all TCTS infrastructure will be removed and the disturbed areas rehabilitated. During the decommissioning phase, the following activities listed in Table 11-21 are expected to take place that will impact on the fauna and flora.

Table 11-21: Closure and Rehabilitation Phase Interactions with sensitive landscapes

Interaction	Impact
Mine closure and rehabilitation	Post-mining decant of groundwater will have negative impacts on the wetlands as this water is likely to be of a poor water quality.

The post-mining landscape will have groundwater impacts due to decant being realised at some point as the mine voids fill up naturally with water once dewatering stops. Given the altered underground conditions, the water quality may be compromised. Further discussions in regards to decant and its impact on the environment are discussed in further detail in the Groundwater Specialist Report (Appendix N). Plan 29 indicates the locations of potential decant areas.

The significance rating for the decommissioning phase for fauna and flora is considered to be minor and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.7 Wetlands Impact Assessment

Plan 21 in Appendix B below illustrates the wetlands that will be undermined. Plan 22 in Appendix B shows the vent shaft locations and their position in relation to the buffer zones. The consolidation project interacts with wetlands as well as their ecological buffer areas (100 m and 500 m).The following impacts and mitigation measures have been proposed based off the findings of the wetland delineations.

Figure 12 -1 in the Wetland Specialist Study Report (Appendix K) indicates the subsidence risk. Areas of 30 - 50 m mining depth will have a definite risk of subsidence, 50-100 m mining depth has a high risk of subsidence and 100 or more has a low risk of subsidence. This is also based on the expected mining method for that area. There are over 100 ha of wetland that will have a definite risk of subsidence. High risk areas include 608.4 ha of wetlands and low risk areas include 561.3 ha of wetlands (excluding the 100 m buffer areas).

11.7.1 Construction Phase

The only construction activities proposed to be undertaken is the construction of the ventilation shafts which will be constructed outside the 100 m wetland buffer and therefore will only have an indirect impact on the wetlands. However the ventilation shaft will be located within 500 m of the wetland buffer and therefore a general authorisation in terms of NWA will be required. Therefore no direct impact to wetlands is anticipated however indirect risk obtained from A report titled: '*Wetland Impact and Risk Assessment for two Proposed Ventilation Shafts at the Existing Twistdraai Colliery Thubelisha Shaft' WCS, (2016)'* may arise which include:

- Temporary, localised drawdown of shallow groundwater resulting in temporary decreased flow; and
- Runoff from bare soil areas during construction resulting in increased turbidity and suspended sediment load.

11.7.2 Operational Phase

The operational phase activities that will have an impact on the wetlands are summarised in Table 11-22.

Table 11-22: Operational Phase Interactions with Wetlands

Interaction	Impact
High extraction underground mining	Undermining of wetlands leading to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts.

Mining of coal within and around wetland ecosystems represents significant negative impacts to these ecosystems that function from a combination of surface and groundwater inputs. Depth of mine varies from 30 to 215 m.

Subsidence in the areas of stooping is predicted to be 300 to 800 mm depending on the coal seam thickness and depth to coal. It is also possible that no subsidence may occur in areas overlain by a thick enough dolerite sill. Soils derived from dolerites are predominantly vertic, and the vegetation they support is unlikely to be affected by subsidence. Once saturated they are largely impervious and any vertical movement of water through the soils will be largely restricted to the early season before the soils have expanded.

Where dolerite sills do fracture, this could lead to the loss of some of the water that previously contributed to base flow. Stooping of valley bottom wetlands and floodplains will also have a significant negative impact on the watermake in the mine.

High extraction mining and shallower mining activities will have greater negative impacts as the surface is at great risker from destabilisation, resulting in possible subsidence if mitigation measures are not carried out (therefore two separate impact tables are provided; Table 11-23 and Table 11-24). The 30 - 50 m mining depth will have a definite risk of subsidence, 50 - 100 m mining depth has a high risk of subsidence and 100 or more has a low risk of subsidence. Groundwater is a significant water source in the area and this is seen in the extensive hillslope seep wetlands.

Table 11-23: Potential Impacts of Operational on Wetlands: Underground Mining (30 – 100 m below ground level)

Dimension	Rating	Motivation	Significance
Impact Description: Undermining of wetlands leading to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mining between. 30 – 100 m below ground level.			
Prior to Mitigation/Management			
Duration	Permanent (7)	Undermining of sensitive wetlands may have an irreversible impact to the functioning of these ecosystems. The mining will also be a permanent change to the wetland setting and groundwater functioning as mine dewatering will result in the lowering of the water table. Lowering of the water table could result in depletion of aquifers.	-119 Major
Extent	Municipal (4)	The Olifants River Catchment is an important, highly impacted catchment and further impacts to this area may have municipal level significance. Total area at risk of being undermined is 3406.2 ha with 708 ha being at definite and high risk)	

Dimension	Rating	Motivation	Significance
Intensity	Irreplaceable loss of highly sensitive environments (6)	These rivers and wetlands are important for the ecological services they provide to society; particularly due to the high level of cumulative loss of wetland functioning in the area. Undermining of these wetlands may lead to the loss of some of these areas and this is seen as an irreplaceable loss of these highly sensitive systems.	
Probability	Certain/ Definite (7)	Subsidence is a definite risk in some areas, and so is the lowering of the water table.	
Nature	Negative (-)		
Mitigation/Management Actions			
▪ No mitigation measures will reduce the impact of definite subsidence. In this case, a wetland offset strategy would need to be compiled.			
Post-Mitigation			
Duration	Permanent (7)	Although mitigation measures may lessen the impact somewhat, the mining will be a permanent change to the wetland setting and groundwater functioning (decant, subsidence.).	-119 Major
Extent	Local (3)	The impacts may be managed to be contained within the development area and not to have negative impacts of a municipal scale.	
Intensity	Irreplaceable loss of highly sensitive environments (6)	In the definite risk areas of subsidence, no mitigation will control the impact. There will be irreplaceable loss of those wetland habitats.	
Probability	Certain/ Definite (7)	Undermining of these wetlands will lead to subsidence.	
Nature	Negative (-)		

Table 11-24: Potential Impacts of Operational Phase on Wetlands: Underground Mining (>100 m below ground level)

Dimension	Rating	Motivation	Significance
Impact Description: Undermining of wetlands leading to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mining is >100 m below ground level.			

Dimension	Rating	Motivation	Significance
Prior to Mitigation/Management			
Duration	Permanent (7)	Undermining of sensitive wetlands may have an irreversible impact to the functioning of these ecosystems. The mining will also be a permanent change to the wetland setting and groundwater functioning as mine dewatering will result in the lowering of the water table. Lowering of the water table could result in depletion of aquifers.	-85 Moderate
Extent	Municipal (4)	The Olifants River Catchment is an important, highly impacted catchment and further impacts to this area may have municipal level significance. Total area at risk of being undermined is 3406.2 ha with 561.3 ha being at low risk.	
Intensity	Irreplaceable loss of highly sensitive environments (6)	These rivers and wetlands are important for the ecological services they provide to society; particularly due to the high level of cumulative loss of wetland functioning in the area. Undermining of these wetlands may lead to the loss of some of these areas and this is seen as an irreplaceable loss of these highly sensitive systems.	
Probability	Likely (5)	Subsidence is a lower risk in some areas, however lowering of the water table is still likely. A geotechnical study would need to be completed to determine the exact risk of subsidence	
Nature	Negative (-)		
Mitigation/Management Actions			
▪ The highest safety factor as prescribed by the Rock Engineers must be adhered to. ▪ A geotechnical study would need to be compiled to determine the exact risk of subsidence; ▪ Wetland monitoring must be carried out to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible; ▪ A wetland offset strategy may need to be compiled; and ▪ In addition, general mitigation and management actions provided in the specialist studies completed by Digby Wells as part of this Project should be used to guide the effective management of the ecological wetland resources affected.			
Post-Mitigation			

Dimension	Rating	Motivation	Significance
Duration	Permanent (7)	Although mitigation measures may lessen the impact somewhat, the mining will be a permanent change to the wetland setting and groundwater functioning (decant, subsidence etc.).	-68 Minor
Extent	Municipal (4)	The Olifants River Catchment is an important, highly impacted catchment and further impacts to this area may have municipal level significance	
Intensity	Irreplaceable loss of highly sensitive environments (6)	In the definite risk areas of subsidence, no mitigation will control the impact. There will be irreplaceable loss of those wetland habitats.	
Probability	Probable (4)	It is probable that the undermining of these wetlands will lead to subsidence, even with mitigation measures in place	
Nature	Negative (-)		

11.7.3 Decommissioning Phase

The decommissioning phase activities that will have an impact on the wetlands are summarised in Table 11-25.

Table 11-25: Decommissioning Phase Interactions with Wetlands

Interaction	Impact
Mine closure and rehabilitation	Post-mining decant of groundwater will have negative impacts on the wetlands as this water is likely to be of a poor water quality.

This phase will require the removal of the infrastructure and the rehabilitation of the site to an acceptable and sustainable landscape that will be non-polluting in perpetuity. The post-mining landscape will have groundwater impacts due to decant being realised at some point as the mine voids fill up naturally with water once dewatering stops. Given the altered underground conditions, the water quality may be compromised. Groundwater contamination is one of the largest negative impacts to the wetlands and water resources. The decommissioning impacts for wetlands is described and rated in Table 11-26. Further discussions in regards to decant and its impact on the environment are discussed in further detail in the Groundwater Specialist Report (Appendix N). Plan 29 indicates the locations of potential decant areas.

Table 11-26: Potential Impacts of Decommissioning Phase on Wetlands

Dimension	Rating	Motivation	Significance
Impact Description: Post-mining decant of groundwater will have negative impacts on the wetlands as this water is likely to be of a poor water quality.			
Prior to Mitigation/Management			
Duration	Permanent (7)	Decant of polluted underground water into the catchment will have negative impacts beyond the project life and will be irreversible if no managed or mitigated against.	-114 Major
Extent	Regional (5)	The Olifants River Catchment is an important, highly impacted catchment and further impacts to this area may have a regional level significance.	
Intensity	Irreplaceable damage to highly sensitive environments (7)	These wetlands are sensitive receptors and this represents serious impacts to these systems that could lead to irreplaceable damage to and loss of ecological functioning.	
Probability	Highly Probable (6)	It is very likely to lead to the impacts described.	
Nature	Negative (-)		
Mitigation/Management Actions			
▪ Wetland monitoring must be carried out on wetlands that could possibly be impacted on by activities during rehabilitation to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible. Transects should be set up through representative sites and monitored on an annual basis; ▪ Groundwater and wetlands must be monitored post-mining for potential decant (3 years or until the system has stabilised). ▪ Decant should not be allowed to discharge into a wetland system. The decant can be collected and stored in PCD's as a short term mitigation measure; ▪ Investigation into long term solutions for decant management needs to be conducted, should this water not be to the correct standards; ▪ Wetland Rehabilitation Plan will need to be compiled to rectify any damages should decant impact on wetlands; ▪ Monitoring groundwater levels and decant (rate and quality) quarterly.			
Post-Mitigation			
Duration	Permanent (7)	It is likely that the issue of polluted underground water will be a permanent catchment impact to manage.	-36 Minor

Dimension	Rating	Motivation	Significance
Extent	Local (3)	If adequate water treatment is carried out before discharge then the impact can be managed at the local site.	
Intensity	Minor loss and/or damage to biological resources (2)	These wetlands are sensitive receptors and altered water quality represents serious impacts to these systems that must be managed. Therefore if water is treated before entering the wetland systems, the impact will be reduced substantially.	
Probability	Unlikely (3)	If the decant is treated to the river quality objectives, its impact is unlikely/.	
Nature	Negative (-)		

11.8 Surface Water Impact Assessment

Surface water impact associated with the mining of TCTS, Trichardtsfontein and Vaalkop were assessed. The mining method proposed to be utilised to extract the coal was investigated to determine the significance of the impact associated with the use of bord and pillar mining method with some high extraction.

11.8.1 Construction Phase

The assessed activities related to the construction phase include site clearance of the footprint area and the construction of ventilation shafts, access and service roads. These activities have the potential to impact on the surface water resources as discussed in the section below.

Table 11-27: Interactions and Impacts of Activity

Interaction	Impact
Removal of vegetation and exposure of soils	Siltation/Sedimentation of surface water resources leading to deteriorated water quality
Movement of heavy machinery and vehicles during the construction phase	Alteration in surface water drainage patterns and river banks
	Contamination of the natural streams through dirty runoff from the construction areas

Dirty or contaminated runoff emanating from fuels storage areas, other liquid waste and general waste areas have the potential to contaminate the nearby streams. During construction activities, various types of wastes may be generated such as paper, glass, plastic, biological sewage waste and other hazardous waste. Handling and disposal of these waste may poses a risk to the surrounding streams if not managed appropriately. This may lead to the deterioration of water quality which in turn affects the aquatic life and the downstream water users. The significance rating for some impacts associated with the construction phase for surface water is considered to be minor and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.8.2 Operational Phase

Activities that may have surface water impacts during the operational phase include subsidence during high extraction mining, stockpiling of coal before transporting to processing plant and conveying of coal from the shaft to the storage bunker, etc.

Table 11-28: Interactions and Impacts of Activity

Interaction	Impact
Runoff from the dirty water areas (product stockpile)	Runoff reporting into the nearby streams resulting in water contamination or the deterioration of the water quality
Ponding of water due to changes to topography and surface hydrology (high extraction mining), and operation of the shaft areas	Reduction of Catchment Yield as runoff will be contained in the subsided areas

Dirty water runoff laden with carbonaceous material from the contaminated surfaces (emergency coal stockpile) has the potential to contaminate and silt up the natural water resources or streams. This impact will therefore deteriorate the water quality and hence impact the downstream water users and the aquatic life. The potential impact on aquatic life or downstream users of water within the rivers is highly dependent on the pH of the water discharged. This is because acidic conditions will result in mobilisation of metals, and this would be a major contributing factor to the potential toxicity of the water. Based on the prediction that the water is unlikely to be acidic during the operational phase, the following is predicted:

- Metals such as Fe and Al, although likely to be above guideline values, will probably only be marginally elevated.
- An increase in electrical conductivity and overall salinity such that the water is unfit for potable use, as well as informal drinking.
- Sulphate levels could be elevated to the point that there is a risk of developing diarrhoea in infants that may drink the water. Miscarriages in cattle will also be possible.
- SAR (Sodium Adsorption Ratio) levels may be impacted on making the water unsuitable for irrigation without some form of mitigation.

The use of high extraction mining method will result in subsidence where high extraction of coal is taking place. This may results into ponding of surface runoff in areas where subsidence has occurred. As a result, this reduces the amount of runoff reporting to the nearby streams. A decrease in the catchment yield may have an impact on the downstream water users as they may not have sufficient water for their needs, while also decreasing the flow required for the ecological reserve. Subsidence underneath the streams is not expected as it has been stated that high extraction mining (Stooping) will not take place within the 1:100 floodlines and developed areas.

Therefore, the total area to be stooped will amount to approximately 30 km^2. The percentage loss in MAR for this quaternary catchment due to stooping will amount to approximately 8% of the total MAR.

The significant impact on surface water associated with the operational phase has been discussed in Table 11-29; less significant impacts have been discussed in Appendix D.

Table 11-29: Potential Impact of Operational Phase on Surface Water

Dimension	Rating	Motivation	Significance
Impact Description: Water contamination leading to deterioration of water quality			
Prior to Mitigation/Management			
Duration	Project Life (5)	Due to the nature of the mining activities the contamination of water resources may occur over the project life if mitigation measures are not in place.	Moderate - negative (84)
Extent	Municipal (4)	The impacts may affect the nearby streams and surroundings	
Intensity	Serious - negative (-5)	This may have serious impacts on the water quality that will be made available to the downstream water users (agricultural- livestock watering and crop irrigation)	
Probability	Almost Certain (6)	Without appropriate mitigation, there probability of the impact occurring is almost certain <80%	
Mitigation/Management Actions			
▪ As proposed in the project activities, ensure that all the dirty water emanating from the dirty water areas is contained for re-use within the mine, to prevent discharge into the environment; ▪ Use of storage compartments underground to store dirty water; ▪ All pollution control dams must be maintained and is required to operate with a 0.8 m freeboard and able to contain a 1:100 year flood event; ▪ All surface water pollution control structures will be inspected on a three monthly basis and maintenance work carried out as required. Furthermore, all structures (e.g. dams) registered			

Dimension	Rating	Motivation	Significance
in terms of the National Water Act will be maintained in accordance with the Act. ▪ The mines water balances and management of the water balance must be regularly updated and monitored. This should be updated as specified in the IWUL or if on an annual basis; ▪ The wash bays and workshops are be equipped with oil skimming facilities to remove oil and grease from the wash down water; ▪ Clean run-off must be directed around these facilities, and directed back to the clean water catchment; ▪ The emergency coal stockpile area at Thubelisha must ensure that dirty water from the stockpile area is contained and the seepage is minimised (No dirty water is permitted to be discharged to the clean water environment); ▪ No discharge of polluted water should be planned for or allowed; ▪ Where subsidence will occur during operation, measures to rehabilitate the surface area should be implemented as soon as possible to avoid impoundment of surface water; and ▪ Water quality monitoring should continue on the existing and newly proposed monitoring points to ensure detection of impacts.			
Post-Mitigation			
Duration	Medium term (5)	Impact may occur over the project life if mitigation measures are not in place	Minor - negative (42)
Extent	Municipal (4)	The impacts may affect the nearby streams and surroundings	
Intensity	Moderate - negative (-5)	This may have serious impacts on the water quality that will be made available to the downstream water users (agricultural- livestock watering and crop irrigation)	
Probability	Probable (3)	Necessary mitigations will reduce the probability of impact occurrence significantly (<25%)	

11.8.3 Decommissioning Phase

Activities during this phase include dismantling and removal of infrastructure and surface rehabilitation. The major impacts to consider in the decommissioning and rehabilitation of the site will be siltation of surface water resources as a result of soil erosion influenced by removal of infrastructures and water contamination, should there be decant after closure. Removal of infrastructure will expose the soil surfaces and leave it prone to erosion, resulting in siltation of the nearby streams when runoff reports to these rivers. This will deteriorate the water quality and hence impact the downstream agricultural water users.

The post-mining landscape will have groundwater impacts due to the potential for decant to be realised at some point as the mine voids fill up naturally with water once dewatering stops. Given the altered underground conditions, the water quality may be compromised. Further discussions in regards to decant and its impact on the environment are discussed in further detail in the Groundwater Specialist Report (Appendix N). Plan 29 indicates the locations of potential decant areas.

Table 11-30: Interactions and Impacts of Activity

Interaction	Impact
Exposure of soils after the removal of infrastructure	Siltation of surface water resources leading to deteriorated water quality
Mine decant	Deterioration of surface water quality on the surrounding streams

The significant impact on surface water associated with the decommissioning phase has been discussed in Table 11-31; less significant impacts have been discussed in Appendix D.

Table 11-31: Decant of mine water leading to deterioration of water quality

Dimension	Rating	Motivation	Significance
Impact: Decant of mine water leading to deterioration of water quality in the nearby streams			
Pre-Mitigation			
Duration	permanent (7)	Decant occurs far beyond the project life:	Moderate - negative (96)
Extent	Municipal (4)	Water deterioration may affect the whole municipal area	
Intensity	Serious - negative (-5)	This may have serious impacts on the downstream aquatic habitat and the downstream water users	
Probability	Likely (6)	Based on analytical modelling, it is highly probable that there will be a decant after mine closure	
Mitigation/Management Actions			
▪ Should decant occur, decant should be collect and stored at a PCD as a short term solution; ▪ Long term management solutions for decant should be investigated; ▪ Water quality monitoring must continue to enable the detection of decant when it occurs so immediate mitigation measures can be implemented. Monitoring should continue for as long as decant is taking place.			
Post-Mitigation			
Duration	Long term (6)	Decant occurs far beyond the project life:	Negligible - negative (33)
Extent	Municipal (4)	Water deterioration may affect the whole municipal area	

Dimension	Rating	Motivation	Significance
Intensity	serious - negative (1)	Treatment of the decant water prior to discharge will avoid contamination of water and result in a reduce impact on water quality	
Probability	Unlikely (3)	It is unlikely that water quality will be impacted if these mitigation measures are implemented.	

11.9 Aquatic Ecology Impact Assessment

Aquatic ecology impact associated with the mining of TCTS, Trichardtsfontein and Vaalkop were assessed. The construction of the two proposed ventilation shafts on TCTS (East ventilation shaft) is within the 500 m wetland buffer zones but not within the 100 m buffer zones. The ventilation shaft on Trichardtsfontein (South ventilation shaft) does not fall within the 100 m or 500 m wetland buffer zones. However, it is important to note that the underground mining activities interact with the rivers and wetlands, as well as their ecological buffer zones (100 m and 500 m) as observed in Plan 10 in Appendix B. The following outcomes must result from a comprehensive geotechnical investigation to reduce the overall impact:

- Provide appropriate design parameters for pillar and overburden stability, in line with the actual geotechnical rockmass properties;
- Indicate any areas (undermining of the wetlands) that may fall outside of these design parameters; and
- Following the geotechnical investigation, where required a provision must be made for the rehabilitation of these areas in the event of a possible risk of subsidence / intersection collapse.

Figure 10 - 2 in the Aquatic Ecology Specialist Study (Appendix M) indicates the risk of subsidence within the mining area. Areas of 30 - 50 m mining depth will have a definite risk of subsidence, 50-100 m mining depth has a high risk of subsidence and 100 or more has a low risk of subsidence. This is also based on the expected mining method for that area. •There are over 100 ha of wetland that will have a definite risk of subsidence. High risk areas include 608.4 ha of wetlands and low risk areas include 561.3 ha of wetlands (excluding the 100 m buffer areas).

11.9.1 Construction Phase

The only surface infrastructure required is the construction of two ventilation shafts as mentioned above. The construction of the ventilation shafts is outside of the 100 m wetland buffer. However, the following impacts (Table 11-32) were identified with regards to the construction phase activities and the impacts to aquatic ecology.

Table 11-32: Interactions and impacts to aquatic ecology for the construction phase

Interaction	Impact
Site clearance within river catchment and construction of surface infrastructure (ventilation shafts)	Increased runoff from cleared land and man-made structures (vent shafts, vehicle routes to and from construction and paved areas) resulting in erosion and sedimentation of downstream habitats
Waste generation/disposal and working with hazardous products	Runoff containing hazardous substances and solid waste resulting in water and habitat quality degradation in downstream river reaches

The proposed activities have the potential to degrade water and habitat quality within the nearby river systems. Water quality impacts may include increased dissolved/suspended solids, as well as potential persistent pollutants within the water column and sediments of the associated watercourse. In addition, general water chemistry modification may occur as a result of changed salt balances. Habitat quality impacts may include sedimentation, bed, channel and flow modification, as well as the general loss of aquatic habitat through direct modification during the construction of watercourse crossings.

Although the PES (baseline) of the river reaches assessed was derived to be modified from reference conditions, further deterioration is possible and thus a potential decline in the PES could be observed. In addition, erosion and sedimentation of the rivers is currently widespread in the current catchment. The significance rating the impacts associated with the construction phase for aquatic ecology is considered to be negligible and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.9.2 Operational Phase

Impacts on aquatic ecology during the operational phase are expected to result from the physical mining activities taking place under the associated watercourses, from the stockpiling of coal and from waste generation as a result of the mining process. These interactions are summarised in Table 11-33 below.

It is important to note that high extraction mining will take place during the operational phase of the consolidation project. Therefore, the probability of subsidence occurring is high and will have serious effects on aquatic ecology. It is also indicated that mine dewatering will only result in the lowering of the water table within the mine footprint area. As observed in Figure 10 2 in the Aquatic Ecology Specialist Study, the risk of subsidence has been categorised into three classes (namely definite risk, high risk and low risk). As a result, two separate impact ratings were developed for the proposed high to definite risk subsidence areas and for the proposed low risk subsidence areas.

Table 11-33: Interactions and impacts to aquatic ecology for the operation phase

Interaction	Impact
Underground mining	Undermining of wetlands and rivers leading to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts
The emergency stockpiling of coal	Runoff water which may come into contact with the carboniferous material will contain various pollutants that may contaminate downstream river reaches
Waste generation/disposal and working with hazardous products	Runoff containing hazardous substances and solid waste resulting in water and habitat quality degradation in downstream river reaches

The activities and interactions listed above have the potential to degrade water and habitat quality within all of the undermined river systems. The major anticipated impacts would result from subsidence of areas associated with the wetland and riverine areas due to the high extraction mining process. The subsidence of land can alter the hydrology of the river catchment resulting in major effects to local aquatic biota. The possible runoff from the emergency stockpile is also of concern and poses a threat to water and habitat quality. The significant impact on aquatic ecology associated with the operational phase has been discussed in Table 11-34; less significant impacts have been discussed in Appendix D.

Table 11-34: Underground mining high to definite risk subsidence areas – Aquatic Ecology

Dimension	Rating	Motivation	Significance
Impact Description: Subsidence of land within the river catchment and subsidence of land underneath river channels resulting in poor ecosystem functioning			
Prior to Mitigation/Management			
Duration	Permanent (7)	The undermining of a river course and resulting subsidence will be a permanent impact	Major (negative) – 119
Extent	Municipal (4)	The impact would likely impact on the water balance of the associated river systems and thus beyond a local extent	

Dimension	Rating	Motivation	Significance
Intensity x type of impact	Irreplaceable Loss (-6)	The loss of the headwaters of a river system will be permanent and will seriously affect the functioning and connectivity of the downstream river reaches	
Probability	Almost certain (7)	Should mining occur, there is a very high likelihood of the impact occurring especially in the areas where high extraction is proposed	
Nature	Negative		
Mitigation/Management Actions			
▪ No mitigation measures will be able to prevent subsidence where the depth of mining is shallower than 100 m.			
Post-Mitigation			
Duration	Permanent (7)	The impact, should it occur, would still be a permanent feature	Major (negative) – 119
Extent	Municipal (4)	Should subsidence occur, the impact to the associated river systems, specifically the water balance, is likely to extend beyond the project site (municipal extent)	
Intensity x type of impact	Irreplaceable Loss (-6)	The impact would have already resulted in a loss of headwater of the associated river systems and cannot be replaced	
Probability	Probable (7)	Should such a shallow depth of mining occur, there is a very high likelihood of the impact occurring where mitigation will not be possible.	
Nature	Negative		

Table 11-35: Underground mining low risk subsidence areas – Aquatic Ecology

Dimension	Rating	Motivation	Significance
Impact Description: Subsidence of land within the river catchment and subsidence of land underneath river channels resulting in poor ecosystem functioning			
Prior to Mitigation/Management			

Dimension	Rating	Motivation	Significance
Duration	Permanent (7)	The undermining of a river course and resulting subsidence will be a permanent impact	Moderate (negative) – 102
Extent	Municipal (4)	The impact would likely impact on the water balance of the associated river systems and thus beyond a local extent	
Intensity x type of impact	Irreplaceable Loss (-6)	The loss of the headwaters of a river system will be permanent and will seriously affect the functioning and connectivity of the downstream river reaches	
Probability	Almost certain (6)	Should mining occur, there is a very high likelihood of the impact occurring especially in the areas where high extraction is proposed	
Nature	Negative		
Mitigation/Management Actions			
▪ Complete a geotechnical study to identify high risk subsidence areas and avoid or mitigate to support them; ▪ Ensure sufficient pillar support and safety factors to prevent subsidence of undermined wetland/aquatic areas; ▪ The highest safety factor possible (at least 2) must be used for areas of shallow mining (confirm with geotechnical study); ▪ Underground mining should avoid aquifers especially due to the proposed high extraction near aquatic and wetland systems. Punctured aquifers could lead to the dewatering of aquatic/wetland systems; ▪ Mining should not occur above 100 m below aquatic/wetland areas or within the 100 m wetland buffer zones (confirm with geotechnical study if areas can be mined shallower than 100 m without the risk of subsidence); and ▪ Monitoring should take place for excessive inflow into the underground workings.			
Post-Mitigation			
Duration	Permanent (7)	The impact, should it occur, would still be a permanent feature	Minor (negative) – 68
Extent	Municipal (4)	Should subsidence occur, the impact to the associated river systems, specifically the water balance, is likely to extend beyond the project site (municipal extent)	
Intensity x type of impact	Irreplaceable Loss (-6)	The impact would have already resulted in a loss of headwater of the associated river systems and cannot be replaced	

Dimension	Rating	Motivation	Significance
Probability	Probable (4)	Should the mitigation measures be implemented, the likelihood of subsidence is reduced and therefore reduced probability	
Nature	Negative		

11.9.3 Decommissioning Phase

The following interactions between the decommissioning phase activities and the impacts to aquatic ecology are summarised below (Table 11-36).

Table 11-36: Rehabilitation and Closure Phase Interactions on Aquatic Ecology

Interaction	Impact
Removal of infrastructure and surface rehabilitation	Similarly to the construction phase, the removal of the infrastructure will lead to potential negative impacts on the habitat integrity of the associated aquatic ecosystems
Mine closure and rehabilitation	Post-mining decant of groundwater will have negative impacts on the associated rivers downstream water quality

Similar to the construction phase the removal of infrastructure and rehabilitation activities will be a relatively small scale operation and thus has the potential, but limited, to affect the associated aquatic ecosystems. Attention needs to be paid to the ventilation shaft areas as well as the TCTS infrastructure during this phase to limit the possibility of impacting the nearby river systems.

Typically, following the cessation of underground mining activities groundwater returns to the voids created by the mining process. This process results in the contamination of the groundwater resource. Following this influx of groundwater, seepage and decant at specific locations can result in the ingress of contaminated water in the downstream river systems, thus severely degrading the local PES. Further discussions in regards to decant and its impact on the environment are discussed in further detail in the Groundwater Specialist Report (Appendix N). Plan 29 indicates the locations of potential decant areas.

The significant impact on aquatic ecology associated with the decommissioning phase has been discussed in Table 11-37; less significant impacts have been discussed in Appendix D.

Table 11-37: Impact ratings associated with underground mine closure and rehabilitation on aquatic ecology

Dimension	Rating	Motivation	Significance
Impact Description: Decant of severely contaminated water into local aquatic ecosystems			
Prior to Mitigation/Management			
Duration	Permanent (7)	Decant of contaminated water will likely be permanent	Moderate (negative) – 102
Extent	Municipal (4)	Decant is likely to affect downstream river systems, thus extending further than local systems	
Intensity x type of impact	Serious - negative (-6)	The change of water quality in the headwaters of the associated river systems will seriously affect the functioning of the downstream reaches and impact aquatic ecology severely	
Probability	Highly Probable (6)	Should mining occur, there is a very high likelihood of the impact occurring	
Mitigation/Management Actions			
▪ Decant should not be allowed to discharge into the associated aquatic systems. The decant can be collected and stored in PCD's as a short term mitigation measure; and ▪ Investigation into long term solutions for decant management needs to be conducted.			
Post-Mitigation			
Duration	Permanent (7)	The decant of contaminated water will likely be permanent	Minor (negative) – 64
Extent	Municipal (4)	The discharge after mitigation is likely to affect downstream river systems, thus extending further than local systems	
Intensity x type of impact	Serious - negative (-5)	The change of water quality in the headwaters of the river systems will have seriously affected the functioning of the downstream river reaches, however mitigation measures should decrease the impact	
Probability	Unlikely (4)	If water treatment is completed, the probability of the impact will decrease	

11.10 Geology

The construction and decommissioning phase will not have an impact on geology and therefore no impact assessment has been undertaken. The impacts on geology at an operational phase have been assessed.

11.10.1 Operational Phase

The following interactions between the operational phase activities and the impacts to geology are summarised below (Table 11-38).

Table 11-38: Operational Phase Interactions on Geology

Interaction	Impact
Removal of infrastructure and surface rehabilitation	Similarly to the construction phase, the removal of the infrastructure will lead to potential negative impacts on the habitat integrity of the associated aquatic ecosystems

The depth of mining at TCTS, Trichardtsfontein and Vaalkop varies between 160 to 200 m below surface. With bord-and-pillar mining the impact will be restricted to the excavation of the coal seams. Almost 53% of the bord-and-pillar development will be stooped (high extraction mining). With high-extraction mining/ stooping the impact on the geology includes both the excavation of the coal seams as well as the impact on the overlying aquifer above the high-extraction mining/ stooped areas with potential resultant surface subsidence. The main catalyst for surface subsidence is the removal of the coal seam. As the coal pillars are extracted, progressive collapse of the roof leads to potential fracturing and collapse of the overlying rock strata into the void created by coal removal.

The extent of fracturing and collapse in the vertical dimension is a function of various parameters including the level of primitive stresses, the panel extraction width, competence of roof strata and coal seam thickness. Surface subsidence in the area will occur above stooped areas and will be at ±0.3 m in the east of the consolidation project area and up to 0.8 – 1 m in the western areas. The aquifer above the stooped areas will have an increased recharge potential, an increase in groundwater storage and vertical conductivity. The significant impact on aquatic ecology associated with the decommissioning phase has been discussed in Table 11-39.

Table 11-39: Impact ratings associated with underground mining on geology

Dimension	Rating	Motivation	Significance
Impact Description: With high-extraction mining/ stooping the impact on the geology includes both the excavation of the coal seams as well as the impact on the overlying aquifer above the high-extraction mining/ stooped areas with potential resultant surface subsidence.			

Dimension	Rating	Motivation	Significance
Prior to Mitigation/Management			
Duration	Permanent (7)	Once mining has been undertaken the geology will be permanently affected.	Moderate (negative) – 105
Extent	Local (3)	The geology will only be impacted where underground mining activities take place	
Intensity x type of impact	Serious - negative (-5)	The change in geology will impact overlying aquifer as well as a permeant change in the geology of the area.	
Probability	Definite (7)	Mining will definitely result in a permanent change to geology	
Mitigation/Management Actions			
▪ Once geology has been impacted no mitigation measures can be proposed. However measures can be proposes in an attempt to prevent subsidence in areas where only bord and pillar mining has taken place; and ▪ The application of stone dust on coal pillars and maintenance of pillar safety factors above 1:1 million chance of failure under watercourses. Exclude areas with surface infrastructure from pillar extraction.			

11.11 Groundwater

The proposed underground mine has the potential to have a negative impact on the groundwater environment; through the depletion of the local groundwater quantity and quality. The groundwater quality at most of the coal mines in the country is characterised by sulfate concentrations in the order of 2 500 mg/L. Similar impacts could also occur at the consolidation project area and management plans should be put in place with this assumption.

The contamination plume presented is representative of 1 % to 100 % of the contamination at the source and the cone of depression presented is from a drawdown depth from 5 m and above.

Potential impacts are assessed in this section considering the construction, operational and closure phases. Only consolidation project activities that are likely to result in a groundwater impact are assessed below.

11.11.1 Construction Phase

Site clearance (during the construction phase) conducted to accommodate the ventilation shafts could result in impacts to the groundwater. The activity brining about potential interaction with the groundwater environment and potential impact is presented in Table 11-40.

Table 11-40: Interactions and impacts during the construction phase for Groundwater

Interaction	Impact
Site clearing	Lowering of the water table, if the site clearing will take place below the water table

The water table at the consolidation project area ranges between 0 and 32 mbgl. Any site clearing or construction activities that would involve excavation below the water table depth may have a potential impact on the groundwater quantity and quality. The significance rating for the impact associated with the construction phase for groundwater is considered to be negligible and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

11.11.2 Operational Phase

During the operational phase, mine dewatering could result in negative groundwater impacts and is assessed below. Interaction with the groundwater environment and potential impact are presented in Table 11-41.

Table 11-41: Interactions and impacts during the operation phase for Groundwater

Interaction	Impact
Groundwater dewatering	Water level lowering
AMD generation at mine void	Groundwater contamination
Subsidence	Water level rising and groundwater contamination

When mining below the water table, it is important to keep the mine workings dry for safe working conditions. Dewatering is recommended to start as excavations are initiated. This can potentially impact the groundwater environment negatively by lowering the water level and creating a cone of depression, affecting the local aquifers. As the cone of depression is created through dewatering, water flows into the mine voids.

Mining was simulated by applying drains, progressing according to the life of mine, located at the depth of the coal seam floor. The groundwater captured by the drains is reflective of the expected inflows. Inflow rates are not only a function of the aquifer properties but also the mine plans because the mined area, depth and excavation rate affect the inflow rates. Table 11-42, Table 11-43 and Figure 11-1 are presentations of expected inflows into the underground mine as the mine progresses.

Areas where high extraction will be conducted are expected to experience subsidence during operation and or post-operation. The risk of subsidence is dependent on the characteristics of the local geology. The presence of dolerite sill or thick sandstone prevents fracturing of the overburden rock mass through to surface. The depth at which high extraction takes place is also a factor as the risk of subsidence increases with decreasing depth to coal seam from the ground surface. Plan 24 shows the areas where subsidence may or will occur. The depth at which high extraction will be conducted is presented as well in the plan. The probability of subsidence can only be accurately quantified by conducting detailed geotechnical investigations which is outside the scope of this groundwater study.

Subsidence may result in fracturing of the overlying stratigraphy and increased geological permeability, resulting impacts to the groundwater and surface water environment. Additionally, damage to roads, power lines, buildings, and could even claimed the lives as e result of subsidence.

The groundwater environment may be subjected to the following impacts in areas of subsidence:

- Increased groundwater recharge, estimated to reach 9% of the MAP at the shallow weathered aquifer and 5% at deeper fractured aquifers (Vermeulen and Usher, 2006);
- Groundwater quality at the shallow weathered aquifer may be affected in the following ways:
  - Recharge will increase at areas of increased permeability and areas where fractures have developed as a result of subsidence; and
  - After hydraulic head recovery, recharge of contaminated water may occur through artificially created groundwater flow pathways (fractures).
- Increased chances of the occurrence of decant and increased decant rates; and
- Expansion of the contamination plume into the weathered aquifer in areas where it would have not been expected if there was no subsidence. This may occur because as the overlying stratigraphy becomes more permeable, migration of water through these rocks as well as the exposure to air can result in the generation of acid water if these rocks contain pyrite.

Groundwater quality deterioration is then expected to mainly occur at areas of subsidence. Plan 25 in Appendix B shows the expected contamination plume at the weathered aquifer, mainly associated with the impacts of subsidence and to a lesser degree diffusion, which is a result of concentration gradient. The contamination at the weathered aquifer is predominantly less than 20% of the source concentration and in isolated areas reaches a maximum of 35%.

During operation, any contaminants that will originate from the mine workings will be pumped out as part of the mine dewatering process. The contamination plume migrates primarily by advection therefore dewatering enables the management of the potential contamination plume (during the period that dewatering will be taking place at that location), preventing upward migration into the shallow weathered aquifer. With the progression of mining over the 53 years of operation, dewatering will cease in mined out areas and recovery will commence. This is when the contamination plume (to a relatively limited degree) starts being introduced into some parts of the weathered aquifer, mainly at areas of increased permeably as a result of subsidence (Plan 25 in Appendix B). The abstracted water during the operational phase may be contaminated and therefore should be stored in pollution control dams and recycled for coal processing. If excess water exists, it is recommended to be treated and introduced into the streams after ensuring that it meets the required river quality objectives.

Majority of groundwater users utilize the shallow weathered aquifer and some are located within the area of high extraction, therefore monitoring is recommended and affected private borehole owners should be compensated if contamination is proven from monitoring. Deep boreholes intersecting the coal seam aquifer are likely to be impacted by the lowering of the water and generation of a contamination plume over time. The expected contamination plume at the deep fractured aquifer is shown in Plan 26 in Appendix B.

Dolerite sill covers a considerable portion of the mine area. The probability of subsidence is expected to be low in areas where the high extraction is to take place underneath these sills or thick sandstone layers.

Model results show that the cone of depression is mainly at the deep fractured aquifer; its extent is shown in Figure 6.5 which can be found in the Groundwater Specialist Study report (Appendix N). The cone of dewatering impacts to the weathered aquifer are expected to be less significant compared to the fractured aquifer, occurring at isolated areas due to the low vertical hydraulic conductivity of the local aquifers. The drawdown in the weathered aquifer is expected to be less than 5 m and thus only drawdown in the coal seam aquifer has been illustrated.

Table 11-42: Overview of estimated groundwater inflow rates

Year	Year of Operation	Inflows (m^3/d)	Inflows (L/s)	Mine area (m^2)	Cumulative area (m^2)
0	0	0	0	0	0
2016	1	90	1	895900	895900
2017	2	352	4	2598200	3494100
2018	3	694	8	3521600	7015700
2019	4	1020	12	3511600	10527300
2020	5	1380	16	3763300	14290600
2025	10	3280	38	20236300	34526900
2030	15	4990	58	21015200	55542100
2035	20	6550	76	19000500	74542600
2040	25	7600	88	15604900	90147500
2045	30	7850	91	14498700	104646200

Year	Year of Operation	Inflows (m^3/d)	Inflows (L/s)	Mine area (m^2)	Cumulative area (m^2)
2050	35	8410	97	15324500	119970700
2054	39	8460	98	6430100	126400800

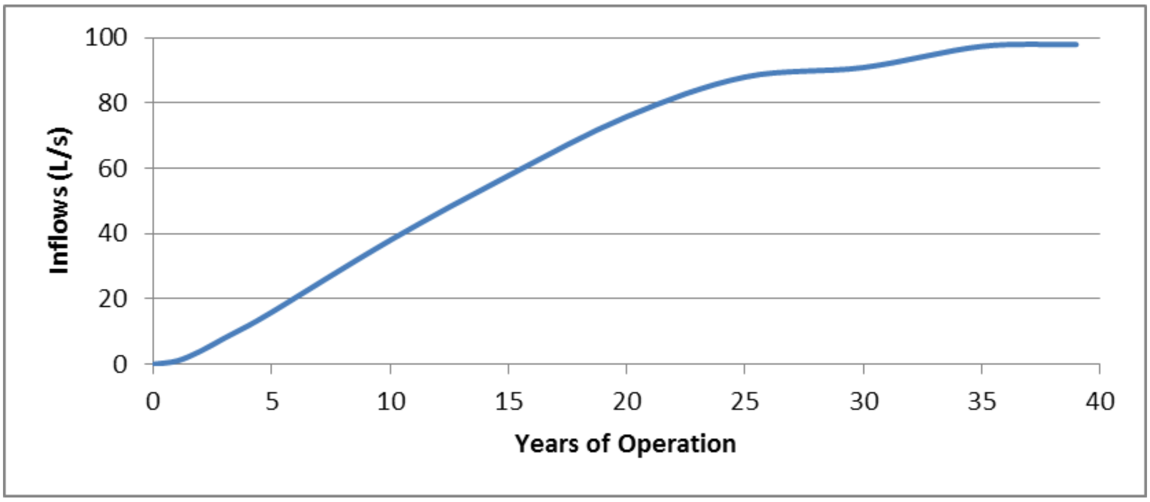

Figure 11-1: Estimated groundwater inflow rates

Table 11-43: Site specific estimated groundwater inflow rates

Year	Year of Operation	Trichardtsfontein	Thubelisha	Vaalkop
0	0	0	0	0
2016	1	0	90	0
2017	2	0	352	0
2018	3	34	660	0
2019	4	112	909	0
2020	5	191	1189	0
2025	10	648	2635	0
2030	15	1101	3769	120
2035	20	1192	4942	413
2040	25	1171	5617	810
2045	30	1138	5460	1255
2050	35	1109	5285	2012
2054	39	1088	5155	2214

The significance rating of the potential impacts of subsidence before and after mitigation plans is provided in Table 11-44. The significance rating for the less significant impacts associated with the operational phase for groundwater is considered to be minor and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

Table 11-44: Potential impacts of subsidence as a result of high extraction on groundwater

Dimension	Rating	Motivation	Significance
Impact Description: Groundwater quality deterioration			
Prior to mitigation/ management			
Duration	Permanent (7)	If subsidence occurs damage will be permanent.	Moderate (-75)
Extent	Local (3)	Impacts of subsidence will only occur within the mining rights area	
Intensity x type of impact	Serious loss (-5)	There may be serious impacts associated with the subsidence with regards groundwater quality at the shallow aquifer (where private boreholes are mostly found) and an impact to the shallow aquifer may impact surface water bodies that receive baseflow.	
Probability	Likely (5)	Subsidence is likely to occur during high extraction however geotechnical evaluations are required to confirm the probability.	
Nature	Negative		
Mitigation/ Management actions			
▪ In order to prevent subsidence during the bord-and-pillar mining in the operational phase, it is required that a safety factor that provides sufficient pillar stability is applied. ▪ The mine should be monitored on an annually basis for subsidence and areas of subsidence should be rehabilitated by backfilling with waste rock and topsoil thereafter revegetating of the disturbed area. ▪ High extraction areas should be delineated as a high risk (depending on the local geology and dolerite sill) for subsidence and for groundwater impact. ▪ If possible, concurrent backfilling of the mine voids with fly ash should be conducted to minimise the risk of subsidence and neutralise any acid that might be generated. This should be done to assist with reducing the risk of subsidence and is a means of waste management. Should this occur a separate environmental authorisation will need to be applied for. ▪ Groundwater level and quality monitoring should be conducted on quarterly basis during operation, with special attention given to the subsidence areas. The			

Dimension	Rating	Motivation	Significance
monitoring frequency can be reduced post-closure depending on the trend of the monitoring results.			
Post- mitigation			
Duration	Project life (5)	If areas of subsidence are monitored and rehabilitated the impacts will occur over a short period.	Minor (-44)
Extent	Local (3)	Impacts of subsidence will only occur within the mining rights area	
Intensity x type of impact	Moderate (-3)	With the application of the mitigation measures, potential impact intensity reduces significantly	
Probability	Likely (4)	If rehabilitated as soon as impact is picked up on through monitoring impact will be short lived and reversible	
Nature	Negative		

11.11.3 Decommissioning Phase

During the decommissioning and post closure phases groundwater contamination is likely to occur.

Table 11-45 provides the activity interaction and the resultant impact after mine closure.

Table 11-45: Interactions and Impacts during the Decommissioning and Post-Closure Phase

Interaction	Impact
Mine contamination	Groundwater contamination
Mine decanting	Surface water contamination

Once the mining and dewatering ceases, groundwater will start to recover towards reaching its pre-mining levels, due to the extensive area (126 km) full hydraulic head recovery varies in different parts of the impacted area. Contaminants may arise due to dissolution of heavy metals and the oxidation of sulphides, resulting in AMD or an excess of particular parameters when compared against various DWS water quality standards.

Following full recovery the potential contaminants will start to migrate away from the mine site. The expected contamination plume 100 years post closure is shown in in the weathered aquifer shown in Plan 27 in Appendix B, a maximum of 40% of the source concentration from the mine voids will reach the weathered aquifer. Due to the low hydraulic conductivity in the deeper aquifers the contamination plume is expected to be retained within the consolidation project area at the deep fractured aquifer shown in Plan 28 in Appendix B.

Model simulations show that decant is unlikely to occur even 100 years after closure at the shafts. Sinkhole formation and geological fractures have not been considered in the decant simulation. Should subsidence and sinkholes occur/form at elevations lower than the hydraulic head and or artificially extended geological structures that act as groundwater flow pathways, decanting is likely to occur at those areas. It is impossible to inform at this moment if and when such structures will be formed. Additionally, exploration boreholes or abstraction boreholes (extending to the depth of the deep fractured aquifer where mining will be taking place) could also be decant zones, taking into consideration the extent of the mine and distribution of the boreholes, identifying the point of expected decant is not possible. Annual monitoring should be conducted for subsidence and sinkhole formation, followed by rehabilitation, as well as decants monitoring at unsealed deep boreholes (greater than 30 mbgl in depth). In the event that decant is detected, it impacts are assessed below. Further discussions in regards to decant and its impact on the environment are discussed in further detail in the Groundwater Specialist Report (Appendix N). Plan 29 indicates the locations of potential decant areas.

The significance rating of the potential impacts of mine decanting and contamination of surface water bodies is provided in Table 11-46. The significance rating for the less significant impacts associated with the decommissioning phase for groundwater is considered to be minor and therefore have not been discussed further. The full impact assessment has been attached as Appendix D.

Table 11-46: Potential impacts of decant on groundwater

Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Decanting of the closed mine			
Prior to mitigation/ management			
Duration	Permanent (7)	If subsidence occurs damage will be permanent.	Moderate (-80)
Extent	Local (3)	Impacts of subsidence will only occur within the mining rights area	
Intensity x type of impact	Serious loss (-6)	There may be serious impacts associated with the subsidence with regards groundwater quality at the shallow aquifer (where private boreholes are mostly found) and an impact to the shallow aquifer may impact surface water bodies that receive baseflow. Over time higher concentrations of the contamination source accumulate at the weathered aquifer (5% more than that	

Dimension	Rating	Motivation	Significance
		what was observed at the end of operation and more extensive distribution of the higher concentrations is observed. However the weathered aquifer is only expected to receive a maximum of 40% of the concentration of the source contamination.	
Probability	Likely (5)	Subsidence is likely to occur during high extraction however geotechnical evaluations are required to confirm the probability.	
Nature	Negative		
Mitigation/ Management actions			
▪ Decant should be collect and stored at a PCD as a short term solution; ▪ Long term management solutions for decant should be investigated; and ▪ Monitoring groundwater levels and decant (rate and quality) quarterly.			
Post- mitigation			
Duration	Permanent (7)	Once the mine starts to decant, it is not expected to stop naturally	Negligible (-30)
Extent	Limited (2)	With the re-introduction of the treated water into the surface water system, the extent of impact will be limited	
Intensity x type of impact	Minimal (1)	Once the decanted water is treated and re-introduced to the streams, the environmental significance is rated as minimal to no loss.	
Probability	Unlikely (3)	If the decant is treated to the river quality objectives, its impact is unlikely	
Nature	Negative		

11.12 Cumulative Impacts

Cumulative impacts are defined as impacts arising from the combined effects of two or more projects or actions. The importance of identifying and assessing cumulative impacts stems from the fact that, the whole is often more than the sum of its parts – implying that the total effect of multiple stressors or change processes acting simultaneously on a system may be greater than the sum of their effects when acting in isolation. Cumulative impacts usually relate to large-scale and more extensive rather than primary concentrated impacts and have a tendency to increase the intensity of impacts already predicted for the consolidation project.

The aim of this section is to highlight the nature of the cumulative impacts that are expected to occur as result of the combined effect of the consolidation project and other current or planned operations in the area (e.g. Syferfontein mine, Anglo Platinum's Isibonelo Colliery, Eskom's Kriel and Matla Power Stations, and Sasol's plants).

11.12.1 Noise

Background noise levels in the area are high as a result of industrial activities and roads. This has been show from the noise monitoring that has been undertaken in both 2008 and 2017 which indicated notice levels exceeding the SANS 10103 standards during day time and night time hours. It is noted that significant impact relating to noise is associated with the Syferfontein conveyer belt and the conveyer belt transporting Coal from TCTS to TEP.

Table 11-47 shows the impact, i.e. the excess in dB over the recommended limit in dBA, of the existing Syferfontein conveyor on its own (Column 3), the collective impact of the existing conveyor plus the new TCTS (Column 4), as well as the impact of the TCTS on its own (Column 5). It is recommended that, considering the acoustic climate in the industrialised Secunda district, limits be set at 40 dBA for farms and 50 dBA for the Kosmosrant residential district. Both limits are 5 dBA higher than what is regarded as typical noise levels for Rural and Residential Districts according to SANS 10103.

Table 11-47: Excess in dB over recommended dBA limit for the Project site (TCTS EIA/EMPr, 2008)

Excess in dB over recommended ambient dBA limit				
1	**2**	**3**	**4**	**5**
Location	**Limit**	**Existing**	**Existing + New**	**New**
(Residence)	dBA	(Syferfontein Conveyor)	(Syferfontein + TCTS)	(TCTS)
Moolman	40	7	8	0
Du Preez	40	14	15	7
Te Water 2	40	20	20	11
Krüger Senior	40	28	28	7
Krüger Junior	40	2	5	2
Kosmosrant	50	1	2	-6

11.12.2 Social

Three possible cumulative impacts were identified during the completion of the SIA for Trichardtsfontein, and are deemed applicable and relevant to the proposed consolidation of the Mining Right areas.

11.12.2.1 Multiplier effects on the local economy

The extended life of the current mining operations through the consolidation of the three mining areas will extend the time that active operational employment opportunities exist. There are 1 221 people employed through the TCTS operations, with this employees complement expected to fulfil resourcing requirements in the mining of Trichardtsfontein and Vaalkop, once mining extends to these areas. Several nearby mining and industrial operations also employ substantial numbers of people; other mines planned for the area such as Igoda Coal, will also potentially add to the number of people employed in the mining sector. The contribution of mining and coal related industries (e.g. Eskom Power Plants and Sasol's Petrochemical Plants) to job creation will therefore be enhanced through the proposed consolidation.

Secondly the consolidation project, together with other existing and planned coal mining related operations will result in several economic benefits for local communities through direct and multiplier effects. These effects are usually stimulated by wage bills, local and regional procurement spend, and investment into LED and skills development. The current mining operations and proposed consolidation will add to the existing positive effect of mining on local economic development by applying national principles in terms of local employment and procurement, as well as LED.

11.12.2.2 Impacts related to population influx

The area has already experienced a significant influx of people in search of work at nearby industrial and coal mining operations. It is likely that this existing impact will continue to see an increase in population influx, exacerbated by the high unemployment rates in the country and the down-scaling and closure of other non-fossil fuel based mines.

Any additional people that migrate to the area will likely not be taken up through recruitment on the TCTS operations, as the current staff complement will not change. In this instance, influx is also likely to exacerbate pressures on existing social/community infrastructure and services, the growth or establishment of informal settlements and a negative impact on housing prices.

11.12.2.3 Dependency on mining to sustain the local economy

As mentioned earlier in this report, economic activities in the area are dominated by coal mining and industrial sector (i.e. Sasol Mining), the latter also being dependant on mining. Because mining creates a much larger number of jobs than the services sector, and because mine workers tend to earn better salaries than those employed in most other sectors, it is fair to deduce that the local economy is heavily dependent on the mines or mining related industry (e.g. Sasol Mining). As emphasised earlier, all mines have a finite lifespan. Inevitably, mining operations in the area will at some point in the future begin to scale down and close, affecting all coal dependant industries (e.g. Sasol and nearby coal-fired power stations). Unless significant investment is made into economic diversification, the area is destined for a considerable economic slump once this process commences.

11.12.3 Heritage

The following possible cumulative impacts of the consolidation project have been identified which could have an impact on heritage resources:

Table 11-48: Summary of potential cumulative impacts

Type	Cumulative Impact	Direction of Change	Extent of Impact
Synergistic Space crowding	Continued contribution to the enhancement of an industrial/mining landscape through establishing new ventilation shafts. Contributing to the alteration of the sense-of-place of the cultural landscape from a historic, agrarian cultural landscape.	Negative	Regional
Additive	The continued effects operational activities, i.e. underground mining activities, on the integrity of the various known heritage resources within the site-specific study area.	Negative	Site-specific
Additive Synergistic	Increased significance of remaining *in situ* archaeological sites and accumulations and historic built structures regardless of integrity within the greater local study area.	Negative	Local

11.12.4 Soil, land use and land capability

The major impact associated with mining is the disturbance of the natural occurring soil profiles consisting of soil horizons. Rehabilitation of disturbed areas aims to restore land capability. Soil quality deteriorates during stockpiling and replacement of the soil materials into soil profiles during rehabilitation cannot imitate pre-mining soil quality properties. A change in land capability then forces a change in land use. Arable land capability changes to grazing land capability. The impact on post mining land capability could be considered high in the event that mitigation is not adopted for issues related to subsidence which could have impacts to agricultural production on surface.

11.12.5 Fauna and Flora

The cumulative impacts that are considered from a perspective of terrestrial biodiversity include the following:

- Loss of habitat on a national scale – the threatened ecosystems programme outlines the most significant habitats that are important for conserving on a national scale. Minimal loss of the Eastern Highveld Grassland (correlating to the *Eragrostis*-dominated grassland in this report) is expected and the impact of this is regarded as minor.
- Loss of diversity on a regional scale – the *Eragrostis* Grassland is a broad habitat that encompasses many smaller plant communities.

11.12.6 Wetlands

Some of the major contributing factors to the decline of wetlands in South Africa include mining, industrial and agricultural activities as well as poor treatment of waste water from industry and mining (Oberholster *et al.*, 2011). Coal mining causes destruction of wetlands via direct impacts such as removal of habitat, alteration of flow and contamination of water, but also indirectly through the drawdown of groundwater resources during the dewatering process (van Der Walt, 2011).

Dewatering has cumulative impacts on wetlands, which are complex, interlinked systems in the Highveld. Underground mining, particularly in Mpumalanga due to bord and pillar methods, has frequently resulted in unplanned surface collapse (Ochieng *et al.* 2010). This collapse has been the cause of ground and surface water contamination due to acidification and/or salinisation of nearby aquifers. Coal mining is already prevalent in the region and 5 coal mines are located within a 30 km radius of the consolidation project site, with more planned in the future. The consolidation project is likely to continue to contribute to these cumulative impacts through increasing dewatering, causing a reduction in groundwater and potentially increasing the loss of wetlands in the Mpumalanga Province region.

11.12.7 Surface Water

Mining activities may have negative impacts on the surface water quality. All runoff draining from the consolidation project area via the Trichardtspruit, Krapfonteinspruit, Debeerspruit and Piekespruit will eventually report into the Olifants River.

The baseline water quality showed poor qualities of water as TDS/EC, ammonia and chloride were exceeding the water quality guidelines for irrigation, this is likely due to runoff from cultivated areas with fertilizers, pesticides etc. The Olifants River has several tributaries downstream of the consolidation project area; where there are different activities (irrigation, mining, domestic uses and livestock watering) taking place along its catchment. The Olifants River is already under stress regarding the quality status due to coal mines within the catchment, impacts from all these activities may result in a significant impact and further deterioration of water quality in the Olifants River.

A loss in the Witbank Dam catchment runoff yield has been determined to be 0.7% due to subsidence at the TCTS mining area and approximately 8% loss due to the proposed Vaalkop and Trichardtsfontein will come in as an addition to the existing loss. Although the initial TCTS loss was considered to be insignificant as compared to the total runoff yield, additional loss due to Trichardtsfontein and Vaalkop mining area will also add into this impact and further stress on the Witbank Dam and Olifants River thereof.

However, implementation of the recommended mitigation and management measures (presented in this report) will prevent or minimise further deterioration of water quality and impact on water quantity to the Olifants River (due to this consolidation project) may be avoided.

11.12.8 Aquatic Ecology

The following cumulative impacts have been identified, and can occur due to the consolidation project:

- Cumulative deterioration of water quality within the associated river systems; and
- Cumulative deterioration of aquatic habitat within the associated river systems.

The PES of the river reaches associated with the consolidation project is currently modified as a result of habitat quality modification and the moderate water quality modification. The consolidation project will likely not affect water quality of this reach until the closure phase, where-after potential decant poses a risk to the water quality impairment.

Dissolved solids (salinity) and the pH of the rivers within the consolidation project area have been increasing as a possible result of extensive farming practices. Therefore, it is probable that the proposed consolidation project will contribute toward these increasing water quality constituents and further degradation of water quality within the associated reaches. Considering this, if mitigation actions are not put in place, the effects thereof will be significant.

11.12.9 Groundwater

Observing the consolidation project area and its surroundings (10 km radius from the project area) it is evident that the area is dominated by mining related operations. Concentration of these facilities is observed especially downstream of the consolidation project area. All these operations are expected to have contributed or are currently contributing to the local groundwater quality deterioration. Impacts of dewatering activities and the contamination plume may extend beyond the consolidation project site considering cumulative impacts.

However, depending on the mine size, depth, life of mine and mining method, and the cone of dewatering from the existing or future mines could possibility reach the consolidation project site. Considering the distance between the mines and the limited rock permeability, however, this is an unlikely scenario.

The potential occurrence of the cone of dewatering in isolated parts of the shallow weathered aquifer may bring about cumulative impacts that could deteriorate water quantity at the local rivers that are part of the Olifants River Catchment. The potential groundwater contamination plume in the deep fractured aquifer from all the mines in the catchment is likely to have a negative impact on the groundwater quality, potentially impacting deep private boreholes.

12 Item 3(g)(vi): Methodology used in determining and ranking the Nature, Significance, Consequence, Extent, Duration and Probability of Potential Environmental Impacts and Risks

Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below.

The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

Nature = Positive (+1) or negative (-1) impact

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts.

The matrix calculates the rating out of 147, whereby Intensity, Extent, Duration and Probability are each rated out of seven as indicated in Table 12-3. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in this environmental impact assessment report. The significance of an impact is then determined and categorised into one of eight categories, as indicated in Table 12-2, which is extracted from Table 12-1. The description of the significance ratings is discussed in Table 12-3.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e. there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Table 12-1: Impact Assessment Parameter Ratings

Rating	Intensity/ Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
7	Irreplaceable loss or damage to biological or physical resources or highly sensitive environments. Irreplaceable damage to highly sensitive cultural/social resources.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or moderate to highly sensitive environments. Irreplaceable damage to cultural/social resources of moderate to highly sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.

Rating	Intensity/ Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
5	Serious loss and/or damage to physical or biological resources or highly sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or moderately sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures/ items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

Rating	Intensity/ Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
3	Moderate loss and/or damage to biological or physical resources of low to moderately sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	Minor loss and/or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare/ improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.

Rating	Intensity/ Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
1	Minimal to no loss and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely/ None: Expected never to happen. <1% probability.

Table 12-2: Probability/Consequence Matrix

Probability	Significance																																					
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Consequence	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Table 12-3: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

12.1 Item 3(g)(vii): The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and the community that may be affected

During the previous EIA processes which were completed for the TCTS mine in 2008 and the Trichardtsfontein Mine in 2014, various alternative where investigated and decisions were made based on the most feasible as well as the option that would result in the least environmental impact. As the TCTS mine has been operational since 2010, the infrastructure has already been constructed and therefore will remain where is has been previously established. No infrastructure has been constructed for Trichardtsfontein.

Ventilation shafts are proposed to be constructed, it was noted that the areas that have been selected were found to not have any significant impact to any environmental aspects. The location of the ventilation shafts is however limited as it is dependent on the underground operation and where additional ventilation is required in the underground workings for health and safety purposes. It can be confirmed that the preferred ventilation shaft location is situated outside the 1:100 floodline however it is located within 500 m buffer of the wetlands and aquatic habitats. Therefore a general authorisation for a water use licence will need to be applied for. It is also not located on any sensitive environmental features such as threatened habitats, wetlands, archaeological or grave sites, and is far enough away from human habitation to ensure that noise and dust will not affect neighbours. The placing of shaft infrastructure was done carefully to avoid impacts on the few wetlands in the area.

12.2 Item 3(g)(viii): The possible mitigation measures that could be applied and the level of risk

Mitigation measures for each identified impact have been proposed and are presented in Section 14.

12.3 Item 3(g)(ix): Motivation where no alternatives sites were considered

In terms of mining, alternative sites (i.e. locations) could not be considered since the location of the mineral resource determines the location of the mining operations. Additionally, alternative site layouts excluding the ventilation shafts have also not been considered as all infrastructure has already been constructed. However alternative locations to the ventilation shafts have been investigated to identify the most suitable location with the least environmental impact as discussed in Section 8.1.

12.4 Item 3(g)(x): Statement motivating the alternative development location within the overall site

As discussed, no additional infrastructure will be constructed for the mining areas except for the construction of the ventilation shafts. The shafts are proposed to be constructed on the following farms:

- Rooipoort 143 IS Ptn 3;
- Rooipoort 144 IS Ptn 8;
- Zeekoegat 145 IS Ptn 1; and
- Palmietfontein 110 IS Ptn 18.

Specialist studies have been undertaken to determine where any sensitivities exist where the ventilation shafts are proposed to be constructed as well as to determine the impact the ventilation shaft will have on environmental aspects. It can be confirmed that no significant impacts will arise from the construction and operation of the ventilation shafts. Additionally, it can confirmed that the preferred ventilation shaft location is situated away from the 1:100 floodline, is not located on any sensitive environmental features such as threatened habitats, wetlands, archaeological or grave sites, and is far enough away from human habitation to ensure that noise and dust will not affect neighbours. The placing of shaft infrastructure was done carefully to avoid impacts on the few wetlands in the area. Plan 22 in Appendix B provides a sensitivity map of the areas around the ventilation shafts.

13 Item 3(h): Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (In respect of the final site layout plan) through the life of the activity

During the previous EIA processes which were completed for the TCTS mine in 2008 and the Trichardtsfontein Mine in 2014, various alternative where investigated and decisions were made based on the most feasible as well as the option that would result in the least environmental impact. As the TCTS mine has been operational since 2010, the infrastructure has already been constructed and therefore will remain where is has been previously established. No infrastructure has been constructed for Trichardtsfontein.

No alternative in regards to location as the mines where investigated as the mine is dependent on the location of the resource and where the mine has been authorised to extract the coal. The mining activities will be undertaken within of the mining right area only.

Alternative were considered in regards to the location of the ventilation shafts which has been investigated in detail during the Amendment phase to ensure the most suitable alternative is selected. Stakeholders will be given the opportunity during the public review period to provide comment on the various alternatives provided in this report. Should comments be received the alternative will be revised where applicable. The impacts and risks discussed in Section 11 are applicable to the final site layout plan (Plan 3 in Appendix B). A more detailed depiction of the TCTS infrastructure plan is provided in Plan 3 A in Appendix B.

14 Item 3(i): Assessment of each Identified Potentially Significant Impact and Risk

Table 14-1 provides all identified impacts associated with each phase and each aspect.

Table 14-1: Assessment of Each Identified Potentially Significant Impact

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
Construction Phase	Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Air Quality	Reduction in ambient air quality due to dust generation and soiling of surfaces	Negligible (negative) -	▪ Site clearing must be done in phases and use of suppressants and binders on exposed areas to reduce dust generation; ▪ The area of disturbance at all times must be kept to a minimum and no unnecessary clearing, digging or scraping must occur, especially on windy days (with wind speed ≥ 5.4 m/s); ▪ The drop heights when loading onto trucks and at tipping points should be minimised; ▪ Dust suppression must take place on exposed surfaces; and ▪ Set maximum speed limits on site and to have these limits enforced.	Negligible (negative) -
Operational Phase	Mining Process: Tipping of ore at the Bunker and Stockpiling	Air Quality	Reduction in air quality as a result of the crushing activities as well as the tipping of the coal into the bunker.	Negligible (negative) -	▪ Enclosure of tipping points and crusher; ▪ Use of water spray to prevent coal dust dispersion; ▪ The coal bunker design includes a cover and water sprays to prevent coal dust dispersion; and ▪ Ensure bi-weekly inspections of dust suppression equipment on the bunker and transfer stations and replace faulty components.	Negligible (negative) -
Operational Phase	Operation of the Ventilation Shaft	Air Quality	Release of TSP, PM_{10}, $PM_{2.5}$, NO_2, SO_2 and CO from the ventilation shafts will increase ambient levels of these pollutants.	Negligible (negative) -	▪ Mitigation measures such as: use of electrostatic precipitators to remove fine particles is recommended if ambient levels are exceeding regulatory standards; ▪ Use of Catalytic Converters is recommended if the levels of toxic gases are in exceedance of the regulatory standards; and ▪ Use of gas scrubbers to remove particulates and/or gases from emissions being released form the ventilation shafts if regulatory standards are exceeded.	Negligible (negative) -
Decommissioning Phase	Sealing of shaft, decommissioning of mine infrastructure and rehabilitation	Air Quality	Sealing of ventilation shafts and rehabilitation results in dust emission	Negligible (negative) -	▪ Drop heights should be minimised when offloading materials; ▪ The dismantling area disturbed must be kept to a minimum; ▪ Limit rehabilitation activities to non-windy days, where possible; ▪ Rehabilitation must be undertaken in accordance with rehabilitation plan (Appendix O); and ▪ Dust suppression on exposed surfaces must be implemented including haul roads.	Negligible (negative) -
Construction Phase	Site clearing, including the removal of topsoil and vegetation; Construction of ventilation shafts	Noise	Noise will emanate from the machinery and vehicles operating during the construction activities	Negligible (negative) -	▪ Restricting construction activities to daylight hours (06:00 – 18:00); and ▪ Switching off equipment when not in use.	Negligible (negative) -
Operational Phase	Operation of ventilation shafts	Noise	Noise will emanate from the operation of the ventilation shafts	Negligible (negative) -	▪ The ventilation fan diffuser outlets should be installed horizontally and directed north.	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
Operational Phase	Operation of the TCTS mine with associated infrastructure	Noise	Noise will emanate from the operation of the TCTS mine specifically the crushing facility as well as conveyor belt	Minor (negative) -	▪ Ensure regular inspections of the conveyor line are undertaken on a weekly basis and replace faulty rollers and other faulty components resulting in excessive noise. This should be undertaken not only from an environmental perspective but also from an operational perspective; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Investigate all noise complaints promptly and advise the complainant of the outcome(s).	Negligible (negative) -
Decommissioning Phase	Removal of infrastructure and surface rehabilitation	Noise	Noise will emanate from the machinery and vehicles operating during the decommissioning activities	Negligible (negative) -	▪ Restricting decommissioning activities to daylight hours (06:00 – 18:00); ▪ Switching off equipment when not in use	Negligible (negative) -
Operational Phase	Sustained employment during operation	Social	Job creation during operation	Minor (positive) +	▪ Where feasible, promote the creation of employment opportunities for women and youth; ▪ Sasol Mining procurement and/or contracts department (or similar) to establish a monitoring system to ensure that the subcontractors honour the specified local employment policy. This can be stipulated in contractor agreements; ▪ If required, the local resident status of applicants should be verified in consultation with community representatives and local government; ▪ Ensure that existing employees have access to pertinent skills training and are able to improve their professional proficiencies throughout their employment with Sasol. This will assist with self-improvement and provide an opportunity for employees to achieve professional's goals; and ▪ In addition, it is recommended that local employment opportunities that may arise be maximised as far as possible, by intensifying efforts in the SLP, which are aimed at developing scarce skills.	Moderate (positive) +
Operational Phase	Operation of the Mine	Social	Economic Growth will result in a positive contribution to GDP	Minor (positive) +	▪ Recruitment to be coordinated by Sasol Mining in accordance with recruitment policy; ▪ Promotion of female and youth employment; and ▪ Effective implementation of training and skills development initiatives.	Negligible (negative) -
Operational Phase	Operation of the Mine	Social	Conflict / competition between newcomers and incumbent population	Minor (negative) -	▪ Recruitment to be coordinated by Sasol Mining in accordance with recruitment policy; ▪ Promotion of female and youth employment; ▪ Effective implementation of training and skills development initiatives; and ▪ Where possible, maximise the extent of short-term employment (over and above the full time employees and contractors) through piecemeal work and the like.	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
Operational Phase	Operation of the Mine	Social	Potential financial implication for town developers	Minor (negative) -	▪ Public awareness campaigns regarding subsidence; and ▪ Investment in development to secure housing options for employees, and thereby reassuring public.	Minor (negative) -
Operational Phase	Operation of the Mine	Social	Community development induced by Local Economic Development (LED) and Corporate Social Investment (CSI)	Minor (positive) +	▪ The details of Sasol Mining's' proposed LED programmes must be designed and implemented in consultation with both community representatives and municipal management to ensure that the actual needs of communities are met; and ▪ All LED projects must include a monitoring and evaluation plan, to ensure that the effectiveness of each project is tracked and aligned to its intended objectives. Identified areas for improvement should be incorporated into the following years planning	Moderate (positive) +
Operational Phase	Operation of the Mine	Social	Potential subsidence related impacts	Negligible (negative) -	▪ Ensure regular communication with stakeholders; and ▪ Any unintended (factual) damage and/or losses that are incurred by impacted persons must be addressed on a case-by-case basis, in accordance with South African.	Negligible (negative) -
Operational Phase	Theft during the operation of the mine	Social	Theft of cattle, farming equipment and other valuables within the project site associated with increased activity from the mine	Moderate (negative) -	▪ Ensure theft is prohibited at the mine and warn workers of the consequence of stealing; ▪ Transporting workers to and from site after their shifts; ▪ Advise workers not to buy anything from farm workers; and ▪ All communication with farmers will be undertaken through the Sasol Mineral Rights Department (SMRD).	Negligible (negative) -
Operational Phase	Operation of the Mine	Social	Operation-related health and safety impacts	Minor (negative) -	▪ The mine should be maintained during its lifetime so as to minimise the risk of mine personnel being injured as result of failed machinery etc.; ▪ Operational health and safety programmes should be implemented; ▪ All mine employees should be issued with the appropriate personal protective equipment (PPE) and educated regarding the risks involved in mining activities; ▪ Unauthorised access to the mine and future construction sites must be prevented through appropriate fencing and security to be erected/ established at the start of operation and maintained throughout the life of the proposed project; and ▪ Ensure that diversions are clearly marked and sign posted, especially for night time.	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
Decommissioning Phase	Decommissioning of the Mine	Social	Dependency on Mine for sustaining local economy	Moderate (negative) -	▪ Develop alternative and sustainable livelihoods for instance through LED programmes listed in the Mine's SLP; ▪ During the life of mine workers are given the opportunity to better and formalise their skills in order to aid their attempts to find alternative employment; ▪ The Mine's SLP should provide strategies and measures that reduce job loss through redeployment at other operations; ▪ Where feasible alternatives to save jobs/avoid downscaling should be investigated beforehand, including LED, potential redeployment at other operation; ▪ In addition to this it is vital that at all times but particularly towards the end of mine life that issues around retrenchment are dealt with in a transparent manner. All workers must know where they stand with regard to employment, what processes will be followed in the event of retrenchment and what services are available to them in this regard. ▪ Proactively assess and manage the social and economic impacts on individuals, regions and economies where; retrenchment and/or closure of the mine are certain. In particular through promoting economic diversification, portable skills development and local economic development where possible; ▪ Ensure open discussions with relevant government departments to ensure the closure process is correctly followed; and ▪ Rehabilitation must be undertaken in accordance with rehabilitation plan.	Minor (negative) -
Construction Phase	Site clearing and topsoil removal for the construction of the ventilation shafts	Soil, Land Use and Land Capability	Loss of topsoil as a resource: During clearing of vegetation and removal of soil for establishment of ventilation shafts (3.5 ha), the soil chemical and physical properties are impacted on. The movement of vehicles on the soil surface causes compaction which reduces the vegetation's ability to grow and as a result erosion could occur.	Minor (negative) -	▪ If possible soil should be removed during dry months, as to reduce compaction; ▪ Only clear vegetation when and where necessary; ▪ Only the designated access routes are to be used; ▪ The soils stripped for the ventilation shafts should be stripped and conserved for rehabilitation; ▪ Topsoil stockpiles are to be kept to a maximum height of 3 m at a 2:5:1 slope; ▪ If erosion occurs on the site or on the stockpiles, corrective actions must be taken to minimise any further erosion from taking place; ▪ The handling of the stripped topsoil should be minimised to ensure the soil's structure does not deteriorate significantly; ▪ The stockpiles should be vegetated to reduce the risk of erosion, and to reinstitute the ecological processes within the soil; ▪ Compaction of the removed soil should be avoided by prohibiting traffic on stockpiles; and ▪ Ensure designed storm water management is in place.	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
Operational Phase	Maintenance of roads and topsoil stockpiles	Soil, Land Use and Land Capability	Topsoil losses can occur during the operational phase as a result of rainwater runoff and wind erosion from roads and soil stockpiles where steep slopes are present. Compaction of soils during operational phase will occur.	Moderate (negative) -	▪ Topsoil stockpiles are to be kept to a maximum height of 3 m at a 2:5:1 slope angle and away from drainages lines and surface water; ▪ Only the designated access routes are to be used; and ▪ If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place.	Negligible (negative) -
Operational Phase	Potential impacts of operational phase on soils, land capability and land use (30 – 100 m below ground level)	Soil, Land Use and Land Capability	Collapsed underground mine roof could potentially cause significant surface subsidence. This may restrict post mining land capability and agricultural productivity. Surface cracking and subsidence will occur due to large areas that could be affected by high extraction.	Major (negative) -	▪ Rehabilitation of cracks once identified and areas where vegetation is affected by ponding, where practicable ; ▪ Subsided areas can be backfilled and re-shaped to match the original topography to mitigate ponding and waterlogging conditions depending on the degree of the collapse and available soil material, where practicable; ▪ Planning for free drainage of ponded areas, where practicable; ▪ Monitoring of undermined areas to assess the effects of subsidence at surface. Annual surface surveys will be undertaken over mined out areas to establish the degree of subsidence; and ▪ Failing these mitigation measures, the only other alternative will be to compensate the farmers for loss of productive land.	Moderate (negative) -
Operational Phase	Potential impacts of operational phase on soils, land capability and land use (>100 m below ground level)	Soil, Land Use and Land Capability	Collapsed underground mine roof could potentially cause significant surface subsidence. This may restrict post mining land capability and agricultural productivity. Surface cracking and subsidence will occur due to large areas that could be affected by the high extraction.	Minor (negative)	▪ Rehabilitation of cracks once identified and areas where vegetation is affected by ponding; ▪ Subsided areas can be backfilled and re-shaped to match the original topography to mitigate ponding and waterlogging conditions depending on the degree of the collapse and available soil material; ▪ Planning for free drainage of ponded areas; and ▪ Monitoring of undermined areas to assess the effects of subsidence at surface	Negligible (negative)
Decommissioning Phase	Rehabilitation of infrastructure areas, roads and subsided areas	Soil, Land Use and Land Capability	Rehabilitation of roads, associated infrastructure and subsided areas could cause compaction and erosion if rehabilitation is not done correctly. This could be as a result of poor vegetation establishment which would result in exposed surfaces and increase the risk of erosion.	Minor (negative) -	▪ Rehabilitate according to the rehabilitation plan; ▪ Return the land conditions capable of supporting prior land use or uses equal than prior land use to the extent feasible or practical. ▪ Contour slopes to minimise erosion and run-off; ▪ Plant native vegetation to prevent erosion and encourage self-sustaining development of a productive ecosystem such as *Cynodon dactylon, eragrostis tef, eragrostis chloromelas, chloris gayana, digitaria eriantha* and *panicum*; ▪ Remove buildings to foundation level. All rubble to be relocated to a specified approved rubble dump or used as backfilling in shafts, etc ▪ Use waste rock for backfill and followed by topsoil of 0.3 m to the extent feasible ▪ Compacted areas are to be ripped to loosen the soil and vegetation cover re-instated; ▪ Inventory of hazardous waste materials stored on site should be	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
					compiled and arrange complete removal; ▪ Seal the shaft by placing concrete plugs; ▪ Ensure proper storm water management designs are in place to ensure no erosion or ponding occurs, where practicable; ▪ Conduct soil contamination assessment to assess if any remediation is require prior to future land use development; ▪ Only designated access routes are to be used to reduce any unnecessary compaction; ▪ The topsoil should be shaped taking the pre-mining landscape into consideration, where practicable; ▪ The rehabilitated areas must be assessed twice a year for compaction, erosion and fertility; and ▪ Monitoring for subsidence must be done annually.	
Construction Phase	Site Clearing for the construction of the Ventilation Shafts	Fauna & Flora	Site clearing resulting in alien plant invasion	Minor (negative) -	▪ The footprint area should be kept as small as possible; ▪ The site should be screened prior to construction, preferably between the months of November to March, for any plant Species of Special Concern (SSC); ▪ Existing access roads should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road; and ▪ An alien invader management plan should be implemented, whereby the disturbed site is monitored quarterly for at least two years to ensure that alien invasion does not take place.	Negligible (negative) -

Operational Phase	High extraction underground mining	Fauna & Flora	No direct loss of fauna, flora or sensitive ecosystems will occur, except if subsidence occurs. However, undermining of sensitive areas/landscapes leading to changes that will negatively affect the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mine varies from 30 to 215 m.	Major (negative) -	▪ A comprehensive geotechnical investigation should be undertaken for the following:
					    ▪ Provide appropriate design parameters for pillar and overburden stability, in line with the actual geotechnical rockmass properties, and
					    ▪ Indicate any areas (undermining of the natural ecosystems) that may fall outside of these design parameters.
					▪ Following the geotechnical investigation, where required a provision must be made for the rehabilitation of these areas in the event of a possible risk of subsidence / intersection collapse.
					▪ The edge of the wetlands and a 100 m buffer must be demarcated near where the areas of high risk or definite subsidence area located and the ventilation shafts to reduce the risk of being impacted on from subsidence;
					▪ Sensitive landscape monitoring must be carried out to ensure no unnecessary impact to these areas is realised; and if so that a remedy is put in place as soon as possible;
					▪ The safety factor prescribe by the Rock Engineer must be used;
					▪ No high extraction mining to be done within 100 m from watercourses;
					▪ Monitoring should take place for excessive inflow into the underground workings;
						Moderate (negative) -

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
					▪ If any plant SSC are recorded, these should be translocated with the involvement of a qualified botanist. The donor habitat should resemble the receiving habitat and the species/populations should be monitored monthly after translocation for up to one year; and ▪ If any important fauna species (SSC) are identified (as listed in the expected species lists) that have not been included in the site-specific species lists, this should be reported to the Environmental Control Officer on site and the provincial authority (MPTA) for their reference. Further to this, measures should be undertaken to ensure that negative impacts to the species in question are not imposed due to the development.	
Decommissioning Phase	Dismantling and removal of infrastructure	Fauna & Flora	Alien plant invasion may take place	Minor (negative) -	▪ An alien invasive plant management plan should be implemented. ▪ Riparian habitat and river biomonitoring must be carried out during rehabilitation to ensure these areas are not impacted upon; and if they are remedial action must be implemented. Transects should be set up through representative sites and monitored on an annual basis; ▪ Should there be decant, the water will need to be treated with active or passive treatment and a Rehabilitation Plan will need to be compiled to rectify any damages. ▪ Rehabilitation must be undertaken in accordance with rehabilitation plan;	Negligible (negative) -
Operational Phase	Potential Impacts on Wetlands: Underground Mining (30-100 m below ground level)	Wetland	Undermining of wetlands leading to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mining is between 30 – 100 m below ground level.	Major (negative) -	▪ No mitigation measures will reduce the impact of definite subsidence. In this case, a wetland offset strategy would need to be compiled.	Major (negative) -
Operational Phase	Potential Impacts on Wetlands: Underground Mining (>100 m below ground level)	Wetland	Undermining of wetlands leading to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mining is >100 m below ground level.	Moderate (negative)	▪ The highest safety factor as prescribed by the Rock Engineers must be adhered to. ▪ A geotechnical study would need to be compiled to determine the exact risk of subsidence; ▪ Wetland monitoring must be carried out to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible. ▪ A wetland offset strategy may need to be compiled.	Minor (negative) -

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
Decommissioning Phase	Mine closure and rehabilitation	Wetland	Post-mining decant of groundwater will have negative impacts on the wetlands as this water is likely to be of a poor water quality.	Major (negative) -	▪ Wetland monitoring must be carried out on wetlands that could possibly be impacted on by activities during rehabilitation to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible. Transects should be set up through representative sites and monitored on an annual basis; ▪ Groundwater and wetlands must be monitored post-mining for potential decant (3 years or until the system has stabilised). ▪ Decant should not be allowed to discharge into a wetland system. The decant can be collected and stored in PCD's as a short term mitigation measure; ▪ Investigation into long term solutions for decant management needs to be conducted, should this water not be to the correct standards; ▪ Wetland Rehabilitation Plan will need to be compiled to rectify any damages should decant impact on wetlands; ▪ Monitoring groundwater levels and decant (rate and quality) quarterly.	Minor (negative) -
Construction Phase	Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Surface Water	Siltation of surface water resources leading to deteriorated water quality	Minor (negative) -	▪ Clearing of vegetation must be limited to the development footprint area, and the use of existing access roads must be prioritized so as to minimize construction of new access roads in these areas; ▪ If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments, dust generation and hazardous substances (oil, diesel, etc.) from construction vehicles used during site clearing; ▪ Dust suppression with water on the haul roads and cleared areas must be undertaken to limit dust. During dry times, this could be undertaken on a daily basis where there is visible dust being generated;	Minor (negative) -
Construction Phase	Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Surface Water	Alteration of surface water drainage patterns and river banks	Minor (negative) -	▪ Construction work closer to the streams should be suspended during heavy rains to avoid erosion and sedimentation of the streams and unnecessary vehicle movement should be avoided. ▪ Designs should avoid the causing of erosion or spillages of material during the construction phase.	Negligible (negative) -
Construction Phase	Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Surface Water	Deterioration of water quality due to dirty water reporting into natural water resources	Minor (negative) -	▪ All fuel storage areas should be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; ▪ Vehicles should regularly be maintained as per the mine's developed maintenance program. This should also be inspected on a daily basis before use to ensure there are no leakages underneath ▪ Ablutions facility for construction workers and general waste bins should be provided. An accredited contractor should be appointed to properly dispose the waste; and ▪ No dirty water should be allowed off site and into a stream.	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
Operational Phase	Operation of the mine	Surface Water	Water contamination leading to deterioration of water quality	Moderate (negative) -	▪ As proposed in the project activities, ensure that all the dirty water emanating from the dirty water areas is contained for re-use within the mine, to prevent discharge into the environment; ▪ Use of storage compartments underground to store dirty water; ▪ All pollution control dams must be maintained and is required to operate with a 0.8 m freeboard and able to contain a 1:100 year flood event; ▪ All surface water pollution control structures will be inspected on a three monthly basis and maintenance work carried out as required. Furthermore, all structures (e.g. dams) registered in terms of the National Water Act will be maintained in accordance with the Act. ▪ The mines water balances and management of the water balance must be regularly updated and monitored. This should be updated as specified in the IWUL or if on an annual basis; ▪ The wash bays and workshops are be equipped with oil skimming facilities to remove oil and grease from the wash down water; ▪ Clean run-off must be directed around these facilities, and directed back to the clean water catchment; ▪ The emergency coal stockpile area at Thubelisha must ensure that dirty water from the stockpile area is contained and the seepage is minimised (No dirty water is permitted to be discharged to the clean water environment); ▪ No discharge of polluted water should be planned for or allowed; ▪ Where subsidence will occur during operation, measures to rehabilitate the surface area should be implemented as soon as possible to avoid impoundment of surface water; and ▪ Water quality monitoring should continue on the existing and newly proposed monitoring points to ensure detection of impacts.	Minor (negative) -

Operational Phase	High extraction underground mining	Surface Water	Reduction in catchment yield	Minor (negative) -	▪ There is no mitigation for the loss of catchment yield. However, the area to be stooped is assumed to be approximately 30 km^2 and makes up 8% of the total quaternary catchment of 371 km^2.
					▪ The mine will limit the extent of pillar extraction to target only areas with low potential water ingress. This implies excluding
					    ▪ All floodplain areas and areas within 100 m of a watercourse or 1: 100 year floodline whichever is greatest
					    ▪ All areas with a thin soil cover that have a significant catchment draining to them.
					▪ As far as is practical, the mine will avoid rocky outcrops, although the areas currently designated for pillar extraction do contain some percentage of thin cover and rocky outcrop.
					▪ Clean water from upstream should be diverted around these areas and report to the natural streams.
					▪ The surface of stooped areas will be inspected to ensure they remain free draining. This will involve the use of surface teams undertaking civil works such as cutting drains where required to ensure areas of
						Minor (negative) -

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
					settlement can drain. Sasol Mining has developed a range of strategies for stooped areas based on their experiences elsewhere ▪ The percentage decrease in MAR amounts to 8 % for B11C quaternary catchment (where the proposed new mining areas are located). Therefore, the loss in MAR for the quaternary catchment is considered to be of moderately low significant.	
Decommissioning Phase	Dismantling and removal of infrastructure	Surface Water	Siltation of surface water resources leading to deteriorated water quality	Minor (negative) -	▪ Use of accredited contractors for removal or demolition of infrastructures; this will reduce the risk of waste generation and accidental spillages; ▪ Rehabilitated and backfilled areas (where subsidence has occurred) must be seeded as soon as possible to avoid siltation due to erosion; ▪ Surface inspection on the fully rehabilitated areas must be undertaken to ensure a surface profile that allows good drainage. This will ensure improvement or increased catchment yield to the surrounding streams. ▪ Rehabilitation must be undertaken in accordance with rehabilitation plan (Appendix O);	Minor (negative) -
Decommissioning Phase	Mine closure and rehabilitation	Surface Water	Decant of mine water leading to deterioration of water quality in the nearby streams	Moderate (negative) -	▪ Should decant occur, decant should be collect and stored at a PCD as a short term solution; ▪ Long term management solutions for decant should be investigated; ▪ Water quality monitoring must continue to enable the detection of decant when it occurs so immediate mitigation measures can be implemented. Monitoring should continue for as long as decant is taking place.	Negligible (negative) -
Construction Phase	Site clearance and construction of ventilation shafts within associated wetland habitats and river catchment	Aquatic	Increased runoff and erosion within the rivers nearby to the ventilation shafts	Negligible (negative) -	▪ Minimise and keep the footprint as small as possible; ▪ Buffer zones (100 m wetlands and 100 m riparian); ▪ Revegetation of the construction footprint as soon as possible; ▪ Storm water should be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ Construction should take place during the dry season to minimise runoff; and ▪ Sequential removal of the vegetation (not all vegetation immediately).	Negligible (negative) -
Construction Phase	Waste generation/disposal and the use of hazardous products	Aquatic	Water and habitat quality deterioration	Negligible (negative) -	▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ Approved barrier systems to minimise contaminated seepage and runoff from entering the local aquatic systems; ▪ Ensure correct waste management; and ▪ Ensure correct storage systems are used for the storage of hazardous products when constructing.	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
Operational Phase	Underground mining high to definite risk subsidence areas	Aquatic	Subsidence of land within the river catchment and subsidence of land underneath river channels resulting in poor ecosystem functioning and connectivity	Major (negative) -	▪ No mitigation measures will be able to prevent subsidence where the depth of mining is shallower than 100 m.	Major (negative) -
Operational Phase	Underground mining low risk subsidence areas	Aquatic	Subsidence of land within the river catchment and subsidence of land underneath river channels resulting in poor ecosystem functioning	Moderate (negative)	▪ Complete a geotechnical study to identify high risk subsidence areas and avoid or mitigate to support them; ▪ Ensure sufficient pillar support and safety factors to prevent subsidence of undermined wetland/aquatic areas; ▪ The highest safety factor possible (at least 2) must be used for areas of shallow mining (confirm with geotechnical study); ▪ Underground mining should avoid aquifers especially due to the proposed high extraction near aquatic and wetland systems. Punctured aquifers could lead to the dewatering of aquatic/wetland systems; ▪ Mining should not occur above 100 m below aquatic/wetland areas or within the 100 m wetland buffer zones (confirm with geotechnical study if areas can be mined shallower than 100 m without the risk of subsidence); and ▪ Monitoring should take place for excessive inflow into the underground workings.	Minor (negative)

Operational Phase	Emergency coal stockpiling	Aquatic	Runoff from the emergency coal stockpile into local aquatic systems will result in the degradation of the water and habitat quality of the polluted system	Minor (negative) -	▪ Clean and dirty water storm water management: Clean water should be managed in a manner according to the Department of Water and Sanitation Best Practice Guidelines;
					▪ Barrier systems, including synthetic, clay and geological/natural or other approved mitigation methods to minimise contaminated seepage and runoff from entering the local aquatic systems;
					▪ Storm water management plan must be implemented to ensure clean storm water is diverted away from the surface operations and dirty water stored in the existing Pollution Control Dam (PCD);
					▪ The emergency stockpile should be managed to minimise infiltration of contaminants to the groundwater. Mitigation methods that should be considered include:
					  ▪ Management of the stockpile shape to control the ease with which water can run off from the facility.
					  ▪ The vegetation of the soil/overburden stockpile and covering them with soil to minimise rainfall infiltration and mobilisation of dissolved metals.
					  ▪ Implementation of a lime cover on overburden stockpiles to neutralise acidity.
						Negligible (negative)

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
Operational Phase	Storage/disposal of generated waste and the working with hazardous products	Aquatic	Runoff from operational site containing contaminants will degrade habitat and water quality of polluted aquatic systems	Minor (negative) -	▪ Clean storm water must be diverted from operational sites and managed in such a manner to disperse runoff to prevent an accumulation of storm water flow that may carry contaminants from the site to aquatic systems; ▪ Ensure correct waste management; and ▪ Ensure correct storage systems are used for the storage of hazardous products throughout the project life.	Negligible (negative) -
Decommissioning Phase	Mine closure and rehabilitation	Aquatic	Decant of severely contaminated water into local aquatic ecosystems	Moderate (negative) -	▪ Decant should not be allowed to discharge into the associated aquatic systems. The decant can be collected and stored in PCD's as a short term mitigation measure; and ▪ Investigation into long term solutions for decant management needs to be conducted.	Minor (negative) -
Decommissioning Phase	Removal of infrastructure and surface rehabilitation.	Aquatic	Increased runoff and erosion	Negligible (negative) -	▪ Avoid rehabilitation or unimpeached areas; ▪ Stay within already impacted areas and avoid activity within the 100 m buffer zones of the rivers; and ▪ Commence the phase during the dry season to limit runoff.	Negligible (negative) -
Operational Phase	Underground mining	Geology	With high-extraction mining/ stooping the impact on the geology includes both the excavation of the coal seams as well as the impact on the overlying aquifer above the high-extraction mining/ stooped areas with potential resultant surface subsidence.	Moderate (negative) -	▪ Once geology has been impacted no mitigation measures can be proposed. However measures can be proposes in an attempt to prevent subsidence in areas where only bord and pillar mining has taken place. ▪ The application of stone dust on coal pillars and maintenance of pillar safety factors above 1:1 million chance of failure under watercourses. Exclude areas with surface infrastructure from pillar extraction.	Moderate (negative) -
Construction Phase	Site clearing for the development of surface infrastructure through the removal of the top soil and weathered rocks	Groundwater	Lowering of the water table	Negligible (negative) -	▪ Site clearance and construction activities should take place above the water table, at the unsaturated zone, (if possible); no impact on the groundwater level will then be expected. ▪ Site clearance should be kept to a minimum area and short duration. ▪ If trenches are going to be excavated below the water level, dewatering of the aquifer to lower the water table locally should be considered to ensure that the construction takes place above the groundwater level. Since the groundwater is not expected to be polluted at this stage, the utilisation of the water for activities such as dust suppression or irrigation will not cause negative environmental impacts. ▪ Install monitoring boreholes as recommended in Section 8.1.7.	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
Operational Phase	Subsidence as a result of high extraction	Groundwater	Groundwater quality deterioration	Moderate (negative) -	▪ In order to prevent subsidence during the bord-and-pillar mining in the operational phase, it is required that a safety factor that provides sufficient pillar stability is applied. ▪ The mine should be monitored on an annually basis for subsidence and areas of subsidence should be rehabilitated by backfilling with waste rock and topsoil thereafter revegetating of the disturbed area. ▪ High extraction areas should be delineated as a high risk (depending on the local geology and dolerite sill) for subsidence and for groundwater impact. ▪ If possible, concurrent backfilling of the mine voids with fly ash should be conducted to minimise the risk of subsidence and neutralise any acid that might be generated. This should be done to assist with reducing the risk of subsidence and is a means of waste management. Should this occur a separate environmental authorisation will need to be applied for. ▪ Groundwater level and quality monitoring should be conducted on quarterly basis during operation, with special attention given to the subsidence areas. The monitoring frequency can be reduced post-closure depending on the trend of the monitoring results.	Minor (negative) -
Operational Phase	Removing water from the mine for the safety of people and operations and possible creation of cone of dewatering	Groundwater	Possibility of lowering of the water table and affecting the yield of boreholes	Minor (negative) -	▪ To minimise the impact associated with the lowering of the water table, dewatering should be conducted by abstracting groundwater ingress into mine voids during operation; ▪ Contaminated mine water should be stored in compartment and/or pollution control dams and reused for machine cooling or dust suppression underground; ▪ Groundwater monitoring should be conducted quarterly to assess the time series water level, water quality impacts and trends. Thereafter sampling frequency could be adjusted following the trend analysis; and ▪ Numerical model should be updated every two years in the first four years and thereafter every five years based on groundwater monitoring results. ▪ Impact to receptors such as private boreholes and surface water bodies (if proven through monitoring) should be compensated.	Negligible (negative) -
Operational Phase	Groundwater contamination as a result of underground mining	Groundwater	Groundwater contamination	Minor (negative) -	▪ If subsidence occurs during operation, it should be rehabilitated as soon as possible to minimise water and oxygen inflow from the atmosphere. ▪ Nitrate-based explosives can contaminate water thus no underground water should be discharged unless it meets standards to minimise ground and surface water contamination. ▪ Quarterly groundwater monitoring should be conducted to assess the time series water level, water quality impacts and trends.; and ▪ Numerical model should be updated every two years in the first four years and thereafter every five years based on groundwater monitoring results.	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Mitigation Measures	Rating
Decommissioning Phase	Subsidence as a result of high extraction	Groundwater	Lowering of the water table	Moderate (negative) -	▪ In order to prevent subsidence during the bord-and-pillar mining in the operational phase, it is required that a safety factor that provides sufficient pillar stability is applied. ▪ The mine should be monitored on an annually basis for subsidence and areas of subsidence should be rehabilitated by backfilling with waste rock and topsoil thereafter revegetating of the disturbed area. ▪ If possible, concurrent backfilling of the mine voids with fly ash should be conducted to minimise the risk of subsidence and neutralise any acid that might be generated. This should be done to assist with reducing the risk of subsidence and is a means of waste management. Should this occur a separate environmental authorisation will need to be applied for. ▪ Groundwater level and quality monitoring should be conducted on quarterly basis during operation, with special attention given to the subsidence areas. The monitoring frequency can be reduced post-closure depending on the trend of the monitoring results.	Minor (negative) -
Decommissioning Phase	Groundwater contamination as a result of underground mining	Groundwater	Groundwater contamination	Minor (negative) -	▪ Impact to receptors such as private boreholes and surface water bodies (if proven through monitoring) should be compensated. ▪ Update numerical model every 5 years post closure to calibrate with monitoring results.	Negligible (negative) -
Decommissioning Phase	Decanting of the closed mine *No decant is expected at the shafts however subsidence, sinkholes and unsealed deep boreholes are potential decant locations and monitoring is required*	Groundwater	Mine decanting and contamination of surface water bodies	Moderate (negative) -	▪ Decant should be collect and stored at a PCD as a short term solution; ▪ Long term management solutions for decant should be investigated; and ▪ Monitoring groundwater levels and decant (rate and quality) quarterly.	Negligible (negative) -

The supporting impact assessment conducted by the EAP must be attached as an appendix, marked Appendix D

15 Item 3(j): Summary of Specialist Reports

Table 15-1 provides a summary of the specialist studies that were undertaken for the consolidation project. It must be noted that the specialist studies undertaken for the 2008 TCTS EIA/EMPr and the 2014 Trichardtsfontein EIA/EMPr have not been included in this table.

Table 15-1: Specialist Studies that have been undertaken for the Project

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
Air Quality Specialist Study	An AQIA was undertaken to determine the impacts associated with the proposed construction and operation of the ventilation shaft and operation of the mine and associated facilities. Pollutants quantified and evaluated in the assessment included dust fallout, fine particulate matter (PM_{10} and $PM_{2.5}$) as well as gaseous pollutants (SO_2, NO_2 and CO). The operation of the ventilation shaft will not result in adverse impacts. If the ventilation shaft and associated facilities are operated with mitigation measures in place i.e. enclosure of crusher, fitting of dust extraction system and water spray, use of selective catalytic technology and gas scrubbers at the vent upcast, predicted particulate and gaseous emissions will have negligible impacts on air ambient quality of the area. The following recommendations were made: ▪ Site clearing and decommissioning of infrastructure must be done in phases and use of suppressants and binders on exposed areas to reduce dust generation; ▪ The drop heights when loading onto trucks and at tipping points should be minimised during construction and decommissioning phase; ▪ Dust suppression must take place on exposed surfaces; ▪ Use of water sprays at the crushing facility and bunker; and ▪ Enclosure of crushers.	X - All recommendations have been considered and included in the Amendment Report / BAR.	Mitigation and management measures included in this report were recommended by the Air Quality Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.
Noise Specialist Study	The aim of the environmental noise impact assessment is to ultimately assess whether the proposed ventilation shafts will impact on the surrounding noise sensitive receptors by causing disturbing noise as defined by the national noise control regulations. Based on the daytime results from the noise measurements it is noted that the LAeql levels measured above the SANS guideline for the maximum allowable outdoor daytime rating level for ambient noise in rural districts (45 dBA). The noise levels ranged from 50 dBA to 57 dBA. The night time results also measured above the SANS guideline for the maximum allowable outdoor night time rating level for ambient noise in rural districts (35 dBA). The noise levels ranged from 42 dBA to 53 dBA. As per the results of the noise dispersion models, it is concluded that the noise from the proposed ventilation fans will have a negligible impact on the surrounding rural receptors. No noise monitoring due to the insignificant impact is proposed however the following has been recommended: ▪ Construction activities are restricted to daylight hours (06:00 – 18:00); ▪ Switching off equipment when not in use; and ▪ The ventilation fan diffuser outlets should be installed horizontally and directed north.	X - All recommendations have been considered and included in the Amendment Report / BAR.	Mitigation and management measures included in this report were recommended by the Noise Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
Social Specialist Study	Throughout the SIA process, the specialist identified a number of issues that warrant consideration by Sasol Mining. Firstly the risks identified in require particular attention and close monitoring and management. The extent of this monitoring will need to be re-assessed to ensure that the inclusion of social risks associated with the consolidation of the three Mining Right areas. Secondly it is recommended that Sasol Mining establish strong linkages with other institutions (e.g. government, NGOs, and other existing or planned mines) involved in local and regional economic development and social upliftment so as to maximise the benefits of its contribution to the welfare of local communities. Opportunities for linkages and synergies include: ▪ LED projects listed in future IDPs of GMLM or GSDM; ▪ LED initiatives by existing and planned mines in the area; and ▪ LED related activities of civil society and non-governmental organisations. Other recommendations included within the SIA are listed below: ▪ Where feasible, promote the creation of employment opportunities for women and youth; ▪ Sasol Mining procurement and/or contracts department (or similar) to establish a monitoring system to ensure that the subcontractors honour the specified local employment policy. This can be stipulated in contractor agreements; ▪ If required, the local resident status of applicants should be verified in consultation with community representatives and local government; ▪ Ensure that existing employees have access to pertinent skills training and are able to improve their professional proficiencies throughout their employment with Sasol. This will assist with self-improvement and provide an opportunity for employees to achieve professional's goals; and ▪ In addition, it is recommended that local employment opportunities that may arise be maximised as far as possible, by intensifying efforts in the SLP, which are aimed at developing scarce skills.	X - All recommendations have been considered and included in the Amendment Report / BAR.	Mitigation and management measures included in this report were recommended by the Social Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.
Heritage Specialist Study	Portions of the site-specific study area are underlain by the Vryheid Formation with a high palaeontological sensitivity and very high CS. The fossiliferous material commonly occurs in the shale lenses between coal seams at sub-surface levels. Digby Wells acknowledges the significance of the Vryheid Formation but is of the opinion that a detailed palaeontological assessment at this stage will not add value. Based on the nature of the consolidation project and the distribution of heritage resources, no direct impacts from the construction and operation of the ventilations shafts are envisaged. Furthermore, the proposed mining methodologies will all occur at sub-surface levels, with no mining occurring on the surface. These methodologies avoid potential direct impacts to identified heritage resources occurring within or in proximity to the underground operations. The inclusion of high-extraction mining however, does increase the risk of subsidence during operation and decommissioning phases. To mitigate against the identified potential risk of subsidence to known heritage resources, Digby Wells recommends the development and implementation of a Conservation Management Plan (CMP) as a condition of authorisation. A Fossil Chance Find Procedure must be complied with as included in this EMPr and detailed in the	X - All recommendations have been considered and included in the Amendment Report / BAR.	Mitigation and management measures included in this report were recommended by the Heritage Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	Heritage Specialist Study (Appendix H)		
Soil, Land Use and Land Capability Specialist Study	During the establishment phase site clearing is necessary for the preparation surface infrastructure development (ventilation shafts) where vegetation will be removed and topsoil. When soil is removed, the physical properties are changed and the soils' chemical properties will deteriorate unless properly managed. Vehicles will drive on the soil surface during the establishment phase, thereby causing compaction of the soils. Bord and pillar method of mining could cause subsidence which would result in impacts to soil. The underground mining activities will cause a significant impact on the land capability of the identified soils causing subsidence and cracks (high extraction). The following recommendations are made to minimise the impact on the soils: ▪ If possible topsoil should be stripped when the soil is dry, as to reduce compaction, adhering to clearly defined guidelines for stripping, with topsoil being saved separately. ▪ The soil stockpile should have a maximum height of 4 m to minimise adverse effects on soil chemical and physical properties. ▪ Stockpiles should be protected by a berm wall to prevent erosion of stockpiled material and deflect surface water runoff. ▪ Runoff must be controlled and managed by use of proper storm water management. ▪ Fuel and oils spills are common, remediate using commercially available emergency clean up kits and focus on awareness of prevention. ▪ Replaced soils require both physical and chemical amelioration as the actions of the soil removal; stockpiling and replacement result in soil compaction and dilution of the soil fertility. The actions that should be taken during the amelioration of soils include: ▪ Soils must be ripped to ensure reduced compaction; ▪ Restore soil fertility; ▪ Incorporate fertilisers in to the planting zone; and ▪ Apply maintenance dressing of fertilisers on an annual basis until the soil fertility cycle has been restored.	X - All recommendations have been considered and included in the Amendment Report / BAR.	Mitigation and management measures included in this report were recommended by the Soil, Land Use and Land Capability Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.
Fauna and Flora Specialist Study	The consolidation project site is located within the threatened ecosystems: Eastern Highveld Grassland and Soweto Highveld Grassland. Further to this, the site falls within areas that have been demarcated as irreplaceable according to the Mpumalanga Sector Plan. The results of the field investigations confirm that the irreplaceable areas are intact natural systems and should be conserved. The surface infrastructure does not coincide within any of the irreplaceable areas according to the Mpumalanga Sector Plan. The overall impact of the proposed development on flora and fauna is expected to be moderate. The following recommendations have been made for this study: ▪ The site should be screened prior to construction, preferably between the months of November to March, for any plant SSC; ▪ The Engineers Rock Report will be required to show where the risk of subsidence is high, if at all, as this will result in loss of sensitive landscapes; ▪ If any plant SSC are recorded, these should be translocated with the involvement of a qualified botanist. The donor habitat should resemble the receiving habitat and the species/populations should be monitored monthly after translocation for up to one year; ▪ If any important fauna species (SSC) are identified (as listed in the expected species lists)	X - All recommendations have been considered and included in the Amendment Report / BAR.	Mitigation and management measures included in this report were recommended by the Fauna and Flora Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	that have not been included in the site-specific species lists, this should be reported to the Environmental Control Officer on site and the provincial authority (MPTA) for their reference. Further to this, measures should be undertaken to ensure that negative impacts to the species in question are not imposed due to the development; and ▪ The mine has an opportunity to reduce their overall liability in terms of spread of alien invasive plant species. It is recommended that all alien invasive plant species are controlled throughout the site as far as possible.		
Wetland Specialist Study	The Project area encompasses large wetland areas totalling 6080.1 ha (26% of the Project area). Approximately 3406.2 ha of wetlands are proposed to be undermined (100 ha definite risk, 608 ha high risk, 561 ha low risk (excluding buffers) with the remainder not being at risk of subsidence). Although the mine surface infrastructure will not result in any direct destruction of wetlands, the indirect loss of wetlands due to altered hydrology from undermining activities cannot be quantified in detail. Furthermore, the impacts of subsidence will be very high where the shallow mining (30 – 100 m) is going to be taking place and will result in a complete loss of the undermined wetlands. The impact of decant will also be high unless mitigated. The Project, therefore, has the potential to result in significant negative impacts on the natural wetlands and to alter the functioning of these systems and compromise their ecosystem services provided. The following is recommended: ▪ Wetlands in South Africa are protected under the NWA and a Water Use License is required for any development within a wetland or within 500 m from a wetland; ▪ A buffer around wetlands of 100 m must be adhered to avoid impacts on wetlands. Furthermore decant points must be kept outside of the 100 m buffer; and ▪ Monitoring as described in the Monitoring Plan must be implemented throughout the Project life. Fixed point transects should be set up in at least 5 locations to monitor the wetlands and any impacts on these systems. Piezometers should be installed to determine wetland hydrology.	X - All recommendations have been considered and included in the Amendment Report / BAR.	Mitigation and management measures included in this report were recommended by the Wetland Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.
Surface Water Specialist Study	Water quality samples were collected within the consolidation project area and the surrounding streams to determine a baseline water quality status prior to commencement of the consolidation project. The results indicated some impacts on the streams within the area, parameters such Total Dissolved Solids, Chloride, Phosphate and Ammonia were exceeding the target water quality range for the irrigational use as set in the South African Water Quality Guidelines (DWAF, 1996) and the Olifants River Water Quality management Objectives. The existing and proposed mining of the Vaalkop area, together with the associated activities have the potential to impact on the surface water resources within and around the consolidation project area. The following recommendations have been made: ▪ Limiting the vegetation clearing to the development footprint; ▪ Implementation of dust suppression measures during construction and operational activities; ▪ All bulk fuel storage areas should be appropriately bunded and spill kits should be in place to contain and immediately clean up any potential leakages of fuels and oils; ▪ To ensure that all the dirty water emanating from the dirty water areas is contained within the mine site for re-use to prevent unnecessary discharge into the environment; ▪ Where subsidence will occur during operation, measures to rehabilitate the surface area	X - All recommendations have been considered and included in the Amendment Report / BAR.	Mitigation and management measures included in this report were recommended by the Surface Water Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	should be implemented as soon as possible to avoid impoundment of surface water; ▪ Water quality monitoring should continue on the existing and newly proposed monitoring points to ensure detection of impacts ▪ Use of accredited contractors for removal or demolition of infrastructures; this will reduce the risk of waste generation and accidental spillages; ▪ Surface inspection on the fully rehabilitated areas must be undertaken to ensure a surface profile that allows good drainage. This will ensure improvement or increased catchment yield on to the surrounding streams; and ▪ Should decant occur, decant water should be captured before it flows into the streams. The water should then be treated prior to discharge into the streams.		
Aquatic Ecology Specialist Study	The aquatic ecological assessment which was undertaken identified several impacts that were considered to be significant. The following recommendations have been made to mitigate against these identified impacts: ▪ Buffer zone establishment: 100 m from delineated wetland and river areas as stipulated in the Wetlands report by Digby Wells (2017); ▪ Effective storm water management, so as to limit (or prevent) potential contamination from 'dirty' water runoff originating from the ventilation shafts; ▪ Exposed topsoils and soil stockpiles must be revegetated to reduce erosion and subsequent sedimentation; ▪ Correct storage and management of hazardous products must be implemented; ▪ Although a basic geotechnical study has been completed for TCTS, it is recommended that a comprehensive geotechnical study must be conducted for the entire project area to assess the risk of subsidence in areas associated with river systems. Mitigation actions to increase stability should then be used in high risk areas. These mitigation actions include limiting mining underneath the river systems and the use of thicker support pillars. However, detailed mitigation actions should be defined in the comprehensive geotechnical study. Subsidence is expected to result at all shallow mining areas (100 m or less) as illustrated in Plan 24 in Appendix B. Therefore mitigation measures for these areas are not feasible due to the shallow depth of mining. This report should not be considered in isolation and other specialist reports, such as surface water, groundwater and wetland studies should be reviewed to ensure a holistic understanding of the study area.	X - All recommendations have been considered and included in the Amendment Report / BAR.	Mitigation and management measures included in this report were recommended by the Aquatic Ecology Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.
Rehabilitation Specialist Study	Closure and rehabilitation is a continuous series of activities that begin with planning prior to the project's design and construction, and end with achievement of long-term site stability and the establishment of a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it will also reduce the financial burden of closure and rehabilitation. Rehabilitation and closure objectives have been tailored to the consolidation project at hand with the objective of assisting Sasol Mining in carrying out successful rehabilitation. It is recommended that the following actions be taken prior to the update of the Rehabilitation, Decommissioning and Mine Closure Plan: ▪ Care must be taken when stripping and stockpiling soil due to the sensitive nature of the	X - All recommendations have been considered and included in the Amendment Report / BAR.	Mitigation and management measures included in this report were recommended by the Rehabilitation Specialist, as well as the monitoring programmes

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	soils on site; ▪ Soil stockpile locations need to be determined and sited away from sensitive landscapes, such as pans/wetlands; ▪ Implement the measures as outlined in the specialist studies to minimise the risk to surface/groundwater contamination from the operations during rehabilitation and closure; ▪ Further trials should be conducted during the operational phase to determine other rehabilitation options that could be considered for the closure and rehabilitation of the disturbed site; ▪ There should be a constant interaction and communication with local stakeholders, so that their requirements can be taken into consideration in the rehabilitation process; ▪ Annual audits should be undertaken by a soil scientist to determine soil fertility; ▪ Regular mining monitoring to be undertaken on an annual basis for five years of the groundwater should take place in order to determine if there is a potential for mine affected water to occur; ▪ Annual update of the Environmental Risk Assessment (ERA) as part of Financial Provision update as required by GNR1147; ▪ Invasive alien plants should be removed on an ongoing basis; and ▪ Monitoring and maintenance of the rehabilitated areas should take place on an annual basis for at least five years after closure.		
Closure Specialist Study	The following has been recommended: ▪ This financial provision needs to be updated as soon as more detailed and final infrastructure information is available; and ▪ The financial provision figures need to be updated on an annual basis as per the requirement of the NEMA. This will ensure that costs become more accurate over time and will reflect current market conditions.	X - All recommendations have been considered and included in the Amendment Report / BAR.	Mitigation and management measures included in this report were recommended by the Closure Specialist, as well as the monitoring programmes
Groundwater Specialist Study	Further hydrogeological assessments are recommended to gain site specific rock permeability values through borehole drilling and aquifer testing the deep fractured aquifer and the local fractures. This will improve the conceptual model and numerical model accuracy. Recommended mitigation activities proposed for the constructional, operational and closure phase include: ▪ Groundwater monitoring should be conducted to assess the time series water level, water quality impacts and to observe trends as to aid decision making; ▪ Annual monitoring for subsidence and sinkhole formation is highly recommended, followed by rehabilitation if required and decant monitoring at unsealed deep boreholes (greater than 30 mbgl in depth); ▪ During operation the numerical model should be updated every two years in the first four years and thereafter every five years based on groundwater monitoring results and updated every 5 years to calibrate with monitoring results post closure; ▪ In order to prevent subsidence during the bord-and-pillar mining in the operational phase, it is required that a safety factor that provides sufficient pillar stability is applied. ▪ The mine should be monitored on an annually basis for subsidence and areas of	X - All recommendations have been considered and included in the Amendment Report / BAR.	Mitigation and management measures included in this report were recommended by the Groundwater Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	subsidence should be rehabilitated by backfilling with waste rock and topsoil thereafter revegetating of the disturbed area. ▪ High extraction areas should be delineated as a high risk (depending on the local geology and dolerite sill) for subsidence and for groundwater impact. ▪ If possible, concurrent backfilling of the mine voids with fly ash should be conducted to minimise the risk of subsidence and neutralise any acid that might be generated. This should be done to assist with reducing the risk of subsidence and is a means of waste management. Should this occur a separate environmental authorisation will need to be applied for.		

Attach copies of specialist reports as appendices

16 Item 3(k): Environmental Impact Statement

16.1 Item 3(k)(i): Summary of the Key Findings of the Environmental Impact Assessment

The consolidation project has been assessed in accordance with the various environmental aspects and associated impacts assessed in Section 11. The impacts have been identified from the EIA/EMPr compiled in 2008 for the TCTS and the impacts identified from the EIA/EMPr compiled in 2014 for the Trichardtsfontein mine. Additional impacts have been identified for the construction of the ventilation shafts, the change in mining method from bord and pillar to bord and pillar with high extraction mining and the identification of impact associated with the underground mining of the Vaalkop mining area. All impacts have been captured in Appendix D. A summary of the impacts associated with the consolidation project has been discussed below:

16.1.1 Construction Phase

The only construction activities proposed to be undertaken as part of the consolidation project is associated with the construction of the ventilation shafts on TCTS (East ventilation shaft - up and downcast) and Trichardtsfontein (South ventilation shaft - up and downcast). Therefore the impacts for all aspects were considered negligible. It was found that the shafts were proposed to be located near wetlands and aquatic ecosystems; however the ventilation shafts were outside the 100 metre buffer, and therefore mitigation measures have been proposed to prevent these impacts occurring. It must be noted that a general authorisation for a WUL must be obtained due to the ventilation shafts being located within 500 m of a wetland.

16.1.2 Operational Phase

The air quality assessment concluded that there are instances were dust fallout rate, daily PM_{10} and $PM_{2.5}$, and hourly NO_2 and 1-hour and 24-hour SO_2 ground level concentrations (GLC) exceeded the recommended South African standards South African standards protective of the environment and human health . Despite these exceedances, the zones of exceedance are mainly within the consolidation project boundary (at a radius of 20 m to 40 m) from the ventilation shaft and TCTS. The GLC predicted at the surrounding receptors, which include surrounding landowners and various individuals living within the project area are below the South African standard. Therefore the impact was considered minor.

Based on the distribution of known heritage resources, none occur within or in proximity to the development of the proposed ventilation shafts on TCTS (East ventilation shaft) and Trichardtsfontein (South ventilation shaft). Therefore no direct impacts to heritage resources from the construction and operation of the ventilations shafts are envisaged. It should be noted that although graves were relocated during the construction of the TCTS operations, this has been completed and no further impact from the operation of the TCTS is anticipated on heritage resources. Therefore, no direct impacts to heritage resources from the consolidation project are envisaged. The proposed mining method will occur at sub-surface levels, with no mining occurring on the surface. This mining method will avoid potential direct impacts to identified heritage resources occurring within or in proximity to the underground operations. The inclusion of high-extraction mining however, does increase the risk of subsidence during operation and decommissioning phases. The risks associated with subsidence and its impact to heritage resources is discussed in further detail in Section 10.2.1.

It was found that the site falls within areas that have been demarcated as irreplaceable according to the Mpumalanga Sector Plan. The results of the field investigations confirm that the irreplaceable areas are intact natural systems and should be conserved. However, the ventilation shafts proposed to be constructed does not coincide within any of the irreplaceable areas according to the Mpumalanga Sector Plan. The overall impact of the proposed development on flora and fauna is expected to be minor. However during the operational phase the occurrence of substance poses a major risk to fauna and flora. The underground mining will occur from a depth of 30 m. Sensitive habitat such as wetlands will be affected due to subsidence in areas where subsidence is rated as definite, this will have an impact on both plants and animals that depend on these sensitive ecosystems.

No significant noise impacts were identified during construction, operational and decommissioning phases. The noise impact assessment indicated that the LAeqI levels measured above the SANS guideline for the maximum allowable outdoor daytime rating level for ambient noise in rural districts (45 dBA). The noise levels ranged from 50 dBA to 57 dBA. The night time results also measured above the SANS guideline for the maximum allowable outdoor night time rating level for ambient noise in rural districts (35 dBA). The noise levels ranged from 42 dBA to 53 dBA. As per the results of the noise dispersion models, it is concluded that the noise from the proposed ventilation fans will have a negligible impact on the surrounding rural receptors. The noise study completed in 2008 indicated that the noise impacts were anticipated to be relatively high with the commencement of the operation of the TCTS mine. This was considered to be due to the cumulative impacts of the existing noise climate, the operation of the Syferfontein complex specifically the conveyor belt as well as the conveyor belt which transports coal from TCTS to TEP and the increase in noise from the TCTS mine. However when considered in isolation, the noise associated with the operation of the TCTS is considered to be a minor impact.

The social assessment concluded that both negative and positive impacts were associated with the consolidation project. The consolidation of the three mining right areas, as proposed by Sasol Mining, will utilise the existing workforce to mine the Trichardtsfontein and Vaalkop areas, once mining at TCTS is complete. This phased approach to the consolidation project (i.e. mining Trichardtsfontein and then Vaalkop) will provide continuous employment opportunities for the current workforce. The proposed life of mine at the Trichardtsfontein operation is estimated at 17 years, whilst the mining of the Vaalkop area will only begin in 2029. This extended operational period can have a major, long term, positive impact for employees and their dependents. The consolidation project will also contribute to growth and diversification of the economy during the operational phase through, royalty and tax payments, economic diversification and procurement activities. It is expected that the benefits of the consolidation project will extend beyond members of the mine's workforce to suppliers through the procurement of products and services. The consolidation of the various SLPs associated with each Mining Right has been undertaken and was submitted to the DMR on 22 June 2016. This has opened up opportunity for a more widely spread distribution of consolidation project benefits, through LED and CSI initiatives.

The operation of the mine will result in the generation of dirty water runoff laden with carbonaceous material from the contaminated surfaces (emergency coal stockpile). This could have a significant impact to surface water, wetlands and aquatic ecology which may result in contaminate and silt up the natural water resources or streams. This impact will therefore deteriorate the water quality and hence impact the downstream water users and the aquatic life.

The most significant impact associated with the consolidation project is the impact on soils, wetlands, groundwater, surface water and aquatic ecology as a result from the use of high extraction which can result in subsidence; in areas where the depth of mining is shallow and the roof support is weak. High extraction will result in subsidence the amount of subsidence expected is equivalent to the depth of the coal seam (2 m to 4 m). However, with increase in depth in mining, the effect of subsidence becomes reduced. The high extraction mining method will have a negative impact on soils, wetlands and aquatic ecology due to the potential for subsidence which may significantly restrict post-mining land capability and agricultural productivity. Additionally it can result in the loss of wetland and aquatic ecology habitats as a result of the change in groundwater flow due to subsidence. Subsidence of land within the river catchment and subsidence of land underneath river channels can result in poor ecosystem functioning. Where high extraction occurs between 30 – 100 m below the surface this may result in complete loss of functionality of the various aspects discussed above.

Subsidence as a result of the high extraction (stooping) can also results into ponding of surface runoff which reduces the amount of runoff reporting to the nearby streams. A decrease in the catchment yield may have an impact on the downstream water users which include farmers as users of surface water bodies for water supply (irrigation, livestock and the rivers feed into dams that are used for water supply) as they may not have sufficient water for their needs, while also decreasing the flow required for the ecological reserve. Downstream uses may include farmers which include livestock farming and irrigation farming. Subsidence underneath the streams is not expected as it has been stated that high extraction mining (stooping) will not take place within the 100 m of the watercourses and wetlands and under infrastructure areas. Therefore, the total area to be stooped will amount to approximately 30 km^2. The percentage loss in MAR for this quaternary catchment due to stooping will amount to approximately 8% of the total MAR.

The groundwater environment may be subjected to the following impacts in areas of subsidence:

- Increased groundwater recharge, estimated to reach 9% of the MAP at the shallow weathered aquifer and 5% at deeper fractured aquifers (Vermeulen and Usher, 2006);
- Groundwater quality and quantity at the shallow weathered aquifer may be affected
- Increased chances of the occurrence of decant and increased decant rates; and
- Expansion of the contamination plume into the weathered aquifer. This may occur because as the overlying stratigraphy becomes more permeable, migration of water through these rocks as well as the exposure to air can result in the generation of acid water if these rocks contain pyrite.

Dolerite sill covers a considerable portion of the mine area. The probability of subsidence is expected to be low in areas where the high extraction is to take place underneath these sills or thick sandstone layers. Model results show that the cone of depression is mainly at the deep fractured aquifer.

In general the impacts associated with the use of high extraction mining between 30 – 100 metres below ground level have been found to have a significant impact on the environment and no mitigation measures can be proposed to avoid this impact. It is therefore highly recommended that areas identified to have high to definite risk of subsidence are not mined as indicated in Plan 24 in Appendix B.

16.1.3 Decommissioning Phase

At a decommissioning phase the impacts were associated with the removal of infrastructure utilised by the mine as well as the potential for the release of decant from the underground works and its impact on the water resources including wetland and aquatic environments. The impacts associated with the decommissioning of infrastructure included the release of dust from demolition which would have an impact on air quality, the noise associated with the decommissioning activities, as well as the impact to soil as a result of the removal of infrastructure and the exposure of the soil which could lead to erosion and compaction.

The eventual termination of the Mine's operating life would inevitably result in several socio-economic consequences. Most socio-economic impacts related to decommissioning are related to dependencies created by the consolidation project throughout its operations.

Once the mining and mining operations cease, groundwater will start to recover towards reaching its pre-mining levels, due to the extensive area (126 km) full hydraulic head recovery varies in different parts of the impacted area. Contaminants may arise due to dissolution of heavy metals and the oxidation of sulphides, resulting in AMD or an excess of particular parameters when compared against various DWS water quality standards

Following full recovery the potential contaminants will start to migrate away from the mine site. The expected contamination plume 100 years post closure is shown in Plan 26 due to the low hydraulic conductivity in the deeper aquifers the contamination plume is expected to be retained within the project area at the deep fractured aquifer. However it is anticipated that groundwater would be impacted due to decant being realised at some point as the mine voids fill up naturally with water once dewatering stops. Given the altered underground conditions, the water quality may be compromised which will impact wetlands, aquatic habitats and surface water resources (rivers and streams).

Model simulations show that decant is unlikely to occur even 100 years after closure at the shafts. Subsidence, sinkhole formation and unsealed deep boreholes have not been considered in the decant simulation. Should subsidence and sinkholes occur/form at elevations lower than the hydraulic head and or artificially extended geological structures that act as groundwater flow pathways, decanting is likely to occur at those areas. It is impossible to inform at this moment if and when such structures will be formed. Additionally, exploration boreholes or abstraction boreholes (extending to the depth of the deep fractured aquifer where mining will be taking place) could also be decant zones, taking into consideration the extent of the mine and distribution of the boreholes, identifying the point of expected decant is not possible. Annual monitoring should be conducted for subsidence and sinkhole formation, followed by rehabilitation, as well as decant monitoring at unsealed deep boreholes (greater than 30 mbgl in depth). Investigations regarding subsidence and sinkhole formation probability, extent and location are limited. However are likely to occur as a result of high extraction mining, location and extent will depend on the depth of mining and character of the geological formations; the risk decreases with increasing depth of mining and the impacts on more ductile geological formations are less significant compared to brittle geological formations. In the event that decant is detected, it impacts are assessed below.

16.2 Item 3(k)(ii): Final Site Map

The infrastructure layout plan for the consolidation project is provided in Plan 3 in Appendix B. A more detailed depiction of the TCTS infrastructure plan is provided in Plan 3 A in Appendix B.

16.3 Item 3(k)(iii): Summary of the positive and negative implications and risks of the proposed activity and identified alternatives

Table 16-1 identified all negative impacts associated with the consolidation project during the construction, operation and decommissioning phase while Table 16-2 identified all positive impacts associated with the consolidation project during the construction, operation and decommissioning phase.

Table 16-1: Summary of all negative impact for the Project

Phase	Activity	Aspect	Impact	Rating	Rating
Construction Phase	Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Air Quality	Reduction in ambient air quality due to dust generation and soiling of surfaces	Negligible (negative) -	Negligible (negative) -
Operational Phase	Mining Process: Tipping of ore at the Bunker and Stockpiling	Air Quality	Reduction in air quality as a result of the crushing activities as well as the tipping of the coal into the bunker.	Negligible (negative) -	Negligible (negative) -
Operational Phase	Operation of the Ventilation Shaft	Air Quality	Release of TSD, PM_{10}, $PM_{2.5}$, NO^2, SO^2 and CO from the ventilation shafts will result in a deterioration of air quality	Negligible (negative) -	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Rating
Decommissioning Phase	Sealing of shaft and rehabilitation	Air Quality	Sealing of Vent Shaft and rehabilitation results in dust emission	Negligible (negative) -	Negligible (negative) -
Construction Phase	Site clearing, including the removal of topsoil and vegetation; Construction of ventilation shafts	Noise	Noise will emanate from the machinery and vehicles operating during the construction activities	Negligible (negative) -	Negligible (negative) -
Operational Phase	Operation of ventilation shafts	Noise	Noise will emanate from the operation of the ventilation shafts	Negligible (negative) -	Negligible (negative) -
Operational Phase	Operation of the TCTS mine with associated infrastructure	Noise	Noise will emanate from the operation of the TCTS mine specifically the crushing facility as well as conveyor belt	Minor (negative) -	Negligible (negative) -
Decommissioning Phase	Removal of infrastructure and surface rehabilitation	Noise	Noise will emanate from the machinery and vehicles operating during the decommissioning activities	Negligible (negative) -	Negligible (negative) -
Operational Phase	Operation of the Mine	Social	Conflict / competition between newcomers and incumbent population	Minor (negative) -	Negligible (negative) -
Operational Phase	Operation of the Mine	Social	Potential Financial implication for town developers	Minor (negative) -	Minor (negative) -

Phase	Activity	Aspect	Impact	Rating	Rating
Operational Phase	Operation of the Mine	Social	Potential subsidence related impacts	Negligible (negative) -	Negligible (negative) -
Operational Phase	Theft during the operation of the mine	Social	Theft of cattle, farming equipment and other valuables within the consolidation project site associated with increased activity from the mine	Moderate (negative) -	Negligible (negative) -
Operational Phase	Operation of the Mine	Social	Operation-related health and safety impacts	Minor (negative) -	Negligible (negative) -
Decommissioning Phase	Decommissioning of the Mine	Social	Dependency on Mine for sustaining local economy	Moderate (negative) -	Minor (negative) -
Construction Phase	Site clearing and topsoil removal for the construction of the ventilation shafts	Soil, Land Use and Land Capability	Loss of topsoil as a resource: During clearing of vegetation and removal of soil for establishment of ventilation shafts (3.5 ha), the soil chemical and physical properties are impacted on. The movement of vehicles on the soil surface causes compaction which reduces the vegetation's ability to grow and as a result erosion could occur.	Minor (negative) -	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Rating
Operational Phase	Maintenance of roads and topsoil stockpiles	Soil, Land Use and Land Capability	Topsoil losses can occur during the operational phase as a result of rainwater runoff and wind erosion from roads and soil stockpiles where steep slopes are present. Compaction of soils during operational phase will occur.	Moderate (negative) -	Negligible (negative) -
Operational Phase	Potential impacts of operational phase on soils, land capability and land use (30 – 100 m below ground level)	Soil, Land Use and Land Capability	Collapsed underground mine roof could potentially cause significant surface subsidence. This may restrict post mining land capability and agricultural productivity. Surface cracking and subsidence will occur due to large areas that could be affected by high extraction.	Major (negative) -	Moderate (negative) -
Operational Phase	Potential impacts of operational phase on soils, land capability and land use (>100 m below ground level)	Soil, Land Use and Land Capability	Collapsed underground mine roof could potentially cause significant surface subsidence. This may restrict post mining land capability and agricultural productivity. Surface cracking and subsidence will occur due to large areas that could be affected by the high extraction.	Minor (negative)	Negligible (negative)

Phase	Activity	Aspect	Impact	Rating	Rating
Decommissioning Phase	Rehabilitation of infrastructure areas, roads and subsided areas	Soil, Land Use and Land Capability	Rehabilitation of roads, associated infrastructure and subsided areas could cause compaction and erosion if rehabilitation is not done correctly. This could be as a result of poor vegetation establishment which would result in exposed surfaces and increase the risk of erosion.	Minor (negative) -	Negligible (negative) -
Construction Phase	Site Clearing for the construction of the Ventilation Shafts	Fauna & Flora	Site clearing resulting in alien plant invasion	Minor (negative) -	Negligible (negative) -
Operational Phase	High extraction underground mining	Fauna & Flora	No direct loss of fauna, flora or sensitive ecosystems will occur, except if subsidence occurs. However, undermining of sensitive areas/landscapes leading to changes that will negatively affect the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mine varies from 30 to 215 m.	Major (negative) -	Moderate (negative) -
Decommissioning Phase	Dismantling and removal of infrastructure	Fauna & Flora	Alien plant invasion may take place	Minor (negative) -	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Rating
Operational Phase	Potential Impacts on Wetlands: Underground Mining (30-100 m below ground level)	Wetland	Undermining of wetlands leading to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mining is between 30 – 100 m below ground level.	Major (negative) -	Major (negative) -
Operational Phase	Potential Impacts on Wetlands: Underground Mining (>100 m below ground level)	Wetland	Undermining of wetlands leading to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mining is >100 m below ground level.	Moderate (negative) -	Minor (negative) -
Decommissioning Phase	Mine closure and rehabilitation	Wetland	Post-mining decant of groundwater will have negative impacts on the wetlands as this water is likely to be of a poor water quality.	Major (negative) -	Minor (negative) -
Construction Phase	Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Surface Water	Siltation of surface water resources leading to deteriorated water quality	Minor (negative) -	Minor (negative) -

Phase	Activity	Aspect	Impact	Rating	Rating
Construction Phase	Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Surface Water	Alteration of surface water drainage patterns and river banks	Minor (negative) -	Negligible (negative) -
Construction Phase	Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Surface Water	Deterioration of water quality due to dirty water reporting into natural water resources	Minor (negative) -	Negligible (negative) -
Operational Phase	Operation of the mine	Surface Water	Water contamination leading to deterioration of water quality	Moderate (negative) -	Minor (negative) -
Operational Phase	High extraction underground mining	Surface Water	Reduction in catchment yield	Minor (negative) -	Minor (negative) -
Decommissioning Phase	Dismantling and removal of infrastructure	Surface Water	Siltation of surface water resources leading to deteriorated water quality	Minor (negative) -	Minor (negative) -
Decommissioning Phase	Mine closure and rehabilitation	Surface Water	Decant of mine water leading to deterioration of water quality in the nearby streams	Moderate (negative) -	Negligible (negative) -
Construction Phase	Site clearance and construction of ventilation shafts within associated wetland habitats and river catchment	Aquatic	Increased runoff and erosion within the rivers nearby to the ventilation shafts	Negligible (negative) -	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Rating
Construction Phase	Waste generation/disposal and the use of hazardous products	Aquatic	Water and habitat quality deterioration	Negligible (negative) -	Negligible (negative) -
Operational Phase	Underground mining high to definite risk subsidence areas	Aquatic	Subsidence of land within the river catchment and subsidence of land underneath river channels resulting in poor ecosystem functioning	Major (negative) -	Major (negative) -
Operational Phase	Underground mining low risk subsidence areas	Aquatic	Subsidence of land within the river catchment and subsidence of land underneath river channels resulting in poor ecosystem functioning	Moderate (negative) -	Minor (negative) -
Operational Phase	Emergency coal stockpiling	Aquatic	Runoff from the emergency coal stockpile into local aquatic systems will result in the degradation of the water and habitat quality of the polluted system	Minor (negative) -	Negligible (negative) -
Operational Phase	Storage/disposal of generated waste and the working with hazardous products	Aquatic	Runoff from operational site containing contaminants will degrade habitat and water quality of polluted aquatic systems	Minor (negative) -	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Rating
Decommissioning Phase	Mine closure and rehabilitation	Aquatic	Decant of severely contaminated water into local aquatic ecosystems	Moderate (negative) -	Minor (negative) -
Decommissioning Phase	Removal of infrastructure and surface rehabilitation.	Aquatic	Increased runoff and erosion	Negligible (negative) -	Negligible (negative) -
Operational Phase	Underground mining	Geology	With high-extraction mining/ stooping the impact on the geology includes both the excavation of the coal seams as well as the impact on the overlying aquifer above the high-extraction mining/ stooped areas with potential resultant surface subsidence.	Moderate (negative) -	Moderate (negative) -
Construction Phase	Site clearing for the development of surface infrastructure through the removal of the top soil and weathered rocks	Groundwater	Lowering of the water table	Negligible (negative) -	Negligible (negative) -
Operational Phase	Subsidence as a result of high extraction	Groundwater	Groundwater quality deterioration	Moderate (negative) -	Minor (negative) -
Operational Phase	Mine dewatering and creation of cone of dewatering	Groundwater	Lowering of the water table	Minor (negative) -	Negligible (negative) -

Phase	Activity	Aspect	Impact	Rating	Rating
Operational Phase	Groundwater contamination as a result of underground mining	Groundwater	Groundwater contamination	Minor (negative) -	Negligible (negative) -
Decommissioning Phase	Subsidence as a result of high extraction	Groundwater	Lowering of the water table	Moderate (negative) -	Minor (negative) -
Decommissioning Phase	Groundwater contamination as a result of underground mining	Groundwater	Groundwater contamination	Minor (negative) -	Negligible (negative) -
Decommissioning Phase	Decanting of the closed mine *No decant is expected at the shafts however subsidence, sinkholes and unsealed deep boreholes are potential decant locations and monitoring is required*	Groundwater	Mine decanting and contamination of surface water bodies	Moderate (negative) -	Negligible (negative) -

Table 16-2: Summary of all positive impact for the Project

Phase	Activity	Aspect	Impact	Rating	Rating
Operational Phase	Sustained employment during operation	Social	Job creation during operation	Minor (positive) +	Moderate (positive) +
Operational Phase	Operation of the Mine	Social	Economic Growth will result in a positive contribution to GDP	Minor (positive) +	Negligible (negative) -
Operational Phase	Operation of the Mine	Social	Community development induced by Local Economic Development (LED) and Corporate Social Investment (CSI)	Minor (positive) +	Moderate (positive) +

17 Item 3(l): Proposed Impact Management Objectives and the Impact Management Outcomes for inclusion in the EMPr

The EMPr seeks to achieve a required end state and describes how activities that have, or could have, an adverse impact on the environment will be mitigated, controlled and monitored.

The EMPr will address the environmental impacts during the construction (ventilation shafts) operational and decommissioning phase of the consolidation project. Due regard must be given to environmental protection during the entire consolidation project; a number of environmental recommendations are made to achieve environmental protection. These recommendations are aimed at ensuring that the contractor maintains adequate control over the consolidation project to:

- Minimise the extent of an impact during the life of mine;
- Ensure appropriate restoration of areas affected by the mine; and
- Prevent long term environmental degradation.

18 Item 3(m): Final Proposed Alternatives

No alternative locations were investigated for the consolidation project as the resource determines the location of the mine. No additional infrastructure will be constructed except for the ventilation shafts as the TCTS mine is currently operational. No additional infrastructure is proposed to be constructed on Trichardtsfontein or Vaalkop. The location of the ventilation shafts has been strategically positioned to ensure the most suitable option and ensure the least environmental impact which has been discussed in detail in Section 8.1. It must be noted that the location of where the infrastructure at TCTS is currently positioned was informed by environmental and technical studies and due to the location of the mineral resource. The alternatives that were previously assessed and considered for the TCTS mine have been included in Section 8.2. It is noted that no alternatives for Trichardtsfontein was investigated during the EIA phase for that project.

19 Item 3(n): Aspects for inclusion as Conditions of Authorisation

It is not foreseen that any additional aspects other that what has been included and discussed in this document, are required.

20 Item 3(o): Description of any Assumptions, Uncertainties and Gaps in Knowledge

This section highlights the assumptions, uncertainties, limitations and knowledge gaps relevant to the various specialist studies undertaken.

20.1 Noise

The following assumptions and limitations are included as part of the noise assessment:

- The construction phase is assumed to be carried out during daytime hours (06:00-22:00), therefore only a daytime scenario was modelled for the construction phase and the subsequent impact of the construction phase refers only to the daytime;
- The resulting noise contours represent worst case L_{Aeq} at any receiver located 360 degrees in the horizontal plane around the noise sources. The noise modelling software is limited to calculating the predominant wind direction (or downwind conditions of propagation) per single receptor only. Calm wind conditions have therefore been included in the model due to the number of surrounding receptors. Thus, the noise dispersion plots do not represent a typical seasonal scenario in the predominant wind direction but rather a yearly average of the area's meteorological conditions in all directions; and
- The modelling follows a conservative worst case scenario approach assuming all activities for each phase are being carried out simultaneously;

20.2 Social

Although all reasonable efforts were made to provide an updated and representative picture of socio-economic baseline profile relevant to the study areas, the social report is still subject to some assumptions and limitations:

- This report is based on available information obtained from the client, the internet, and other specialists. The 2017 social study was conducted within available timeframes and budget. The sources consulted are in no way exhaustive, although deemed sufficient to meet the Terms of Reference (ToR) for the current study objectives. No information has been deliberately excluded from this report, and it is assumed that no party withheld relevant information from the specialists.
- The updated baseline data applicable to the primary and secondary study areas is solely based on a desktop study of all readily available information.
- At the time of the social engagements (2014), several participants admitted that they are reluctant to participate in the study due to the fact that they are currently involved with legal procedures against the applicant for the mining right at the time. It is unknown at what stage these actions have progressed.
- The following assumptions were made:
  - The 2014 Social; Impact Assessment (SIA) was compiled with the assumption that mining would be by the conventional bord-and-pillar method. Based on the proposed consolidation process, the mining methods will include high-extraction mining, thereby increasing the likelihood of surface-related impacts, such as subsidence. It should be noted, however, that appropriate geotechnical design will be required to mitigate against such risks.

- Mining activities will not affect any existing surface land use, and will therefore not result in any economic or physical displacement of those residing on the undermined area; and
- The underground mine and existing and/or planned residential development can and will co-exist; however, the risks associated with subsidence will need to be considered and communicated to the relevant municipal officers.

20.3 Heritage

The following constraints and limitations were experienced during compilation of this heritage specialist study:

- Whilst every attempt to obtain the latest available information was made, the reviewed literature does not represent an exhaustive list of information sources for the consolidation project site;
- The pre-disturbance survey was limited to the Vaalkop Mining Right to assess the current cultural landscape not previously subjected to a specialist heritage study. Previously completed specialist studies were utilised to assess the remaining areas within the mining rights;
- Palaeontological and archaeological resources commonly occur at subsurface levels. These types of resources may not be adequately recorded or documented by assessors without intrusive and destructive methodologies. Therefore, the reviewed literature and previously completed assessments are in themselves limited to surface observations; and
- The HIA was compiled prior to the initiation of the regulated consultation process. No results from formal consultation were considered in the compilation of this HIA. All heritage related comments will be addressed as part of the required Comments and Response Report (CRR) after the public commenting period to further satisfy the requirements Section 38(3) of the NHRA.

20.4 Soil, Land use and Land Capability

The following assumptions have been made:

- The information provided in the soils, land use and land capability report is based on information gathered from site visit undertaken on the February and June 2017;
- The information contained in this report is based on auger points taken and observations on site; and
- Review of all the existing soils information conducted by Earth Science Solutions (2008).

20.5 Fauna and Flora

The following limitations were encountered during the fauna and flora study:

- Whilst every effort is made to cover as much of the site as possible, representative sampling is done and it is possible that some plant and animal species that are present on site were not recorded during the field investigations, due to seasonality; and
- Only a single season survey was completed.

20.6 Wetlands

The following limitations were encountered during the wetland study:

- Only the Vaalkop Project area was delineated by Digby Wells. WCS delineated TCTS and Trichardtsfontein Project areas;
- Portions of the TCTS and Trichardtsfontein Project areas were only delineated by WCS at a desktop level and are indicated as such on the maps. PES and EIS were therefore not conducted for these areas. Ground truthing of these areas was not included completed;
- For the purpose of this report, it is assumed that all wetland boundaries identified by Wetland Consulting Services in 2007 in the report entitled: "Wetland Assessment Report for Twistdraai Colliery: Thubelisha Shaft 2007" were accurately delineated. Furthermore, it is assumed that the standardised methodology defined by DWAF (2005) was employed.
- Fieldwork for Vaalkop was undertaken in the winter of 2017; therefore grasses and forbs were not flowering and so were not always identifiable to species level. In addition, overgrazing, trampling, cultivation, and veld fires in some areas made identification of species impossible. As a result, the species richness will be lower than the actual;
- The Vaalkop area is large (~8 000 ha) and therefore it was not possible to ground-truth all of the wetlands on site. Thus, there was some reliance on desktop delineation; and
- The Rock Engineering Report was not available at the time of writing this report, so the probability of subsidence was unknown. For the purposes of this report, it was assumed to be high. The Wetland Impact Assessment will be updated once this information becomes available.

20.7 Surface Water

The following defines the assumptions and limitations applicable to the surface water assessment:

- The surface water impact assessment was done based on the proposed mining methods and activities. Changes to the mine plans after completion of this report will not form part of the impact assessment; and
- TCTS mining area had a total area of 72 km^2 with which only 25 km^2 (30%) of that area was mined through high extraction method. The same percentage has been assumed for the Vaalkop and Trichardtsfontein area to enable quantification of the loss in mean annual runoff due to stooping.

20.8 Aquatic Ecology

The methods outlined in this study assume that aquatic ecology within the associated river courses is evenly distributed. Access to several sites was not permissible due to land owners' refusal to allow aquatic specialists onsite during the surveys. These sites included several points on the lower reaches of the Trichardtspruit as well as several points on the upper reaches of the Piekespruit.

20.9 Rehabilitation and Closure

The compilation of this Final Rehabilitation, Decommissioning and Mine Closure Plan has been based on the following assumptions and limitations:

- It must be noted that the Trichardtsfontein and Vaalkop Mines are a greenfields project, thus some of the information contained within this report is based as a conceptual level. As the mine progresses and more information becomes available, this report should be updated, thus this report should be considered as a living document and should be reviewed and updated, if required on an annual basis.

The financial provision calculation considered the following assumptions:

- No due diligence was undertaken to determine whether Sasol Mining is responsible for any other areas not specified in this report;
- The financial provision estimate is based on the latest mine plans and information received from the client;
- Allowance for subsidence was made for 178 ha where high extraction mining will occur, extrapolated from the Groundwater Report from Digby Wells (2017);
- 2 Ventilation shaft complexes per area (Thubelisha and Trichardtsfontein) as per Sasol Mining provided data for proposed new infrastructure;
- A third party model was provided by Sasol Mining for the demolition of the Ventilation Shaft Complexes and associated infrastructure;
- The closure costs associated with the current activities undertaken at Thubelisha was not assessed as part of this assessment, only the proposed additional infrastructure was considered;

- The previous closure cost assessment compiled by Jones and Wagener (2016) of **R 84 852 749** for the Thubelisha Operations is assumed to be correct;
- All the information provided by Sasol Mining is true and accurate;
- The calculations do not account for any value recovered from the sale of plant, steel or other material;
- Allowance has been made for preliminary and general fees and contingency;
- Allowance has been made for post closure water and vegetation monitoring for 5 years; and
- No VAT has been included in this assessment.

20.10 Groundwater

The following assumptions were made to develop the groundwater model:

- A numerical groundwater model is a representation of the real system; it is therefore an approximation of the groundwater system which in real life is complex and impossible to replicate accurately. This implies that there are always errors associated with groundwater models due to uncertainty in the data and the capability of numerical methods to accurately describe natural physical processes;
- High extraction is expected to increase permeability of the overlying stratigraphy. This has been assumed to occur throughout the areas of high extraction and incorporated into the model. However, the impacts of high extraction are likely to vary on site due to various factors such as the ductility of the overlying stratigraphy, its thickness, its stability and the mineral constituents;
- The spatial distribution and amount of recharge is uncertain. Due the extent of the area, recharge is simplified into the expected average recharge across the model;
- The dolerite intrusions and faults were not included into the numerical model as separate hydrogeological units as a result of limited understanding of their thickness, extent and hydraulic properties; and
- The hydraulic connection between the different aquifer systems and coal seams, expressed by vertical hydraulic conductivity is unknown and its value is estimated based on literature.

21 Item 3(p): Reasoned opinion as to whether the proposed activity should or should not be authorised

21.1 Item 3(p)(i): Reasons why the activity should be authorised or not

The information provided in this report is based on various specialist studies that have been completed for the mine. This information is dated 2008, 2014 and 2017. These studies have assisted in the identification of various impacts associated with the operation of the mine.

Based on these impacts mitigation measures have been proposed to ensure the significance of the impact is reduced. Therefore it is the opinion of Digby Wells that the consolidation project should be authorised. This opinion holds provided all the recommendations proposed in the specialist studies and the EIA and EMP as well as legislative requirements are implemented and adhered to.

It must however be noted that the impacts associated with high extraction mining between 30 – 100 metres below ground level have been found to have a significant impact on the environment and no mitigation measures can be proposed to avoid this impact. It is therefore highly recommended that areas identified to have high to definite risk of subsidence are not mined as indicated in Plan 24 in Appendix B.

The findings of the impact assessment have shown that the consolidation project may result in certain negative impacts to the environment; however, adequate mitigations measures have been included into this Report to reduce the significance of all the identified negative impacts. Most negative impacts can be reduced through the implementation of mitigation measures. The specific impacts which were considered to be significant but with mitigation have been reduce are listed below:

- Theft of cattle, farming equipment and other valuables within the consolidation project site associated with increased activity from the mine;
- Impact on soil resources due to the potential topsoil losses can occur as a result of rainwater runoff and wind erosion from roads and soil stockpiles where steep slopes are present;
- Undermining of wetlands and river systems with a depth of mining > 100 m below ground level can lead to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts;
- Any subsidence which may occur specifically in areas where high extraction mining is proposed and where mining will be undertaken between 30 – 80 metres will result in an impact to groundwater and can result in water quality deterioration;
- The operation of the mine will result in the generation of dirty water which can result in water contamination leading to deterioration of water quality, if released;
- Possibility of lowering of the water table and affecting the yield of boreholes;
- Post-mining decant of groundwater (should it occur) will have negative impacts on wetlands, surface water and aquatic ecology as this water is likely to be of a poor water quality. It is noted that although no decant is expected at the shafts, subsidence, sinkholes and unsealed deep boreholes are potential decant locations which will lead to decant into the environment and with therefore have a negative impact on it.

The potential positive impacts include the creation of jobs, generation of wealth within the community and economy and potential community development through the implementation of the SLP. The consolidation project have knock-on benefits in terms of local employment, local economic development and, increased government revenue and taxes.

The negative impacts that still remain high even after mitigation or no mitigation measures (if no mitigation can be proposed to prevent the impact from occurring) are able to be implemented is associated with the mining of areas between 30 – 100 metres below ground level with specific mention to the use of high extraction mining in these areas. The stooping of the land will have a major impact on wetlands, aquatic ecology, fauna and flora and Soil, Land Use and Land Capability. Subsidence will result in changes to the environment which will negatively affect the functioning of the ecosystem.

It must be noted that should authorisation not be received negative impacts associated with the mine will occur. Should the ventilation shafts not be constructed, a health and safety risk is posed as ventilation shafts are required to increase the amount of oxygen being brought underground. Additionally high extraction mining will not be utilised while mining Trichardtsfontein. This may mean that the coal reserve is not fully realised which will lead to a loss in economic revenue which will impact on the economy. Sasol Mining will also operate under two separate mining rights with two separate EMPrs which may prove to be inefficient in terms of management of the mines.

21.2 Item 3(p)(ii): Conditions that must be included in the authorisation

The following conditions must be included and approved for the EMPr.

21.2.1 Specific conditions to be included into the compilation and approval of EMPr

The following specific conditions are proposed:

- Air Quality:
  - Site clearing and decommissioning of infrastructure must be done in phases and use of dust suppressants and binders on exposed areas to reduce dust generation;
  - The drop heights when loading onto trucks and at tipping points should be minimised during construction and decommissioning phase;
  - Dust suppression must take place on exposed surfaces;
  - Use of water sprays at the crushing facility and bunker; and
  - Enclosure of crushers.

- Noise:
  - Construction activities are restricted to daylight hours (06:00 – 18:00);
  - Switching off equipment when not in use; and
  - The ventilation fan diffuser outlets should be installed horizontally and directed north.
- Social:
  - Where feasible, promote the creation of employment opportunities for women and youth;
  - Establish a monitoring system to ensure that the subcontractors honour the specified local employment policy;
  - Ensure that existing employees have access to pertinent skills training and are able to improve their professional proficiencies throughout their employment with Sasol Mining. This will assist with self-improvement and provide an opportunity for employees to achieve professional goals;
  - The proponent could consider negotiating terms with the relevant town developers, which can allow housing development and mining to co-exist; for instance, during these negotiations building specifications could be proposed by mine engineers that will allow for development that will eliminate the effect of subsidence;
  - During the life of mine workers must be given the opportunity to better and formalise their skills to aid their attempts to find alternative employment once LoM is reached;
  - The Mine's SLP should provide strategies and measures that reduce job loss through redeployment at other operations during decommissioning phase; and
  - Where feasible, alternatives to save jobs/avoid downscaling should be investigated beforehand, including LED, potential redeployment at other operation.
- Heritage:
  - Fossil Chance Find Procedure must be complied with as included in this EMPr and detailed in the Heritage Specialist Study (Appendix H);
  - To mitigate against the identified potential risk of subsidence to known heritage resources, Digby Wells recommends the development and implementation of a Conservation Management Plan (CMP) as a condition of authorisation that includes inter alia:
    - Site definitions;
    - Descriptions and defines CS of the known heritage resources;

    - Ownership structures;
    - Management structures;
    - Responsibility matrices;
    - Objectives, targets and strategies;
    - Monitoring procedures; and
    - Reporting requirements.
- Soil, Land Use and Land Capability:
  - If possible topsoil should be stripped when the soil is dry, as to reduce compaction, adhering to clearly defined guidelines for stripping, with topsoil being saved separately.
  - Topsoil stockpiles are to be kept to a maximum height of 3 m at a 2:5:1 slope.
  - Stockpiles should be protected by a berm wall to prevent erosion of stockpiled material and deflect surface water runoff.
  - Runoff must be controlled and managed by use of proper storm water management.
  - Fuel and oils spills are common, remediate using commercially available emergency clean up kits and focus on awareness of prevention.
  - Replaced soils require both physical and chemical amelioration as the actions of the soil removal; stockpiling and replacement result in soil compaction and dilution of the soil fertility. The actions that should be taken during the amelioration of soils include:
    - Soils must be ripped to ensure reduced compaction;
    - Restore soil fertility;
    - Incorporate fertilisers in to the planting zone; and
    - Apply maintenance dressing of fertilisers on an annual basis until the soil fertility cycle has been restored.
- Fauna and Flora:
  - A pre disturbance walkthrough must be conducted prior to construction, preferably between the months of November to March, to identify any plant SSC, that could be present in areas where subsidence is high risk or certain;
  - The Engineers Rock Report will be required to show where the risk of subsidence is high, if at all, as this will result in loss of sensitive landscapes;
  - If any plant SSC are recorded, these should be translocated with the involvement of a qualified botanist. The donor habitat should resemble the receiving habitat and the species/populations should be monitored monthly after translocation for up to one year;
  - If any important fauna species (SSC) are identified (as listed in the expected species lists) that have not been included in the site-specific species lists, this

should be reported to the Environmental Control Officer on site and the provincial authority (MPTA) for their reference. Further to this, measures should be undertaken to ensure that negative impacts to the species in question are not imposed due to the development; and

- The mine has an opportunity to reduce their overall liability in terms of spread of alien invasive plant species. It is recommended that all alien invasive plant species are controlled throughout the site as far as possible.

- Wetlands:
- Wetlands in South Africa are protected under the NWA and a Water Use License is required for any development within a wetland or within 500 m from a wetland;
- A buffer around wetlands of 100 m must be adhered to avoid impacts on wetlands. Furthermore decant points must be kept outside of the 100 m buffer; and
- Monitoring as described in the Monitoring Plan must be implemented throughout the Project life. Fixed point transects should be set up in at least 5 locations to monitor the wetlands and any impacts on these systems. Piezometers should be installed to determine wetland hydrology.

- Surface Water:
  - Limiting the vegetation clearing to the development footprint;
  - Implementation of dust suppression measures during construction and operational activities;
  - All bulk fuel storage areas should be appropriately bunded and spill kits should be in place to contain and immediately clean up any potential leakages of fuels and oils;
  - To ensure that all the dirty water emanating from the dirty water areas is contained within the mine site for re-use to prevent unnecessary discharge into the environment;
  - Where subsidence will occur during operation, measures to rehabilitate the surface area should be implemented as soon as possible to avoid impoundment of surface water;
  - Water quality monitoring should continue on the existing monitoring and newly proposed points to ensure detection of impacts;
  - Use of accredited contractors for removal or demolition of infrastructures; this will reduce the risk of waste generation and accidental spillages;
  - Surface inspection on the fully rehabilitated areas must be undertaken to ensure a surface profile that allows good drainage. This will ensure improvement or increased catchment yield to the surrounding streams; and

- Should decant occur, decant water should be captured before it flows into the streams. The water should then be treated prior to discharge into the streams.

- Aquatic Ecology:
  - Buffer zone establishment: 100 m from delineated wetland boundaries and river areas as stipulated in the Wetlands report by Digby Wells (2017);
  - Effective storm water management, so as to limit (or prevent) potential contamination from 'dirty' water runoff originating from the ventilation shafts;
  - Exposed topsoils and soil stockpiles must be revegetated to reduce erosion and subsequent sedimentation;
  - Correct storage and management of hazardous products must be implemented;
  - Although a basic geotechnical study has been completed for TCTS, it is recommended that a comprehensive geotechnical study must be conducted for the entire project area to assess the risk of subsidence in areas associated with river systems. Mitigation actions to increase stability should then be used in high risk areas. These mitigation actions include limiting mining underneath the river systems and the use of thicker support pillars. However, detailed mitigation actions should be defined in the comprehensive geotechnical study. Subsidence is expected to result at all shallow mining areas (100 m or less) as illustrated in Plan 24 in Appendix B. Therefore mitigation measures for these areas are not feasible due to the shallow depth of mining.
  - The emergency stockpile should be managed to minimise infiltration of contaminants to the groundwater;
  - Monitoring should take place for excessive inflow into the underground workings;
  - Although a basic geotechnical study has been completed for TCTS, it is recommended that a comprehensive geotechnical study must be conducted for the entire consolidation project area to assess the risk of subsidence in areas associated with river systems. Mitigation actions to increase stability should be used in delineated high risk areas. These mitigation actions include limiting mining underneath the river system and the use of thicker support pillars. However, detailed mitigation actions should be defined in the comprehensive geotechnical study;
  - Decant should not be allowed to discharge into the associated aquatic systems. The decant can be collected and stored in PCD's as a short term mitigation measure;
  - Investigation into long term solutions for decant management needs to be conducted; and

  - The treated decant should be monitored on an ongoing basis by conducting toxicity tests and physio-chemical monitoring to ensure correct quality before the discharge into any rivers can take place.

- Groundwater:
  - Groundwater monitoring should be conducted on a quarterly basis to assess the time series water level, water quality impacts and to observe trends as to aid decision making. Adjustments to the monitoring frequency can be made based on the observed trends;
  - Annual monitoring for subsidence and sinkhole formation is highly recommended, followed by rehabilitation if required and decant monitoring at unsealed deep boreholes (greater than 30 mbgl in depth); and
  - During operations, the numerical model should be updated every two years in the first four years and thereafter every five years based on groundwater monitoring results and updated every five years to calibrate with monitoring results post closure.

21.2.2 Rehabilitation Requirements

Closure and rehabilitation is a continuous series of activities that begin with planning prior to the mine's design and construction, and end with achievement of long-term site stability and the establishment of a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it will also reduce the financial burden of closure and rehabilitation. Rehabilitation and closure objectives have been tailored to the consolidation project at hand with the objective of assisting Sasol Mining in carrying out successful rehabilitation.

It is recommended that the following actions be taken during rehabilitation:

- Care must be taken when stripping and stockpiling soil due to the sensitive nature of the soils on site;
- Soil stockpile locations need to be determined and sited away from sensitive landscapes, such as pans/wetlands;
- Implement the measures as outlined in the specialist studies to minimise the risk to surface/groundwater contamination from the operations during rehabilitation and closure;
- Further trials should be conducted during the operational phase to determine other rehabilitation options that could be considered for the closure and rehabilitation of the disturbed site;
- There should be a constant interaction and communication with local stakeholders, so that their requirements can be taken into consideration in the rehabilitation process;

- Annual audits should be undertaken by a soil scientist to determine soil fertility;
- Regular mining monitoring to be undertaken on an annual basis for five years of the groundwater should take place in order to determine if there is a potential for mine affected water to occur;
- Annual update of the Environmental Risk Assessment (ERA) as part of Financial Provision update as required by GNR1147;
- Invasive alien plants should be removed on an ongoing basis; and
- Monitoring and maintenance of the rehabilitated areas should take place on an annual basis for at least five years after closure.

22 Item 3(q): Period for which the environmental authorisation is required

Sasol Mining currently holds two mining rights for the three mining areas. The mining rights are authorised for different durations as shown in Table 22-1. Therefore a consolidated environmental authorisation needs to be obtained for the duration of the two mining rights as Sasol Mining wish to consolidate two mining rights and EMPrs into one mining right and EMPr. Therefore it is requested that environmental authorisation is received for the duration of 23 years from 2017 to 2040.

Table 22-1: Mining rights held by Sasol Mining to be consolidated

Mining Right	Reference Number	Years	Duration
TCTS & Vaalkop Mining Right	Ref: MP30/5/1/2/2/138MR	30	2010 - 2040
Trichardtsfontein Mining Right	Ref: MP30/5/1/2/2/10056MR	20	2015 - 2035

23 Item 3(r): Undertaking

Please refer to Part B, Section 12 for the complete undertaking applicable to the EIA and EMP sections of this report.

24 Item 3(s): Financial Provision

Sasol is currently in the process of aligning all their operations (including Twistdraai Colliery: Thubelisha Shaft and the Vaalkop mining) to the new Financial Provision Regulations GN R1147. Sasol indicated that they have a dedicated trust fund that appropriately covers all their operations of which Thubelisha and Vaalkop is a part of.

Table 24-1: Summary of Combined Closure Cost Estimate

DIGBY WELLS ENVIRONMENTAL	Digby Wells Environmental Sasol Thubelisha: Combined Closure Cost Estimate
Thubelisha Shaft 1 (Jones and Wagener)	R 84 852 749
Section 102 two Ventilation shaft complexes and subsidence	R24 091 430
Grand Total (Excl. VAT)	**R 108 944 179**

Table 24-2: Estimated Financial Provision for Additional Proposed Infrastructure and Subsidence

DIGBY WELLS ENVIRONMENTAL	Digby Wells Environmental Sasol Thubelisha: Combined Closure Cost Estimate
Section 102 Ventilation shaft complexes (Thubelisha and Trichardtsfontein)	R 20 487 895
Monitoring and maintenance	R17 064 171
Grand Total (Excl. VAT)	**R24 091 430**

24.1 Item 3(s)(i): Explain how the aforesaid amount was derived

A detailed third party cost model was provided by the client (Sasol Mining) for the demolition and rehabilitation of ventilation shafts.

The assumptions made as part of the financial provision assessment are as follows:

- No due diligence was undertaken to determine whether Sasol Mining is responsible for any other areas not specified in this report;
- The financial provision estimate is based on the latest mine plans and information received from the client;
- Allowance for subsidence was made for 178 ha where high extraction mining will occur, extrapolated from the Groundwater Report from Digby Wells (2017);
- 2 Ventilation shaft complexes per area (Thubelisha and Trichardtsfontein) as per Sasol Mining provided data for proposed new infrastructure;

- A third party model was provided by Sasol Mining for the demolition of the Ventilation Shaft Complexes and associated infrastructure;
- The closure costs associated with the current activities undertaken at Thubelisha was not assessed as part of this assessment, only the proposed additional infrastructure was considered;
- The previous closure cost assessment compiled by Jones and Wagener (2016) of **R 84 852 749** for the Thubelisha Operations is assumed to be correct;
- All the information provided by Sasol Mining is true and accurate;
- The calculations do not account for any value recovered from the sale of plant, steel or other material;
- Allowance has been made for preliminary and general fees and contingency;
- Allowance has been made for post closure water and vegetation monitoring for 5 years; and
- No VAT has been included in this assessment.

24.2 Item 3(s)(ii): Confirm that this amount can be provided for from operating expenditure

Provided the Section 102 / Regulation 31 and basic assessment application is approved, Sasol Mining will provide for closure as per the legal requirements. A liability assessment will also need to be undertaken annually to ensure the financial provision is in line with the closure cost.

25 Item 3(t): Deviations from the approved scoping report and plan of study

25.1 Item 3(t)(i): Deviations from the methodology used in determining the significance of potential environmental impacts and risks

The purpose of this report is to amend and consolidate the Mining Rights and EMPrs pertaining to the TCTS, Trichardtsfontein, into a single Mining Right and EMPr and to compile the Vaalkop EMPr and consolidate it within the same report. Sasol Mining is proposing additional infrastructure in the form of two new ventilation shafts to be constructed at TCTS (East ventilation shaft) and two new ventilation shafts to be constructed at Trichardtsfontein (South Ventilation Shaft). Additionally Twistdraai Thubelisha wish to change the mining method approved for Trichardtsfontein from only bord and pillar to bord and pillar mining method with high extraction mining.

To obtain the authorisation to construct the TCTS mine various listed activities were applied for and granted in a previous EIA Process. It must be noted that no listed activities were applied for to undertake mining activities at Trichardtsfontein as no infrastructure was proposed. Additionally, no listing activities will be triggered for the operation of Vaalkop as no infrastructure is proposed.

The consolidation and amendment process does however trigger one listed activity under NEMA and therefore a Basic Assessment Process in addition to the Amendment Process was undertaken for the consolidation project. Consequently no deviations from the methodology have occurred.

25.2 Item 3(t)(ii): Motivation for the deviation

Refer to Section 25.1 above.

26 Item 3(u): Other Information required by the competent authority

26.1 Item 3(u)(i)(1): Impact on the socio-economic conditions of any directly affected person

The potential social impacts expected to arise as a result of the operation of the mine has been investigated and assessed in the TCTS EMPr and the Trichardtsfontein EMPr. Additionally these impacts have been updated as part of this EIA / EMP Report to include the impacts associated with the mining of Vaalkop. The impacts were also quantified based on the mining conditions experienced at that time.

People in the vicinity of the mine will experience the positive and negative impacts of the consolidation project. The impacts and relevant mitigation measures for all the phases of the consolidation project are discussed in Part A Section 10.1.12 and 11.3 and Part B: Section 5 and 6. Additionally, the social impact assessment has been included in Appendix G.

26.2 Item 3(u)(i)(2): Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act.

The Heritage Impact Assessment (Appendix H) completed as part of this consolidation project investigated and assessed the potential impacts on heritage resources associated with the consolidation project. The identified impacts associated with all the phases of the consolidation project are discussed in Part A Section 10.1.13 Part B: Section 5, 6 and 10.2.1.

27 Item 3(v): Other matters required in terms of sections 24(4)(a) and (b) of the Act

This section is considered to be not applicable.

Part B: Environmental Management Programme Report

1 Item 1(a): Details of the EAP

Digby Wells and Associates (South Africa) (Pty) Ltd (trading as Digby Wells Environmental – hereafter Digby Wells) has been appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the EIA process. The details of the EAP are provided in below.

Table 1-1: Contact Details of the EAP

Name of Practitioner:	Ms Barbara Wessels
Telephone:	011 789 9495
Fax:	011 069 6801
Postal Address	Private Bag X10046, Randburg, 2125, South Africa
Email:	barbara.wessels@digbywells.com

2 Item 1(b): Description of the aspects of the activity

Refer to Part A: Section 10 for the list of aspects.

3 Item 1(c): Composite Map

The composite plan for the consolidation project area, indicating sensitive areas, heritage resources watercourse buffers, is included as Plan 23, Plan 23 A, Plan 23 B and Plan 23 C in Appendix B.

4 Item 1(d): Description of Impact management objectives including management statements

4.1 Item 1(d)(i): Determination of closure objectives

Closure and rehabilitation is a continuous series of activities that begin with planning prior to the project's design and construction, and end with achievement of long-term site stability and the establishment of a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it will also reduce the financial burden of closure and rehabilitation.

The following points outline the main objectives for rehabilitation and closure:

- Achieve a final land use (pre-mining land use where infrastructure was constructed before mining took place) that is sustainable and meets both legislative requirements and stakeholder needs.
- Maintain and monitor all rehabilitated areas following re-vegetation and, if this monitoring shows that the objectives have been met, make an application for closure;

- Comply with local, district and national regulatory requirements; and
- Follow a comprehensive consultation and communication process with all stakeholders.

Rehabilitation and closure objectives have been tailored to the project at hand. The Rehabilitation, Decommissioning and Mine Closure Plan aims to assist Sasol Mining in carrying out successful rehabilitation for the consolidation mine.

4.2 Item 1(d)(ii): The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity

The EMPr and associated management options are intended to minimise environmental risk as far as is practically possible; however, should circumstances lead to unacceptable risks, emergency systems and procedures have been designed and will be implemented, in the case of an emergency, to prevent or minimise the consequential environmental damage. The environmental emergency contingency addresses any reasonably anticipated failure (most probable risk) for the entire mining area and focuses on incidents that could cause environmental emergencies.

The most crucial aspect of the emergency system is the identification and communication of the emergency to the appropriate persons. Consequently, the names of the appropriate contact person together with their contact numbers would be prominently displayed around the facility. The contact details will be updated on an annual basis or if known changes occur to contact information. First-party employees (such as security, safety superintendents, mine overseers, environmental officers) will be trained to respond to the responsible personnel in the event of an emergency. Each person's responsibility would be cleared with him/her beforehand and a copy of the emergency contingency plan (which should be developed by Sasol Mining) would be distributed to each person, including the responsible and/or affected persons not associated with the mine as discussed below:

- Disaster management and firefighting agencies;
- Water supply authorities;
- Downstream users that could be affected in the case of an emergency such as neighbouring mines, farmers and local communities;
- Relevant government authorities such as DWA and DMR; and
- Approved professional person (engineer).

It must be ensured that operating and supervisory staff are familiar with the emergency plan, and that the content thereof is understood and familiar to them. The emergency procedures training and awareness will be included in the induction programme. Training sessions in this regard on a more business-specific basis will be performed on a biannual basis to ensure that the emergency procedure is effective and regular mock exercises will be initiated.

The emergency contingency plan, which must be developed by Sasol Mining will be updated as circumstances change or operating procedures are amended, and as a minimum in the event of:

- Any additional recommendations made by a professional engineer (annual safety inspections) or environmental auditors;
- Any change in operational procedures and/or management of the mining activity;
- The identification of any issues of concern or additional risks as a result of regular inspections and/or monitoring results; and
- Any unplanned or unforeseen emergency situation.

The emergency contingency plan has been developed for the TCTS mine and will be adapted to include Trichardtsfontein and Vaalkop and will be implemented in the case of an emergency.

4.3 Item 1(d)(iii): Potential risk of Acid Mine Drainage

Potential sources of contamination at TCTS were assessed for acid generation potential. Thirteen samples were collected throughout project area, with four located within the Vaalkop area. Assessments were conducted by the Institute of Groundwater Studies (2014), reference can be made to the report for more detail.

Based on geochemical assessments it is observed that the greatest potential for acid generation is apparent at the coal seams. Analysis on waste rock (overburden and interburden) also shows acid generating potential.

A geochemical assessment was undertaken for Trichardtsfontein (2014) to determine the potential for the formation of acid mine water. Samples representative of the waste rock and the coal seams were taken. Seven samples were geochemically evaluated with the aim of defining the contamination expected to emanate from the local geology as a result of exposure to oxygen and air during mining activities. A more detailed discussion of the studies is found in Digby Wells (2014). The analys is shown in Table 4-1 and Table 4-2.

The Acid-base Accounting procedure measures the acid- and alkaline-producing potential of undisturbed soil and rock in order to determine if, after disturbance, the waste and ore material will produce acid and subsequently leach metals. This procedure includes Net Acid Generation tests that evaluate the Net Acid Generation and neutralising potential of the material.

From the ABA and NAG tests analysis the following has been concluded:

- Waste rock Acid Mine Drainage (AMD) potential:
  - All the waste rock paste pH values are above 8 and indicate an alkaline nature with high buffering capacity as confirmed with the mineralogy;

  - All waste rock samples have total sulphur contents well below the 0.25% guideline value above which acid generation starts to occur during oxidation;
  - The Nett Neutralising Potential of the four waste rock samples are above 0 with the exception of TRBH3-199; and
  - The waste rock is deemed not to be acid generating with a high enough buffering capacity from the mineralogy.
- Coal AMD potential:
  - The paste pH values of the coal material were alkaline;
  - The coal material for samples TRBH3-152 and TRBH3-114 had a S content above the 0.3% guideline, with 0.72 and 0.33% respectively, indicating a potential for acid generation;
  - Samples indicate low acid potential and the neutralising potential ratio is equal or below 1:3 indicating a potential for acid generation;
  - The NNP for two of the coal samples are below 0 indicating that if acid is generated the buffering capacity of the material can potentially not be enough to counter any acid generation; and
  - The coal material in whole is thus deemed as a rock type II and potentially acid generating.

Table 4-1: ABA results summary

Acid Base Accounting							
Parameter	**Waste rock**				**Coal**		
	TRBH 3-96	**TRBH 2-80**	**TRBH3 -199**	**TRBH 1-79**	**TRBH 2-70**	**TRBH3 -152**	**TRBH3 -114**
Paste pH	9.3	9.2	8.2	9.2	9.6	8.2	8.6
Total Sulphur (%) (LECO)	0.18	0.04	0.06	0.09	0.09	0.72	0.33
Acid Potential (AP) (kg/t)	5.63	1.25	1.88	2.81	2.81	23	10
Neutralization Potential (NP)	5.75	20	1	9.5	0.75	22	13
Nett Neutralization Potential (NNP)	0.125	19	-0.875	6.69	-2.06	-0.25	2.44
Neutralising Potential Ratio (NPR) (NP : AP)	1.02	16	0.533	3.38	0.267	0.989	1.24
Rock Type	III	III	II	III	II	I	II

Table 4-2: NAG results summary

Nett Acid Generation							
Parameter	**Sample Identification: pH 4.5**						
	TRBH3-96	**TRBH3-152**	**TRBH2-80**	**TRBH3-199**	**TRBH3-114**	**TRBH1-79**	**TRBH2-70**
NAG pH: (H2O2)	6.6	8.5	9.1	6.9	7.1	8.8	7.7
NAG (kg H2SO4 / t)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Sample Identification: pH 7.0						
NAG pH: (H2O2)	6.6	8.5	9.1	6.9	7.1	8.8	7.7
NAG (kg H2SO4 / t)	0.588	<0.01	<0.01	0.196	<0.01	<0.01	<0.01

From the static assessment, it can be concluded that the material that will be disturbed through mining can potentially cause AMD formation.

4.4 Item 1(d)(iv): Steps taken to investigate, assess, and evaluate the impact of acid mine drainage

Two tests were conducted to determine whether the samples have the potential to be acid generating which has been discussed below:

- XRF and XRD tests:
  - X-Ray Fluorescence (XRF) is an X-ray method used to determine the elemental composition of a material and give the general oxide and trace element percentages and concentrations of measureable matter. X-Ray Diffraction (XRD) allows for the measurement of the crystal structures within a sample to determine the mineralogical composition of the material.
- ABA and NAG tests:
  - The Acid-base Accounting (ABA) procedure measures the acid- and alkaline-producing potential of undisturbed soil and rock in order to determine if, after disturbance, the waste and ore material will produce acid and subsequently leach metals. This procedure includes Net Acid Generation (NAG) tests that evaluate the Net acid generation and neutralising potential of the material.

4.5 Item i(d)(v): Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage

The results from the geochemical testing indicate that there is a potential for the generation of acid. The Nett Neutralization Potential (NNP) for two of the coal samples are below 0 indicating that if acid is generated the buffering capacity of the material can potentially not be enough to counter any acid generation. The impact of decant quality on downstream users is potentially significant. The water is unlikely to be fit for use for the aquatic systems, nor for irrigation nor livestock watering, primarily due to the potentially elevated metals, sulphates and EC. The water balance at closure indicates that an average water make in the order of 6000 m^3/day can be expected. Using the expected sulphate concentrations, this equates to 11 ton SO_4 per day, or around 4000 tons SO_4 per year. The loading from the mine equates to around 0,6 ton SO_4/yr/ha, which is reasonable compared to field observations, which indicate some 0.5 to 1 ton SO_4/yr/ha is typical for underground mines. It is proposed that ongoing sampling and monitoring of parameters important to the final water quality and water volumes must be undertaken. Additionally, quantification and verification of the groundwater model, the water balance model, and the geochemical model is required. An evaluation and reassessment of alternative options for the final water use and required associated water quality, together with the technologies required to achieve the required quality must be conducted

4.6 Item 1(d)(vi): Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage

All specialist studies including the rehabilitation study which has been attached as appendices to this report have included mitigation and monitoring measures to ensure that preventative measures are employed. This will assist in preventing the potential for acid mine water generating after closure. It is proposed that should decant water be released from the mine after closure, it must be treated to an acceptable standard before it can be discharged. Additionally the rehabilitation and soil study instruct that during rehabilitation the land must be sloped to ensure the landscape is free draining and prevents ponding on the surface. This must be continuously monitored even after closure to ensure the rehabilitation measures are adequate and prevent water from infiltrating the soil and reacting with the carbonaceous material.

4.7 Item 1(d)(vii): Volumes and rate of water use required for the mining, trenching or bulk sampling operation

A macro mine wide water balance was developed by Jones and Wagner in 2016 for TCTS mining area. It is proposed that no surface infrastructure will be constructed within the Mining Right area as it will be accessed via the TCTS (Except for the proposed ventilation shafts), therefore the process flow or the mine water reticulation system will likely remain the same.

The underground inflows and underground water demand will also be the same as the current situation.

These inflows will vary as the mine progresses, an overview of the estimated inflows into the underground mine has been presented in the Groundwater report. The actual inflows will then be used to calibrate and update the water balance.The following key water uses can be noted on the water balance:

- Portable water is sourced from Rand Water and an average of 584 m^3 is used on a monthly basis;
- Dirty water runoff from the mine area and the groundwater is contained in the mine dirty water dam for re-use for machine cooling and dust suppression on the underground areas from the existing 2016 water balance, it is indicated that there was an average spill of 8616 m^3 from the main dirty water dam.

4.8 Item 1(d)(viii): Has a water use licence has been applied for

The IWUL for the TCTS was approved in 2011 (04/B11C/ACGIJ/995). It is determined that no IWUL will be applied for the Trichardtsfontein as no activities are triggered for the mining of the area. It is noted that mining of Vaalkop will require an IWUL however this will be applied for separately at a later stage. It should be noted that a general authorisation for a WUL for the construction of the ventilation shafts must be obtained due to the ventilation shafts being located within 500 m of a wetland. Should it be determined that an amendment to the TCTS IWULA is required this will be undertaken by Sasol Mining.

5 Item 1(d)(ix): Impacts to be mitigated in their respective phases

Measures to rehabilitate the environment affected by the undertaking of any listed activity

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Construction Phase	Air Quality	The area to be disturbed is very small Impact is limited to the site and immediate surroundings.	▪ Site clearing must be done in phases and use of suppressants and binders on exposed areas to reduce dust generation; ▪ The area of disturbance at all times must be kept to a minimum and no unnecessary clearing, digging or scraping must occur, especially on windy days (with wind speed ≥ 5.4 m/s); ▪ The drop heights when loading onto trucks and at tipping points should be minimised; ▪ Dust suppression must take place on exposed surfaces; and ▪ Set maximum speed limits on site and to have these limits enforced.	▪ National Environmental Management: Air Quality Act, Act.39 of 2004 standards 2009; ▪ National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013). ▪ Act, 2004 (Act No. 39 of 2004) – National Ambient Air Quality Standard for Particulate Matter with Aerodynamic Diameter less than 2.5 Microns Meters (PM 2.5) 2012	Construction Phase
Mining Process: Tipping of ore at the Bunker and Stockpiling	Operational Phase	Air Quality	Impact will be localized, limited to the site and immediate surroundings.	▪ Enclosure of tipping points and crusher; ▪ Use of water spray to prevent coal dust dispersion; ▪ The coal bunker design includes a cover and water sprays to prevent coal dust dispersion; and ▪ Ensure bi-weekly inspections of dust suppression equipment on the bunker and transfer stations and replace faulty components.	▪ National Environmental Management: Air Quality Act, Act.39 of 2004 standards 2009; ▪ National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013). ▪ Act, 2004 (Act No. 39 of 2004) – National Ambient Air Quality Standard for Particulate Matter with Aerodynamic Diameter less than 2.5 Microns Meters (PM 2.5) 2012	Operational Phase
Operation of the Ventilation Shaft	Operational Phase	Air Quality	Impact will be localized, limited to the site and immediate surroundings.	▪ Mitigation measures such as: use of electrostatic precipitators to remove fine particles is recommended if ambient levels are exceeding regulatory standards; ▪ Use of Catalytic Converters is recommended if the levels of toxic gases are in exceedance of the	▪ Mine Health and Safety Act, 1996 (Act No. 29 of 1996) ▪ National Environmental Management: Air Quality Act, Act.39 of 2004	Operational Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				regulatory standards; and ▪ Use of gas scrubbers to remove particulates and/or gases from emissions being released form the ventilation shafts if regulatory standards are exceeded.	standards 2009; ▪ National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013). ▪ Act, 2004 (Act No. 39 of 2004) – National Ambient Air Quality Standard for Particulate Matter with Aerodynamic Diameter less than 2.5 Microns Meters (PM 2.5) 2012.	
Sealing of shaft and rehabilitation	Decommissioning Phase	Air Quality	Impact will be localized, limited to the site and immediate surroundings.	▪ Drop heights should be minimised when offloading materials; ▪ The dismantling area disturbed must be kept to a minimum; ▪ Limit rehabilitation activities to non-windy days, where possible; ▪ Rehabilitation must be undertaken in accordance with rehabilitation plan (Appendix O); and ▪ Dust suppression on exposed surfaces must be implemented including haul roads.	▪ National Environmental Management: Air Quality Act, Act.39 of 2004 standards 2009; ▪ National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013). ▪ Act, 2004 (Act No. 39 of 2004) – National Ambient Air Quality Standard for Particulate Matter with Aerodynamic Diameter less than 2.5 Microns Meters (PM 2.5) 2012.	Decommissioning Phase
Site clearing, including the removal of topsoil and vegetation; Construction of ventilation shafts	Construction Phase	Noise	Site only and immediate surrounding area	▪ Restricting construction activities to daylight hours (06:00 – 18:00); and ▪ Switching off equipment when not in use.	National Noise Control Regulations	Construction Phase
Operation of ventilation shafts	Operational Phase	Noise	Site only and immediate surrounding area	▪ The ventilation fan diffuser outlets should be installed horizontally and directed north	National Noise Control Regulations	Operational Phase
Operation of the TCTS mine with associated infrastructure	Operational Phase	Noise	Site only and immediate surrounding area	▪ Ensure regular inspections of the conveyor line are undertaken on a weekly basis and replace faulty rollers and other faulty components resulting in excessive noise. This should be undertaken not only from an environmental perspective but also	National Noise Control Regulations	Operational Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				from an operational perspective; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Investigate all noise complaints promptly and advise the complainant of the outcome(s).		
Removal of infrastructure and surface rehabilitation	Decommissioning Phase	Noise	Site only and immediate surrounding area	▪ Restricting decommissioning activities to daylight hours (06:00 – 18:00); ▪ Switching off equipment when not in use	National Noise Control Regulations	Decommissioning Phase
Sustained employment during operation	Operational Phase	Social	Impact extended to the local municipality	▪ Where feasible, promote the creation of employment opportunities for women and youth; ▪ Sasol Mining procurement and/or contracts department (or similar) to establish a monitoring system to ensure that the subcontractors honour the specified local employment policy. This can be stipulated in contractor agreements; ▪ If required, the local resident status of applicants should be verified in consultation with community representatives and local government; ▪ Ensure that existing employees have access to pertinent skills training and are able to improve their professional proficiencies throughout their employment with Sasol. This will assist with self-improvement and provide an opportunity for employees to achieve professional's goals; and ▪ In addition, it is recommended that local employment opportunities that may arise be maximised as far as possible, by intensifying efforts in the SLP, which are aimed at developing scarce skills.	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; ▪ National Environmental Management Act (Act of 1998). ▪ IDPs and SPFs of affected municipalities; and ▪ Company CSI Policy.	Operational Phase
Operation of the Mine	Operational Phase	Social	Impact extended to the local municipality	▪ Recruitment to be coordinated by Sasol Mining in accordance with recruitment policy; ▪ Promotion of female and youth employment; and ▪ Effective implementation of training and skills development initiatives.	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; IFC PS 4: Community	Operational Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
					Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).	
Operation of the Mine	Operational Phase	Social	Surrounding rural communities	▪ Recruitment to be coordinated by Sasol Mining in accordance with recruitment policy; ▪ Promotion of female and youth employment; ▪ Effective implementation of training and skills development initiatives; and ▪ Where possible, maximise the extent of short-term employment (over and above the full time employees and contractors) through piecemeal work and the like.	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).	Operational Phase
Operation of the Mine	Operational Phase	Social	Surrounding rural communities	▪ Public awareness campaigns regarding subsidence; and ▪ Investment in development to secure housing options for employees, and thereby reassuring public.	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).	Operational Phase
Operation of the Mine	Operational Phase	Social	Communities in the primary and local study area	▪ The details of Sasol Mining's' proposed LED programmes must be designed and implemented in consultation with both community representatives and municipal management to ensure that the actual needs of communities are met; and	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85	Operational Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ All LED projects must include a monitoring and evaluation plan, to ensure that the effectiveness of each project is tracked and aligned to its intended objectives. Identified areas for improvement should be incorporated into the following years planning	of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).	
Operation of the Mine	Operational Phase	Social	Surrounding rural communities	▪ Ensure regular adhoc communication with stakeholders; and ▪ Any unintended (factual) damage and/or losses that are incurred by impacted persons must be addressed on a case-by-case basis.	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).	Operational Phase
Operation of the Mine	Operational Phase	Social	Mining Right area and extend to outside communities	▪ Ensure theft is prohibited at the mine and warn workers of the consequence of stealing; ▪ Transporting workers to and from site after their shifts; ▪ Advise workers not to buy anything from farm workers; and ▪ All communication with farmers will be undertaken through the Sasol Mineral Rights Department (SMRD).	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).	Operational Phase
Operation of the Mine	Operational Phase	Social	Surrounding rural communities	▪ The mine should be maintained during its lifetime so as to minimise the risk of mine personnel being	▪ Mineral and Petroleum Resource Development Act (Act of 2002);	Operational Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				injured as result of failed machinery etc.; ▪ Operational health and safety programmes should be implemented; ▪ All mine employees should be issued with the appropriate personal protective equipment (PPE) and educated regarding the risks involved in mining activities; ▪ Unauthorised access to the mine and future construction sites must be prevented through appropriate fencing and security to be erected/ established at the start of operation and maintained throughout the life of the proposed project; and ▪ Ensure that diversions are clearly marked and sign posted, especially for night time.	▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).	
Decommissioning of the Mine	Decommissioning Phase	Social	Affect employees and service providers from the local municipal area	▪ Develop alternative and sustainable livelihoods for instance through LED programmes listed in the Mine's SLP; ▪ During the life of mine workers are given the opportunity to better and formalise their skills in order to aid their attempts to find alternative employment; ▪ The Mine's SLP should provide strategies and measures that reduce job loss through redeployment at other operations; ▪ Where feasible alternatives to save jobs/avoid downscaling should be investigated beforehand, including LED, potential redeployment at other operation; ▪ In addition to this it is vital that at all times but particularly towards the end of mine life that issues around retrenchment are dealt with in a transparent manner. All workers must know where they stand with regard to employment, what processes will be followed in the event of retrenchment and what services are available to them in this regard. ▪ Proactively assess and manage the social and economic impacts on individuals, regions and economies where; retrenchment and/or closure of the mine are certain. In particular through promoting economic diversification, portable skills development and local economic development where possible;	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).	Operational Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Ensure open discussions with relevant government departments to ensure the closure process is correctly followed; and ▪ Rehabilitation must be undertaken in accordance with rehabilitation plan.		
Undermining	Operational Phase	Heritage	Affect heritage resources that may contribute to a local, provincial and national level of understanding of the paleontological, archaeological and historical environment.	▪ Develop a project specific Fossil Finds Procedure as a condition of authorisation; ▪ Develop and implement a project specific Conservation Management Plan as a condition of authorisation.	▪ The National Heritage Resources Act, 1999 (Act No. 25 of 1999) ▪ Regulations to the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (GN R 548) (SAHRA Regulations)' ▪ SAHRA Minimum Standards: Archaeological and Paleontological Components of Impact Assessment Reports	Operational Phase
Site clearing and topsoil removal for the construction of the ventilation shafts	Construction Phase	Soil, Land Use and Land Capability	Infrastructure footprint	▪ If possible soil should be removed during dry months, as to reduce compaction; ▪ Only clear vegetation when and where necessary; ▪ Only the designated access routes are to be used; ▪ The soils stripped for the ventilation shafts should be stripped and conserved for rehabilitation; ▪ Topsoil stockpiles are to be kept to a maximum height of 3 m at a 2:5:1 slope; ▪ If erosion occurs on the site or on the stockpiles, corrective actions must be taken to minimise any further erosion from taking place; ▪ The handling of the stripped topsoil should be minimised to ensure the soil's structure does not deteriorate significantly; ▪ The stockpiles should be vegetated to reduce the risk of erosion, and to reinstitute the ecological processes within the soil; ▪ Compaction of the removed soil should be avoided by prohibiting traffic on stockpiles; and ▪ Ensure designed storm water management is in place.	Chamber of Mines Guidelines	Construction Phase
Maintenance of roads and topsoil stockpiles	Operational Phase	Soil, Land Use and Land Capability	Infrastructure footprint	▪ Topsoil stockpiles are to be kept to a maximum height of 3 m at a 2:5:1 slope angle and away from drainages lines and surface water;	Chamber of Mines Guidelines	Operational Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Only the designated access routes are to be used; and ▪ If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place.		
Potential surface subsidence from collapsed underground mine roof	Operational Phase	Soil, Land Use and Land Capability	Areas where Subsidence could occur	▪ Rehabilitation of cracks once identified and areas where vegetation is affected by ponding, where practicable ; ▪ Subsided areas can be backfilled and re-shaped to match the original topography to mitigate ponding and waterlogging conditions depending on the degree of the collapse and available soil material, where practicable; ▪ Planning for free drainage of ponded areas, where practicable; ▪ Monitoring of undermined areas to assess the effects of subsidence at surface. Annual surface surveys will be undertaken over mined out areas to establish the degree of subsidence; and ▪ Failing these mitigation measures, the only other alternative will be to compensate the farmers for loss of productive land.	Chamber of Mines Guidelines	Operational Phase
Rehabilitation of infrastructure areas, roads and subsided areas	Decommissioning Phase	Soil, Land Use and Land Capability	Infrastructure footprint	▪ Rehabilitate according to the rehabilitation plan; ▪ Return the land conditions capable of supporting prior land use or uses equal than prior land use to the extent feasible or practical. ▪ Contour slopes to minimise erosion and run-off; ▪ Plant native vegetation to prevent erosion and encourage self-sustaining development of a productive ecosystem such as *Cynodon dactylon, eragrostis tef, eragrostis chloromelas, chloris gayana, digitaria eriantha* and *panicum*; ▪ Remove buildings to foundation level. All rubble to be relocated to a specified approved rubble dump or used as backfilling in shafts, etc ▪ Use waste rock for backfill and followed by topsoil of 0.3 m to the extent feasible ▪ Compacted areas are to be ripped to loosen the soil and vegetation cover re-instated; ▪ Inventory of hazardous waste materials stored on site should be compiled and arrange complete removal; ▪ Seal the shaft by placing concrete plugs; ▪ Ensure proper storm water management designs	Chamber of Mines Guidelines	Decommissioning Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				are in place to ensure no erosion or ponding occurs, where practicable; ▪ Conduct soil contamination assessment to assess if any remediation is require prior to future land use development; ▪ Only designated access routes are to be used to reduce any unnecessary compaction; ▪ The topsoil should be shaped taking the pre-mining landscape into consideration, where practicable; ▪ The rehabilitated areas must be assessed twice a year for compaction, erosion and fertility; and ▪ Monitoring for subsidence must be done annually.		
Site Clearing for the construction of the Ventilation Shafts	Construction Phase	Fauna & Flora	Infrastructure footprint	▪ The footprint area should be kept as small as possible; ▪ Existing access roads should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road; ▪ An alien invader management plan should be implemented, whereby the disturbed site is monitored quarterly for at least two years to ensure that alien invasion does not take place.	▪ National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) ▪ National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004) ▪ Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983)	Implemented after construction for two years

High extraction underground mining	Operational Phase	Fauna & Flora	Mining Right Areas	▪ A comprehensive geotechnical investigation should be undertaken for the following:
				  ▪ Provide appropriate design parameters for pillar and overburden stability, in line with the actual geotechnical rockmass properties, and
				  ▪ Indicate any areas (undermining of the natural ecosystems) that may fall outside of these design parameters.
				▪ Following the geotechnical investigation, where required a provision must be made for the rehabilitation of these areas in the event of a possible risk of subsidence / intersection collapse.
				▪ The edge of the wetlands and a 100 m buffer must be demarcated near where the areas of high risk or definite subsidence area located and the ventilation shafts to reduce the risk of being impacted on from subsidence;
				▪ Sensitive landscape monitoring must be carried out to ensure no unnecessary impact to these areas is realised; and if so that a remedy is put in
					▪ National Environmental Management Act (NEMA), 1998 (Act 107 of 1998)
					▪ National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004)
					▪ Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983)
						Operational Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				place as soon as possible; ▪ The safety factor prescribe by the Rock Engineer must be used; ▪ No high extraction mining to be done within 100 m from watercourses; ▪ Monitoring should take place for excessive inflow into the underground workings; ▪ If any plant SSC are recorded, these should be translocated with the involvement of a qualified botanist. The donor habitat should resemble the receiving habitat and the species/populations should be monitored monthly after translocation for up to one year; and ▪ If any important fauna species (SSC) are identified (as listed in the expected species lists) that have not been included in the site-specific species lists, this should be reported to the Environmental Control Officer on site and the provincial authority (MPTA) for their reference. Further to this, measures should be undertaken to ensure that negative impacts to the species in question are not imposed due to the development.		
Dismantling and removal of infrastructure	Decommissioning Phase	Fauna & Flora	Infrastructure footprint	▪ An alien invasive plant management plan should be implemented. ▪ Riparian habitat and river biomonitoring must be carried out during rehabilitation to ensure these areas are not impacted upon; and if they are remedial action must be implemented. Transects should be set up through representative sites and monitored on an annual basis; ▪ Should there be decant, the water will need to be treated with active or passive treatment and a Rehabilitation Plan will need to be compiled to rectify any damages. ▪ Rehabilitation must be undertaken in accordance with rehabilitation plan;	▪ National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) ▪ National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004) ▪ Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983)	Implemented after decommissioning for two years
Potential Impacts on Wetlands: Underground Mining (30-100 m below ground level)	Operational Phase	Wetland	3406.19 ha (100 ha definite risk, 608 ha high risk, 561 ha low risk (excl. buffers)) with the remainder being areas that are not at risk of subsidence	▪ No mitigation measures will reduce the impact of definite subsidence. In this case, a wetland offset strategy would need to be compiled.	▪ The NWA Section 21 (c), (g) and (i) of the NWA ▪ Section 24 of the Constitution ▪ NEM:BA ▪ NEMA ▪ Department of Water and Forestry (DWAF)	Operational Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
					guidelines for the delineation of wetlands (2005); ▪ Mining and Biodiversity Guideline (DEA et al., 2013); ▪ MTPB, 2014	
Potential Impacts on Wetlands: Underground Mining (>100 m below ground level)	Operational Phase	Wetland		▪ The highest safety factor as prescribed by the Rock Engineers must be adhered to. ▪ A geotechnical study would need to be compiled to determine the exact risk of subsidence; ▪ Wetland monitoring must be carried out to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible. ▪ A wetland offset strategy may need to be compiled.	▪ The NWA Section 21 (c), (g) and (i) of the NWA ▪ Section 24 of the Constitution ▪ NEM:BA ▪ NEMA ▪ Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); ▪ Mining and Biodiversity Guideline (DEA et al., 2013); ▪ MTPB, 2014	Operational Phase
Mine closure and rehabilitation	Decommissioning Phase	Wetland	N/A	▪ Wetland monitoring must be carried out on wetlands that could possibly be impacted on by activities during rehabilitation to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible. Transects should be set up through representative sites and monitored on an annual basis; ▪ Groundwater and wetlands must be monitored post-mining for potential decant (3 years or until the system has stabilised). ▪ Decant should not be allowed to discharge into a wetland system. The decant can be collected and stored in PCD's as a short term mitigation measure; ▪ Investigation into long term solutions for decant management needs to be conducted, should this water not be to the correct standards; ▪ Wetland Rehabilitation Plan will need to be compiled to rectify any damages should decant impact on wetlands; ▪ Monitoring groundwater levels and decant (rate	▪ The NWA Section 21 (c), (g) and (i) of the NWA ▪ Section 24 of the Constitution ▪ NEM:BA ▪ NEMA ▪ Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); ▪ Mining and Biodiversity Guideline (DEA et al., 2013); ▪ MTPB, 2014	Decommissioning Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				and quality) quarterly.		
Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Construction Phase	Surface Water	Infrastructure footprint (Ventilation Shafts)	▪ Clearing of vegetation must be limited to the development footprint area, and the use of existing access roads must be prioritized so as to minimize construction of new access roads in these areas; ▪ If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments, dust generation and hazardous substances (oil, diesel, etc.) from construction vehicles used during site clearing; ▪ Dust suppression with water on the haul roads and cleared areas must be undertaken to limit dust. During dry times, this could be undertaken on a daily basis where there is visible dust being generated;	Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated.	Construction Phase
Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Construction Phase	Surface Water	Infrastructure footprint (Ventilation Shafts)	▪ Construction work closer to the streams should be suspended during heavy rains to avoid erosion and sedimentation of the streams and unnecessary vehicle movement should be avoided. ▪ Designs should avoid the causing of erosion or spillages of material during the construction phase.	Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated.	Construction Phase
Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Construction Phase	Surface Water	Infrastructure footprint (Ventilation Shafts)	▪ All fuel storage areas should be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; ▪ Vehicles should regularly be maintained as per the mine's developed maintenance program. This should also be inspected on a daily basis before use to ensure there are no leakages underneath ▪ Mobile chemical ablutions for construction workers and general waste bins should be provided and be maintained as per the developed mine's maintenance schedule; and ▪ No dirty water should be allowed off site and into a stream.	Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated.	Construction Phase
Operation of the mine	Operational Phase	Surface Water	Mine infrastructure and associated infrastructure footprint	▪ As proposed in the project activities, ensure that all the dirty water emanating from the dirty water areas is contained for re-use within the mine, to	▪ Based on the GN 704 requirements regarding stormwater management	Operational Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				prevent discharge into the environment; ▪ Use of storage compartments underground to store dirty water; ▪ All pollution control dams must be maintained and is required to operate with a 0.8 m freeboard and able to contain a 1:100 year flood event; ▪ All surface water pollution control structures will be inspected on a three monthly basis and maintenance work carried out as required. Furthermore, all structures (e.g. dams) registered in terms of the National Water Act will be maintained in accordance with the Act. ▪ The mines water balances and management of the water balance must be regularly updated and monitored. This should be updated as specified in the IWUL or if on an annual basis; ▪ The wash bays and workshops are be equipped with oil skimming facilities to remove oil and grease from the wash down water; ▪ Clean run-off must be directed around these facilities, and directed back to the clean water catchment; ▪ The emergency coal stockpile area at Thubelisha must ensure that dirty water from the stockpile area is contained and the seepage is minimised (No dirty water is permitted to be discharged to the clean water environment); ▪ No discharge of polluted water should be planned for or allowed; ▪ Where subsidence will occur during operation, measures to rehabilitate the surface area should be implemented as soon as possible to avoid impoundment of surface water; and ▪ Water quality monitoring should continue on the existing and newly proposed monitoring points to ensure detection of impacts.	for mining activities it is noted that all clean and dirty water must be separated. ▪ The clean water diversion will be sized to accommodate the 1:50 year storm event. ▪ The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.	
High extraction underground mining	Operational Phase	Surface Water	Mining Right Area	▪ There is no mitigation for the loss of catchment yield. However, the area to be stooped is assumed to be approximately 30 km^2 and makes up 8% of the total quaternary catchment of 371 km^2. ▪ The mine will limit the extent of pillar extraction to target only areas with low potential water ingress. This implies excluding	▪ Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated. ▪ The clean water diversion	Operational Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ All floodplain areas and areas within 100 m of a watercourse or 1: 100 year floodline whichever is greatest ▪ All areas with a thin soil cover that have a significant catchment draining to them. ▪ As far as is practical, the mine will avoid rocky outcrops, although the areas currently designated for pillar extraction do contain some percentage of thin cover and rocky outcrop. ▪ Clean water from upstream should be diverted around these areas and report to the natural streams. ▪ The surface of stooped areas will be inspected to ensure they remain free draining. This will involve the use of surface teams undertaking civil works such as cutting drains where required to ensure areas of settlement can drain. Sasol Mining has developed a range of strategies for stooped areas based on their experiences elsewhere ▪ The percentage decrease in MAR amounts to 8 % for B11C quaternary catchment (where the proposed new mining areas are located). Therefore, the loss in MAR for the quaternary catchment is considered to be of moderately low significant.	will be sized to accommodate the 1:50 year storm event. ▪ The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.	
Dismantling and removal of infrastructure	Decommissioning Phase	Surface Water	Mine infrastructure and associated infrastructure footprint	▪ Use of accredited contractors for removal or demolition of infrastructures; this will reduce the risk of waste generation and accidental spillages; ▪ Rehabilitated and backfilled areas (where subsidence has occurred) must be seeded as soon as possible to avoid siltation due to erosion; ▪ Surface inspection on the fully rehabilitated areas must be undertaken to ensure a surface profile that allows good drainage. This will ensure improvement or increased catchment yield to the surrounding streams. ▪ Rehabilitation must be undertaken in accordance with rehabilitation plan (Appendix O);	▪ Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated. ▪ The clean water diversion will be sized to accommodate the 1:50 year storm event. ▪ The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.	Decommissioning Phase
Mine closure and rehabilitation	Decommissioning Phase	Surface Water	N/A	▪ Should decant occur, decant should be collect and stored at a PCD as a short term solution;	▪ Based on the GN 704 requirements regarding	Decommissioning Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Long term management solutions for decant should be investigated; ▪ Water quality monitoring must continue to enable the detection of decant when it occurs so immediate mitigation measures can be implemented. Monitoring should continue for as long as decant is taking place.	stormwater management for mining activities it is noted that all clean and dirty water must be separated. ▪ The clean water diversion will be sized to accommodate the 1:50 year storm event. ▪ The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.	
Site clearance and construction of ventilation shafts within associated wetland habitats and river catchment	Construction Phase	Aquatic	Limited	▪ Minimise and keep the footprint as small as possible; ▪ Buffer zones (100 m wetlands and 100 m riparian); ▪ Revegetation of the construction footprint as soon as possible; ▪ Storm water should be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ Construction should take place during the dry season to minimise runoff; and ▪ Sequential removal of the vegetation (not all vegetation immediately).	The National Water Act (NWA), 1998 (Act No. 36 of 1998)	Construction Phase
Waste generation/disposal and the use of hazardous products	Construction Phase	Aquatic	Limited	▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ Approved barrier systems to minimise contaminated seepage and runoff from entering the local aquatic systems; ▪ Ensure correct waste management; and ▪ Ensure correct storage systems are used for the storage of hazardous products when constructing.	The National Water Act (NWA), 1998 (Act No. 36 of 1998)	Construction Phase
Underground mining high to definite risk subsidence areas	Operational Phase	Aquatic	Municipality	▪ No mitigation measures will be able to prevent subsidence where the depth of mining is shallower than 100 m.	The National Water Act (NWA), 1998 (Act No. 36 of 1998)	Operational Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Underground mining low risk subsidence areas	Operational Phase	Aquatic	Local	▪ Complete a geotechnical study to identify high risk subsidence areas and avoid or mitigate to support them; ▪ Ensure sufficient pillar support and safety factors to prevent subsidence of undermined wetland/aquatic areas; ▪ The highest safety factor possible (at least 2) must be used for areas of shallow mining (confirm with geotechnical study); ▪ Underground mining should avoid aquifers especially due to the proposed high extraction near aquatic and wetland systems. Punctured aquifers could lead to the dewatering of aquatic/wetland systems; ▪ Mining should not occur above 100 m below aquatic/wetland areas or within the 100 m wetland buffer zones (confirm with geotechnical study if areas can be mined shallower than 100 m without the risk of subsidence); and ▪ Monitoring should take place for excessive inflow into the underground workings.	The National Water Act (NWA), 1998 (Act No. 36 of 1998)	Operational Phase

Emergency coal stockpiling	Operational Phase	Aquatic	Local	▪ Clean and dirty water storm water management: Clean water should be managed in a manner according to the Department of Water and Sanitation Best Practice Guidelines;
				▪ Barrier systems, including synthetic, clay and geological/natural or other approved mitigation methods to minimise contaminated seepage and runoff from entering the local aquatic systems;
				▪ Storm water management plan must be implemented to ensure clean storm water is diverted away from the surface operations and dirty water stored in the existing Pollution Control Dam (PCD);
				▪ The emergency stockpile should be managed to minimise infiltration of contaminants to the groundwater. Mitigation methods that should be considered include:
				  ▪ Management of the stockpile shape to control the ease with which water can run off from the facility.
				  ▪ The vegetation of the soil/overburden stockpile and covering them with soil to
					The National Water Act (NWA), 1998 (Act No. 36 of 1998)	Operational Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				minimise rainfall infiltration and mobilisation of dissolved metals. ▪ Implementation of a lime cover on overburden stockpiles to neutralise acidity.		
Storage/disposal of generated waste and the working with hazardous products	Operational Phase	Aquatic	Local	▪ Clean storm water must be diverted from operational sites and managed in such a manner to disperse runoff to prevent an accumulation of storm water flow that may carry contaminants from the site to aquatic systems; ▪ Ensure correct waste management; and ▪ Ensure correct storage systems are used for the storage of hazardous products throughout the project life.	The National Water Act (NWA), 1998 (Act No. 36 of 1998)	Operational Phase
Mine closure and rehabilitation	Decommissioning Phase	Aquatic	Municipality	▪ Decant should not be allowed to discharge into the associated aquatic systems. The decant can be collected and stored in PCD's as a short term mitigation measure; and ▪ Investigation into long term solutions for decant management needs to be conducted.	The National Water Act (NWA), 1998 (Act No. 36 of 1998)	Decommissioning Phase
Removal of infrastructure and surface rehabilitation.	Decommissioning Phase	Aquatic	Local	▪ Avoid rehabilitation or unimpeached areas; ▪ Stay within already impacted areas and avoid activity within the 100 m buffer zones; and ▪ Commence the phase during the dry season to limit runoff.	The National Water Act (NWA), 1998 (Act No. 36 of 1998)	Decommissioning Phase
Surface Rehabilitation	Decommissioning Phase	Aquatic	Local	▪ All infrastructures will be removed and sold or disposed of as legally required. All contaminated soil and rubble will be removed to the bottom of the shafts. Fill material from roads and hard parks will be removed to the bottom of the shafts, soils replaced, scarified and revegetated. All stockpiles of spoils will be placed in shaft voids, soils replaced and revegetated as set out in the operation phase above. The shafts will be sealed according to DME specifications. Electrical and water supplies to the mining area will be terminated and made safe.	N/A	Decommissioning Phase
Surface Rehabilitation	Decommissioning Phase	Aquatic	Local	▪ Previously disturbed areas will be monitored for the establishment of invasive alien plants. Environmentally friendly control methods will be used for the invasive species found	N/A	Decommissioning Phase
Surface Rehabilitation	Decommissioning Phase	Aquatic	Local	▪ Surface surveys will be undertaken over mined out	N/A	Decommissioning Phase

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				areas to establish the degree of subsidence and the success of the re-establishment of surface drainage and vegetation on rehabilitated areas. Remedial rehabilitation will be undertaken as required.		
Site clearing for the development of surface infrastructure through the removal of the top soil and weathered rocks	Construction Phase	Groundwater	Approximately 5 km^2	▪ Site clearance and construction activities should take place above the water table, at the unsaturated zone, (if possible); no impact on the groundwater level will then be expected. ▪ Site clearance should be kept to a minimum area and short duration. ▪ If trenches are going to be excavated below the water level, dewatering of the aquifer to lower the water table locally should be considered to ensure that the construction takes place above the groundwater level. Since the groundwater is not expected to be polluted at this stage, the utilisation of the water for activities such as dust suppression or irrigation will not cause negative environmental impacts. ▪ Install monitoring boreholes as recommended in Section 8.1.7.	N/A	▪ Groundwater monitoring must commence from the construction phase ▪ Where proven to be required, mitigation measures to reduce impact to the groundwater from the construction phase
Potential impacts of subsidence	Operational Phase	Groundwater	Unknown	▪ In order to prevent subsidence during the bord-and-pillar mining in the operational phase, it is required that a safety factor that provides sufficient pillar stability is applied. ▪ The mine should be monitored on an annually basis for subsidence and areas of subsidence should be rehabilitated by backfilling with waste rock and topsoil thereafter revegetating of the disturbed area. ▪ High extraction areas should be delineated as a high risk (depending on the local geology and dolerite sill) for subsidence and for groundwater impact. ▪ If possible, concurrent backfilling of the mine voids with fly ash should be conducted to minimise the risk of subsidence and neutralise any acid that might be generated. This should be done to assist with reducing the risk of subsidence and is a means of waste management. Should this occur a separate environmental authorisation will need to be applied for.	▪ SANS. ▪ River quality objectives. ▪ South African water quality guidelines for drinking, irrigation and livestock watering.	▪ Safety factors should be taken into consideration as mining commences; ▪ Groundwater level and quality monitoring at the shallow weathered aquifer (at high risk areas) should be conducted quarterly; and ▪ Annual subsidence monitoring (aerial surveys/ land surveys) throughout the consolidation project area and monthly subsidence monitoring through visual inspections at high risk areas

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Groundwater level and quality monitoring should be conducted on quarterly basis during operation, with special attention given to the subsidence areas. The monitoring frequency can be reduced post-closure depending on the trend of the monitoring results.		should be conducted
Removing water from the mine for the safety of people and operations and possible creation of cone of dewatering	Operational Phase	Groundwater	Approximately 126 km^2	▪ To minimise the impact associated with the lowering of the water table, dewatering should be conducted by abstracting groundwater ingress into mine voids during operation; ▪ Contaminated mine water should be stored in compartment and/or pollution control dams and reused for machine cooling or dust suppression underground; ▪ Groundwater monitoring should be conducted quarterly to assess the time series water level, water quality impacts and trends. Thereafter sampling frequency could be adjusted following the trend analysis; and ▪ Numerical model should be updated every two years in the first four years and thereafter every five years based on groundwater monitoring results. ▪ Impact to receptors such as private boreholes and surface water bodies (if proven through monitoring) should be compensated.	▪ SANS ▪ River quality objectives. ▪ South African water quality guidelines for drinking, irrigation and livestock watering.	▪ Groundwater monitoring must commence from the start of the construction phase. ▪ Mine should supply private borehole owners with clean water when contamination is detected. ▪ During operation, conceptual and numerical models should be refined every two years in the first four years and thereafter every five years based on groundwater monitoring results. Post closure, numerical model should be updated every 5 years to calibrate with monitoring results.
Groundwater contamination as a result of underground mining	Operational Phase	Groundwater	Approximately 126 km^2	▪ If subsidence occurs during operation, it should be rehabilitated as soon as possible to minimise water and oxygen inflow from the atmosphere. ▪ Nitrate-based explosives can contaminate water thus no underground water should be discharged unless it meets standards to minimise ground and surface water contamination. ▪ Quarterly groundwater monitoring should be conducted to assess the time series water level,	▪ SANS ▪ River quality objectives. South African water quality guidelines for drinking, irrigation and livestock watering.	▪ Groundwater monitoring must commence from the start of the construction phase. ▪ Mine should supply private borehole owners with clean water when

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				water quality impacts and trends.; and ▪ Numerical model should be updated every two years in the first four years and thereafter every five years based on groundwater monitoring results.		contamination is detected. During operation, conceptual and numerical models should be refined every two years in the first four years and thereafter every five years based on groundwater monitoring results. Post closure, numerical model should be updated every 5 years to calibrate with monitoring results.
Subsidence as a result of high extraction	Decommissioning Phase	Groundwater	Unknown	▪ In order to prevent subsidence during the bord-and-pillar mining in the operational phase, it is required that a safety factor that provides sufficient pillar stability is applied. ▪ The mine should be monitored on an annually basis for subsidence and areas of subsidence should be rehabilitated by backfilling with waste rock and topsoil thereafter revegetating of the disturbed area. ▪ If possible, concurrent backfilling of the mine voids with fly ash should be conducted to minimise the risk of subsidence and neutralise any acid that might be generated. This should be done to assist with reducing the risk of subsidence and is a means of waste management. Should this occur a separate environmental authorisation will need to be applied for. ▪ Groundwater level and quality monitoring should be conducted on quarterly basis during operation, with special attention given to the subsidence areas. The monitoring frequency can be reduced post-closure depending on the trend of the monitoring results.	▪ SANS ▪ River quality objectives.	▪ Mitigation measures should be implemented as soon as decant is detected. ▪ Numerical model should be updated every 5 years to calibrate with monitoring results.
Groundwater contamination as a result of underground mining	Decommissioning Phase	Groundwater	Unknown	▪ Impact to receptors such as private boreholes and surface water bodies (if proven through monitoring) should be compensated. ▪ Update numerical model every 5 years post	▪ SANS. ▪ River quality objectives.	▪ Mitigation measures should be implemented as soon as decant is detected.

Activity	Phase	Aspect	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				closure to calibrate with monitoring results.		▪ Numerical model should be updated every 5 years to calibrate with monitoring results.
Mine decanting and contamination of surface water bodies *No decant is expected at the shafts however subsidence, sinkholes and unsealed deep boreholes are potential decant locations and monitoring is required*	Decommissioning Phase	Groundwater	Unknown	▪ Decant should be collect and stored at a PCD as a short term solution; ▪ Long term management solutions for decant should be investigated; and ▪ Monitoring groundwater levels and decant (rate and quality) quarterly.	▪ SANS. ▪ River quality objectives.	▪ Mitigation measures should be implemented as soon as decant is detected. ▪ Numerical model should be updated every 5 years to calibrate with monitoring results.

6 Item 1(e): Impact Management Outcomes

A description of impact management outcomes, identifying the standard of impact management required for the aspects contemplated in Section 14 of Part A

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Construction Phase	Air Quality	Reduction in ambient air quality due to dust generation and soiling of surfaces	▪ Site clearing must be done in phases and use of suppressants and binders on exposed areas to reduce dust generation; ▪ The area of disturbance at all times must be kept to a minimum and no unnecessary clearing, digging or scraping must occur, especially on windy days (with wind speed ≥ 5.4 m/s); ▪ The drop heights when loading onto trucks and at tipping points should be minimised; ▪ Dust suppression must take place on exposed surfaces; and ▪ Set maximum speed limits on site and to have these limits enforced.	▪ National Environmental Management: Air Quality Act, Act.39 of 2004 standards 2009; ▪ National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013). ▪ Act, 2004 (Act No. 39 of 2004) – National Ambient Air Quality Standard for Particulate Matter with Aerodynamic Diameter less than 2.5 Microns Meters (PM 2.5) 2012
Mining Process: Tipping of ore at the Bunker and Stockpiling	Operational Phase	Air Quality	Reduction in air quality as a result of the crushing activities as well as the tipping of the coal into the bunker.	▪ Enclosure of tipping points and crusher; ▪ Use of water spray to prevent coal dust dispersion; ▪ The coal bunker design includes a cover and water sprays to prevent coal dust dispersion; and ▪ Ensure bi-weekly inspections of dust suppression equipment on the bunker and transfer stations and replace faulty components.	▪ National Environmental Management: Air Quality Act, Act.39 of 2004 standards 2009; ▪ National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) -

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
					National Dust Control Regulations (2013). ▪ Act, 2004 (Act No. 39 of 2004) – National Ambient Air Quality Standard for Particulate Matter with Aerodynamic Diameter less than 2.5 Microns Meters (PM 2.5) 2012
Operation of the Ventilation Shaft	Operational Phase	Air Quality	Release of TSD, PM_{10}, $PM_{2.5}$, NO^2, SO^2 and CO from the ventilation shafts will result in a deterioration of air quality	▪ Mitigation measures such as: use of electrostatic precipitators to remove fine particles is recommended if ambient levels are exceeding regulatory standards; ▪ Use of Catalytic Converters is recommended if the levels of toxic gases are in exceedance of the regulatory standards; and ▪ Use of gas scrubbers to remove particulates and/or gases from emissions being released form the ventilation shafts if regulatory standards are exceeded.	▪ Mine Health and Safety Act, 1996 (Act No. 29 of 1996) ▪ National Environmental Management: Air Quality Act, Act.39 of 2004 standards 2009; ▪ National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013). ▪ Act, 2004 (Act No. 39 of 2004) – National Ambient Air Quality Standard for Particulate Matter with Aerodynamic Diameter less than 2.5 Microns Meters (PM 2.5) 2012.
Sealing of shaft and rehabilitation	Decommissioning Phase	Air Quality	Sealing of Vent Shaft and rehabilitation results in dust emission	▪ Drop heights should be minimised when offloading materials; ▪ The dismantling area disturbed must be kept to a minimum; ▪ Limit rehabilitation activities to non-windy days, where possible; ▪ Rehabilitation must be undertaken in accordance with rehabilitation plan (Appendix O); and ▪ Dust suppression on exposed surfaces must be implemented including haul roads.	▪ National Environmental Management: Air Quality Act, Act.39 of 2004 standards 2009; ▪ National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013). ▪ Act, 2004 (Act No. 39 of 2004) – National Ambient Air Quality Standard for Particulate Matter with Aerodynamic Diameter less than 2.5 Microns Meters (PM 2.5) 2012.
Site clearing, including the removal of topsoil and vegetation; Construction of ventilation	Construction Phase	Noise	Noise will emanate from the machinery and vehicles operating during the construction activities	▪ Restricting construction activities to daylight hours (06:00 – 18:00); and ▪ Switching off equipment when not in use.	National Noise Control Regulations

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
shafts					
Operation of ventilation shafts	Operational Phase	Noise	Noise will emanate from the operation of the ventilation shafts	▪ The ventilation fan diffuser outlets should be installed horizontally and directed north	National Noise Control Regulations
Operation of the TCTS mine with associated infrastructure	Operational Phase	Noise	Noise will emanate from the operation of the TCTS mine specifically the crushing facility as well as conveyor belt	▪ Ensure regular inspections of the conveyor line are undertaken on a weekly basis and replace faulty rollers and other faulty components resulting in excessive noise. This should be undertaken not only from an environmental perspective but also from an operational perspective; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Investigate all noise complaints promptly and advise the complainant of the outcome(s).	National Noise Control Regulations
Removal of infrastructure and surface rehabilitation	Decommissioning Phase	Noise	Noise will emanate from the machinery and vehicles operating during the decommissioning activities	▪ Restricting decommissioning activities to daylight hours (06:00 – 18:00); ▪ Switching off equipment when not in use	National Noise Control Regulations
Sustained employment during operation	Operational Phase	Social	Job creation during operation	▪ Where feasible, promote the creation of employment opportunities for women and youth; ▪ Sasol Mining procurement and/or contracts department (or similar) to establish a monitoring system to ensure that the subcontractors honour the specified local employment policy. This can be stipulated in contractor agreements; ▪ If required, the local resident status of applicants should be verified in consultation with community representatives and local government; ▪ Ensure that existing employees have access to pertinent skills training and are able to improve their professional proficiencies throughout their employment with Sasol. This will assist with self-improvement and provide an opportunity for employees to achieve professional's goals; and ▪ In addition, it is recommended that local employment opportunities that may arise be maximised as far as possible, by intensifying efforts in the SLP, which are aimed at developing scarce skills.	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; ▪ National Environmental Management Act (Act of 1998). IDPs and SPFs of affected municipalities; and ▪ Company CSI Policy.
Operation of the Mine	Operational Phase	Social	Economic Growth will result in a positive contribution to GDP	▪ Recruitment to be coordinated by Sasol Mining in accordance with recruitment policy; ▪ Promotion of female and youth employment; ▪ Effective implementation of training and skills development initiatives.	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
					1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).
Operation of the Mine	Operational Phase	Social	Conflict / competition between newcomers and incumbent population	▪ Recruitment to be coordinated by Sasol Mining in accordance with recruitment policy; ▪ Promotion of female and youth employment; ▪ Effective implementation of training and skills development initiatives; and ▪ Where possible, maximise the extent of short-term employment (over and above the full time employees and contractors) through piecemeal work and the like.	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).
Operation of the Mine	Operational Phase	Social	Potential Financial implication for town developers	▪ Public awareness campaigns regarding subsidence; and ▪ Investment in development to secure housing options for employees, and thereby reassuring public.	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).
Operation of the Mine	Operational Phase	Social	Community development induced by Local Economic Development (LED) and Corporate Social Investment (CSI)	▪ The details of Sasol Mining's' proposed LED programmes must be designed and implemented in consultation with both community representatives and municipal management to ensure that the actual needs of communities are met; and ▪ All LED projects must include a monitoring and evaluation plan, to ensure that the effectiveness of each project is tracked and aligned to its intended objectives. Identified areas for improvement should be incorporated into the	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles;

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
				following years planning	▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).
Operation of the Mine	Operational Phase	Social	Potential subsidence related impacts	▪ Ensure regular communication with stakeholders; and ▪ Any unintended (factual) damage and/or losses that are incurred by impacted persons must be addressed on a case-by-case basis, in accordance with South African.	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).
Operation of the Mine	Operational Phase	Social	Theft of cattle, farming equipment and other valuables within the consolidation project site associated with increased activity from the mine	▪ Ensure theft is prohibited at the mine and warn workers of the consequence of stealing; ▪ Transporting workers to and from site after their shifts; ▪ Advise workers not to buy anything from farm workers; and ▪ All communication with farmers will be undertaken through the Sasol Mineral Rights Department (SMRD).	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).
Operation of the Mine	Operational Phase	Social	Operation-related health and safety impacts	▪ The mine should be maintained during its lifetime so as to minimise the risk of mine personnel being injured as result of failed machinery etc.; ▪ Operational health and safety programmes should be implemented; ▪ All mine employees should be issued with the appropriate PPE and educated regarding the risks involved in mining activities; ▪ Unauthorised access to the mine and future construction sites must be prevented through appropriate fencing and security to be erected/ established at the start of operation	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
				and maintained throughout the life of the proposed project; and ▪ Ensure that diversions are clearly marked and sign posted, especially for night time.	▪ National Environmental Management Act (Act of 1998).
Decommissioning of the Mine	Decommissioning Phase	Social	Dependency on Mine for sustaining local economy	▪ Develop alternative and sustainable livelihoods for instance through LED programmes listed in the Mine's SLP; ▪ During the life of mine workers are given the opportunity to better and formalise their skills in order to aid their attempts to find alternative employment; ▪ The Mine's SLP should provide strategies and measures that reduce job loss through redeployment at other operations; ▪ Where feasible alternatives to save jobs/avoid downscaling should be investigated beforehand, including LED, potential redeployment at other operation; ▪ In addition to this it is vital that at all times but particularly towards the end of mine life that issues around retrenchment are dealt with in a transparent manner. All workers must know where they stand with regard to employment, what processes will be followed in the event of retrenchment and what services are available to them in this regard. ▪ Proactively assess and manage the social and economic impacts on individuals, regions and economies where; retrenchment and/or closure of the mine are certain. In particular through promoting economic diversification, portable skills development and local economic development where possible; ▪ Ensure open discussions with relevant government departments to ensure the closure process is correctly followed; and ▪ Rehabilitation must be undertaken in accordance with rehabilitation plan.	▪ Mineral and Petroleum Resource Development Act (Act of 2002); ▪ Mine Health and Safety Act (Act of 1996); ▪ Occupational Health and Safety, 1993 (Act no. 85 of 1993) (OHS); ▪ International Human Rights Guiding Principles; ▪ IFC PS 4: Community Health, Safety and Security; and ▪ National Environmental Management Act (Act of 1998).
Undermining	Operational Phase	Heritage	Damage or destruction of NHRA Section 34, 35 and 36 heritage resources	▪ Develop a project specific Fossil Finds Procedure as a condition of authorisation; ▪ Develop and implement a project specific Conservation Management Plan as a condition of authorisation.	▪ The National Heritage Resources Act, 1999 (Act No. 25 of 1999) ▪ Regulations to the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (GN R 548) (SAHRA Regulations) ▪ SAHRA Minimum Standards: Archaeological and Paleontological Components of Impact Assessment Reports

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
Site clearing and topsoil removal for the construction of the ventilation shafts	Construction Phase	Soil, Land Use and Land Capability	Loss of topsoil as a resource: During clearing of vegetation and removal of soil for establishment of ventilation shafts (1.5 ha), the soil chemical and physical properties are impacted on. The movement of vehicles on the soil surface causes compaction which reduces the vegetation's ability to grow and as a result erosion could occur.	▪ If possible soil should be removed during dry months, as to reduce compaction; ▪ Only clear vegetation when and where necessary; ▪ Only the designated access routes are to be used; ▪ The soils stripped for the ventilation shafts should be stripped and conserved for rehabilitation; ▪ Topsoil stockpiles are to be kept to a maximum height of 3 m at a 2:5:1 slope; ▪ If erosion occurs on the site or on the stockpiles, corrective actions must be taken to minimise any further erosion from taking place; ▪ The handling of the stripped topsoil should be minimised to ensure the soil's structure does not deteriorate significantly; ▪ The stockpiles should be vegetated to reduce the risk of erosion, and to reinstitute the ecological processes within the soil; ▪ Compaction of the removed soil should be avoided by prohibiting traffic on stockpiles; and ▪ Ensure designed storm water management are in place.	Chamber of Mines Guidelines
Maintenance of roads and topsoil stockpiles	Operational Phase	Soil, Land Use and Land Capability	Topsoil losses can occur during the operational phase as a result of rainwater runoff and wind erosion from roads and soil stockpiles where steep slopes are present. Compaction of soils during operational phase will occur.	▪ Topsoil stockpiles are to be kept to a maximum height of 3 m at a 2:5:1 slope angle and away from drainages lines and surface water; ▪ Only the designated access routes are to be used; and ▪ If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place.	Chamber of Mines Guidelines
Potential impacts of operational phase on soils, land capability and land use (30 – 100 m below ground level)	Operational Phase	Soil, Land Use and Land Capability	Collapsed underground mine roof could potentially cause significant surface subsidence. This may restrict post mining land capability and agricultural productivity. Surface cracking and subsidence will occur due to large areas that could be affected by high extraction.	▪ Rehabilitation of cracks once identified and areas where vegetation is affected by ponding, where practicable ; ▪ Subsided areas can be backfilled and re-shaped to match the original topography to mitigate ponding and waterlogging conditions depending on the degree of the collapse and available soil material, where practicable; ▪ Planning for free drainage of ponded areas, where practicable; ▪ Monitoring of undermined areas to assess the effects of subsidence at surface. Annual surface surveys will be undertaken over mined out areas to establish the degree of subsidence; and ▪ Failing these mitigation measures, the only other alternative will be to compensate the farmers for loss of productive land.	Chamber of Mines Guidelines
Potential impacts of operational phase on soils, land capability and land use	Operational Phase	Soil, Land Use and Land Capability	Collapsed underground mine roof could potentially cause significant surface subsidence. This may restrict post	▪ Rehabilitation of cracks once identified and areas where vegetation is affected by ponding; ▪ Subsided areas can be backfilled and re-shaped to match	Chamber of Mines Guidelines

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
(>100 m below ground level)			mining land capability and agricultural productivity. Surface cracking and subsidence will occur due to large areas that could be affected by the high extraction.	the original topography to mitigate ponding and waterlogging conditions depending on the degree of the collapse and available soil material; ▪ Planning for free drainage of ponded areas; and ▪ Monitoring of undermined areas to assess the effects of subsidence at surface	
Rehabilitation of infrastructure areas, roads and subsided areas	Decommissioning Phase	Soil, Land Use and Land Capability	: Rehabilitation of roads, associated infrastructure and subsided areas could cause compaction and erosion if rehabilitation is not done correctly. This could be as a result of poor vegetation establishment which would result in exposed surfaces and increase the risk of erosion.	▪ Rehabilitate according to the rehabilitation plan; ▪ Return the land conditions capable of supporting prior land use or uses equal than prior land use to the extent feasible or practical. ▪ Contour slopes to minimise erosion and run-off; ▪ Plant native vegetation to prevent erosion and encourage self-sustaining development of a productive ecosystem such as *Cynodon dactylon, eragrostis tef, eragrostis chloromelas, chloris gayana, digitaria eriantha* and *panicum*; ▪ Remove buildings to foundation level. All rubble to be relocated to a specified approved rubble dump or used as backfilling in shafts, etc ▪ Use waste rock for backfill and followed by topsoil of 0.3 m to the extent feasible ▪ Compacted areas are to be ripped to loosen the soil and vegetation cover re-instated; ▪ Inventory of hazardous waste materials stored on site should be compiled and arrange complete removal; ▪ Seal the shaft by placing concrete plugs; ▪ Ensure proper storm water management designs are in place to ensure no erosion or ponding occurs, where practicable; ▪ Conduct soil contamination assessment to assess if any remediation is require prior to future land use development; ▪ Only designated access routes are to be used to reduce any unnecessary compaction; ▪ The topsoil should be shaped taking the pre-mining landscape into consideration, where practicable; ▪ The rehabilitated areas must be assessed twice a year for compaction, erosion and fertility; and ▪ Monitoring for subsidence must be done annually.	Chamber of Mines Guidelines
Site Clearing for the construction of the Ventilation Shafts	Construction Phase	Fauna & Flora	Site clearing resulting in alien plant invasion	▪ The footprint area should be kept as small as possible; ▪ Existing access roads should be used to reach the site for clearing and vehicles should not be allowed to traverse natural areas or leave the demarcated road; ▪ An alien invader management plan should be	▪ National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) ▪ National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004)

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
				implemented, whereby the disturbed site is monitored quarterly for at least two years to ensure that alien invasion does not take place.	▪ Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983)

High extraction underground mining	Operational Phase	Fauna & Flora	No direct loss of fauna, flora or sensitive ecosystems will occur, except if subsidence occurs. However, undermining of sensitive areas/landscapes leading to changes that will negatively affect the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mine is approximately 200 m.	▪ A comprehensive geotechnical investigation should be undertaken for the following:
				  ▪ Provide appropriate design parameters for pillar and overburden stability, in line with the actual geotechnical rockmass properties, and
				  ▪ Indicate any areas (undermining of the natural ecosystems) that may fall outside of these design parameters.
				▪ Following the geotechnical investigation, where required a provision must be made for the rehabilitation of these areas in the event of a possible risk of subsidence / intersection collapse.
				▪ The edge of the wetlands and a 100 m buffer must be demarcated near where the areas of high risk or definite subsidence area located and the ventilation shafts to reduce the risk of being impacted on from subsidence;
				▪ Sensitive landscape monitoring must be carried out to ensure no unnecessary impact to these areas is realised; and if so that a remedy is put in place as soon as possible;
				▪ The safety factor prescribe by the Rock Engineer must be used;
				▪ No high extraction mining to be done within 100 m from watercourses;
				▪ Monitoring should take place for excessive inflow into the underground workings;
				▪ If any plant SSC are recorded, these should be translocated with the involvement of a qualified botanist. The donor habitat should resemble the receiving habitat and the species/populations should be monitored monthly after translocation for up to one year; and
				▪ If any important fauna species (SSC) are identified (as listed in the expected species lists) that have not been included in the site-specific species lists, this should be reported to the Environmental Control Officer on site and the provincial authority (MPTA) for their reference. Further to this, measures should be undertaken to ensure that negative impacts to the species in question are not imposed due to the development.
					▪ National Environmental Management Act (NEMA), 1998 (Act 107 of 1998)
					▪ National Environmental Biodiversity Act (NEMBA), 2004 (Act 10 of 2004)
					▪ Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983)

Dismantling and removal of infrastructure	Decommissioning Phase	Fauna & Flora	Alien plant invasion may take place	▪ An alien invasive plant management plan should be implemented. ▪ Riparian habitat and river biomonitoring must be carried out during rehabilitation to ensure these areas are not	▪ National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) ▪ National Environmental

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
				impacted upon; and if they are remedial action must be implemented. Transects should be set up through representative sites and monitored on an annual basis; ▪ Should there be decant, the water will need to be treated with active or passive treatment and a Rehabilitation Plan will need to be compiled to rectify any damages. ▪ Rehabilitation must be undertaken in accordance with rehabilitation plan;	Biodiversity Act (NEMBA), 2004 (Act 10 of 2004) ▪ Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983)
Potential Impacts on Wetlands: Underground Mining (30-100 m below ground level)	Operational Phase	Wetland	Undermining of wetlands leading to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mining is between 30 – 100 m below ground level.	▪ No mitigation measures will reduce the impact of definite subsidence. In this case, a wetland offset strategy would need to be compiled.	▪ The NWA ▪ Section 21 (c), (g) and (i) of the NWA ▪ Section 24 of the Constitution NEM:BA ▪ NEMA ▪ Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); ▪ Mining and Biodiversity Guideline (DEA et al., 2013); ▪ MTPB, 2014
Potential Impacts on Wetlands: Underground Mining (>100 m below ground level)	Operational Phase	Wetland	Undermining of wetlands leading to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts. Depth of mining is >100 m below ground level.	▪ The highest safety factor as prescribed by the Rock Engineers must be adhered to. ▪ A geotechnical study would need to be compiled to determine the exact risk of subsidence; ▪ Wetland monitoring must be carried out to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible. ▪ A wetland offset strategy may need to be compiled.	▪ The NWA ▪ Section 21 (c), (g) and (i) of the NWA ▪ Section 24 of the Constitution ▪ NEM:BA ▪ NEMA ▪ Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); ▪ Mining and Biodiversity Guideline (DEA et al., 2013); ▪ MTPB, 2014
Mine closure and rehabilitation	Decommissioning Phase	Wetland	Post-mining decant of groundwater will have negative impacts on the wetlands as this water is likely to be of a poor water quality.	▪ Wetland monitoring must be carried out on wetlands that could possibly be impacted on by activities during rehabilitation to ensure no unnecessary impact to wetlands is realised; and if so that a remedy is put in place as soon as possible. Transects should be set up through representative sites and monitored on an annual basis; ▪ Groundwater and wetlands must be monitored post-mining for potential decant (3 years or until the system has stabilised). ▪ Decant should not be allowed to discharge into a wetland	▪ The NWA ▪ Section 21 (c), (g) and (i) of the NWA ▪ Section 24 of the Constitution ▪ NEM:BA ▪ NEMA ▪ Department of Water and Forestry (DWAF) guidelines for the delineation of wetlands (2005); ▪ Mining and Biodiversity

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
				system. The decant can be collected and stored in PCD's as a short term mitigation measure; ▪ Investigation into long term solutions for decant management needs to be conducted, should this water not be to the correct standards; ▪ Wetland Rehabilitation Plan will need to be compiled to rectify any damages should decant impact on wetlands; ▪ Monitoring groundwater levels and decant (rate and quality) quarterly.	Guideline (DEA et al., 2013); ▪ MTPB, 2014
Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Construction Phase	Surface Water	Siltation of surface water resources leading to deteriorated water quality	▪ Clearing of vegetation must be limited to the development footprint area, and the use of existing access roads must be prioritized so as to minimize construction of new access roads in these areas; ▪ If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments, dust generation and hazardous substances (oil, diesel, etc.) from construction vehicles used during site clearing; ▪ Dust suppression with water on the haul roads and cleared areas must be undertaken to limit dust. During dry times, this could be undertaken on a daily basis where there is visible dust being generated;	Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated.
Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Construction Phase	Surface Water	Alteration of surface water drainage patterns and river banks	▪ Construction work closer to the streams should be suspended during heavy rains to avoid erosion and sedimentation of the streams and unnecessary vehicle movement should be avoided. ▪ Designs should avoid the causing of erosion or spillages of material during the construction phase.	Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated.
Construction of ventilation shafts including vegetation clearing and sinking of ventilation shafts	Construction Phase	Surface Water	Deterioration of water quality due to dirty water reporting into natural water resources	▪ All fuel storage areas should be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; ▪ Vehicles should regularly be maintained as per the mine's developed maintenance program. This should also be inspected on a daily basis before use to ensure there are no leakages underneath ▪ Mobile chemical ablutions for construction workers and general waste bins should be provided and be maintained as per the developed mine's maintenance schedule; and ▪ No dirty water should be allowed off site and into a stream.	Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated.
Operation of the mine	Operational Phase	Surface Water	Water contamination leading to deterioration of water quality	▪ As proposed in the project activities, ensure that all the dirty water emanating from the dirty water areas is contained for re-use within the mine, to prevent discharge into the environment;	▪ Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
				▪ Use of storage compartments underground to store dirty water; ▪ All pollution control dams must be maintained and is required to operate with a 0.8 m freeboard and able to contain a 1:100 year flood event; ▪ All surface water pollution control structures will be inspected on a three monthly basis and maintenance work carried out as required. Furthermore, all structures (e.g. dams) registered in terms of the National Water Act will be maintained in accordance with the Act. ▪ The mines water balances and management of the water balance must be regularly updated and monitored. This should be updated as specified in the IWUL or if on an annual basis; ▪ The wash bays and workshops are be equipped with oil skimming facilities to remove oil and grease from the wash down water; ▪ Clean run-off must be directed around these facilities, and directed back to the clean water catchment; ▪ The emergency coal stockpile area at Thubelisha must ensure that dirty water from the stockpile area is contained and the seepage is minimised (No dirty water is permitted to be discharged to the clean water environment); ▪ No discharge of polluted water should be planned for or allowed; ▪ Where subsidence will occur during operation, measures to rehabilitate the surface area should be implemented as soon as possible to avoid impoundment of surface water; and ▪ Water quality monitoring should continue on the existing and newly proposed monitoring points to ensure detection of impacts.	all clean and dirty water must be separated. ▪ The clean water diversion will be sized to accommodate the 1:50 year storm event. ▪ The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.

High extraction underground mining	Operational Phase	Surface Water	Reduction in catchment yield	▪ There is no mitigation for the loss of catchment yield. However, the area to be stooped is assumed to be approximately 30 km^2 and makes up 8% of the total quaternary catchment of 371 km^2.
				▪ The mine will limit the extent of pillar extraction to target only areas with low potential water ingress. This implies excluding
				    ▪ All floodplain areas and areas within 100 m of a watercourse or 1: 100 year floodline whichever is greatest
				    ▪ All areas with a thin soil cover that have a significant catchment draining to them.
				▪ As far as is practical, the mine will avoid rocky outcrops,
					▪ Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated.
					▪ The clean water diversion will be sized to accommodate the 1:50 year storm event.
					▪ The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
				although the areas currently designated for pillar extraction do contain some percentage of thin cover and rocky outcrop. ▪ Clean water from upstream should be diverted around these areas and report to the natural streams. ▪ The surface of stooped areas will be inspected to ensure they remain free draining. This will involve the use of surface teams undertaking civil works such as cutting drains where required to ensure areas of settlement can drain. Sasol Mining has developed a range of strategies for stooped areas based on their experiences elsewhere ▪ The percentage decrease in MAR amounts to 8 % for B11C quaternary catchment (where the proposed new mining areas are located). Therefore, the loss in MAR for the quaternary catchment is considered to be of moderately low significant.	storm event.
Dismantling and removal of infrastructure	Decommissioning Phase	Surface Water	Siltation of surface water resources leading to deteriorated water quality	▪ Use of accredited contractors for removal or demolition of infrastructures; this will reduce the risk of waste generation and accidental spillages; ▪ Rehabilitated and backfilled areas (where subsidence has occurred) must be seeded as soon as possible to avoid siltation due to erosion; ▪ Surface inspection on the fully rehabilitated areas must be undertaken to ensure a surface profile that allows good drainage. This will ensure improvement or increased catchment yield to the surrounding streams. ▪ Rehabilitation must be undertaken in accordance with rehabilitation plan (Appendix O);	▪ Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated. ▪ The clean water diversion will be sized to accommodate the 1:50 year storm event. ▪ The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.
Mine closure and rehabilitation	Decommissioning Phase	Surface Water	Decant of mine water leading to deterioration of water quality in the nearby streams	▪ Should decant occur, decant should be collect and stored at a PCD as a short term solution; ▪ Long term management solutions for decant should be investigated; ▪ Water quality monitoring must continue to enable the detection of decant when it occurs so immediate mitigation measures can be implemented. Monitoring should continue for as long as decant is taking place.	▪ Based on the GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated. ▪ The clean water diversion will be sized to accommodate the 1:50 year storm event. ▪ The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
Site clearance and construction of ventilation shafts within associated wetland habitats and river catchment	Construction Phase	Aquatic	Increased runoff and erosion within the rivers nearby to the ventilation shafts	▪ Minimise and keep the footprint as small as possible; ▪ Buffer zones (100 m wetlands and 100 m riparian); ▪ Revegetation of the construction footprint as soon as possible; ▪ Storm water should be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ Construction should take place during the dry season to minimise runoff; and ▪ Sequential removal of the vegetation (not all vegetation immediately).	The National Water Act (NWA), 1998 (Act No. 36 of 1998)
Waste generation/disposal and the use of hazardous products	Construction Phase	Aquatic	Water and habitat quality deterioration	▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ Approved barrier systems to minimise contaminated seepage and runoff from entering the local aquatic systems; ▪ Ensure correct waste management; and ▪ Ensure correct storage systems are used for the storage of hazardous products when constructing.	The National Water Act (NWA), 1998 (Act No. 36 of 1998)
Underground mining high to definite risk subsidence areas	Operational Phase	Aquatic	Subsidence of land within the river catchment and subsidence of land underneath river channels resulting in poor ecosystem functioning	▪ No mitigation measures will be able to prevent subsidence where the depth of mining is shallower than 100 m.	The National Water Act (NWA), 1998 (Act No. 36 of 1998)
Underground mining low risk subsidence areas	Operational Phase	Aquatic	Subsidence of land within the river catchment and subsidence of land underneath river channels resulting in poor ecosystem functioning	▪ Complete a geotechnical study to identify high risk subsidence areas and avoid or mitigate to support them; ▪ Ensure sufficient pillar support and safety factors to prevent subsidence of undermined wetland/aquatic areas; ▪ The highest safety factor possible (at least 2) must be used for areas of shallow mining (confirm with geotechnical study); ▪ Underground mining should avoid aquifers especially due to the proposed high extraction near aquatic and wetland systems. Punctured aquifers could lead to the dewatering of aquatic/wetland systems; ▪ Mining should not occur above 100 m below aquatic/wetland areas or within the 100 m wetland buffer zones (confirm with geotechnical study if areas can be mined shallower than 100 m without the risk of subsidence); and ▪ Monitoring should take place for excessive inflow into the underground workings.	The National Water Act (NWA), 1998 (Act No. 36 of 1998)
Emergency coal stockpiling	Operational Phase	Aquatic	Runoff from the emergency coal	▪ Clean and dirty water storm water management: Clean	The National Water Act (NWA), 1998

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards

			stockpile into local aquatic systems will result in the degradation of the water and habitat quality of the polluted system	water should be managed in a manner according to the Department of Water and Sanitation Best Practice Guidelines;
				▪ Barrier systems, including synthetic, clay and geological/natural or other approved mitigation methods to minimise contaminated seepage and runoff from entering the local aquatic systems;
				▪ Storm water management plan must be implemented to ensure clean storm water is diverted away from the surface operations and dirty water stored in the existing Pollution Control Dam (PCD);
				▪ The emergency stockpile should be managed to minimise infiltration of contaminants to the groundwater. Mitigation methods that should be considered include:
				  ▪ Management of the stockpile shape to control the ease with which water can run off from the facility.
				  ▪ The vegetation of the soil/overburden stockpile and covering them with soil to minimise rainfall infiltration and mobilisation of dissolved metals.
				  ▪ Implementation of a lime cover on overburden stockpiles to neutralise acidity.
					(Act No. 36 of 1998)

Storage/disposal of generated waste and the working with hazardous products	Operational Phase	Aquatic	Runoff from operational site containing contaminants will degrade habitat and water quality of polluted aquatic systems	▪ Clean storm water must be diverted from operational sites and managed in such a manner to disperse runoff to prevent an accumulation of storm water flow that may carry contaminants from the site to aquatic systems; ▪ Ensure correct waste management; and ▪ Ensure correct storage systems are used for the storage of hazardous products throughout the project life.	The National Water Act (NWA), 1998 (Act No. 36 of 1998)
Mine closure and rehabilitation	Decommissioning Phase	Aquatic	Decant of severely contaminated water into local aquatic ecosystems	▪ Decant should not be allowed to discharge into the associated aquatic systems. The decant can be collected and stored in PCD's as a short term mitigation measure; and ▪ Investigation into long term solutions for decant management needs to be conducted.	The National Water Act (NWA), 1998 (Act No. 36 of 1998)
Removal of infrastructure and surface rehabilitation.	Decommissioning Phase	Aquatic	Increased runoff and erosion	▪ Avoid rehabilitation or unimpeached areas; ▪ Stay within already impacted areas and avoid activity within the 100 m buffer zones; and ▪ Commence the phase during the dry season to limit runoff.	The National Water Act (NWA), 1998 (Act No. 36 of 1998)
Surface Rehabilitation	Decommissioning Phase	Aquatic	Impact associated with the removal of infrastructure	▪ All infrastructures will be removed and sold or disposed of as legally required. All contaminated soil and rubble will be removed to the bottom of the shafts. Fill material from roads and hard parks will be removed to the bottom of the shafts, soils replaced, scarified and revegetated. All	N/A

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
				stockpiles of spoils will be placed in shaft voids, soils replaced and revegetated as set out in the operation phase above. The shafts will be sealed according to DME specifications. Electrical and water supplies to the mining area will be terminated and made safe.	
Surface Rehabilitation	Decommissioning Phase	Aquatic	Impact associated with the removal of infrastructure	▪ Previously disturbed areas will be monitored for the establishment of invasive alien plants. Environmentally friendly control methods will be used for the invasive species found	N/A
Surface Rehabilitation	Decommissioning Phase	Aquatic	Impact associated with the removal of infrastructure	▪ Surface surveys will be undertaken over mined out areas to establish the degree of subsidence and the success of the re-establishment of surface drainage and vegetation on rehabilitated areas. Remedial rehabilitation will be undertaken as required.	N/A
Site clearing for the development of surface infrastructure through the removal of the top soil and weathered rocks	Construction Phase	Groundwater	Lowering of the water table	▪ Site clearance and construction activities should take place above the water table, at the unsaturated zone, (if possible); no impact on the groundwater level will then be expected. ▪ Site clearance should be kept to a minimum area and short duration. ▪ If trenches are going to be excavated below the water level, dewatering of the aquifer to lower the water table locally should be considered to ensure that the construction takes place above the groundwater level. Since the groundwater is not expected to be polluted at this stage, the utilisation of the water for activities such as dust suppression or irrigation will not cause negative environmental impacts. ▪ Install monitoring boreholes as recommended in Section 8.1.7.	N/A
Subsidence as a result of high extraction	Operational Phase	Groundwater	Groundwater quality deterioration	▪ In order to prevent subsidence during the bord-and-pillar mining in the operational phase, it is required that a safety factor that provides sufficient pillar stability is applied. ▪ The mine should be monitored on an annually basis for subsidence and areas of subsidence should be rehabilitated by backfilling with waste rock and topsoil thereafter revegetating of the disturbed area. ▪ High extraction areas should be delineated as a high risk (depending on the local geology and dolerite sill) for subsidence and for groundwater impact. ▪ If possible, concurrent backfilling of the mine voids with fly ash should be conducted to minimise the risk of subsidence and neutralise any acid that might be	▪ SANS. ▪ River quality objectives. ▪ South African water quality guidelines for drinking, irrigation and livestock watering.

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
				generated. This should be done to assist with reducing the risk of subsidence and is a means of waste management. Should this occur a separate environmental authorisation will need to be applied for. ▪ Groundwater level and quality monitoring should be conducted on quarterly basis during operation, with special attention given to the subsidence areas. The monitoring frequency can be reduced post-closure depending on the trend of the monitoring results.	
Removing water from the mine for the safety of people and operations and possible creation of cone of dewatering	Operational Phase	Groundwater	Lowering of the water table	▪ To minimise the impact associated with the lowering of the water table, dewatering should be conducted by abstracting groundwater ingress into mine voids during operation; ▪ Contaminated mine water should be stored in compartment and/or pollution control dams and reused for machine cooling or dust suppression underground; ▪ Groundwater monitoring should be conducted quarterly to assess the time series water level, water quality impacts and trends. Thereafter sampling frequency could be adjusted following the trend analysis; and ▪ Numerical model should be updated every two years in the first four years and thereafter every five years based on groundwater monitoring results. ▪ Impact to receptors such as private boreholes and surface water bodies (if proven through monitoring) should be compensated.	▪ SANS. ▪ River quality objectives. ▪ South African water quality guidelines for drinking, irrigation and livestock watering.
Groundwater contamination as a result of underground mining	Operational Phase	Groundwater	Groundwater contamination	▪ If subsidence occurs during operation, it should be rehabilitated as soon as possible to minimise water and oxygen inflow from the atmosphere. ▪ Nitrate-based explosives can contaminate water thus no underground water should be discharged unless it meets standards to minimise ground and surface water contamination. ▪ Quarterly groundwater monitoring should be conducted to assess the time series water level, water quality impacts and trends.; and ▪ Numerical model should be updated every two years in the first four years and thereafter every five years based on groundwater monitoring results.	▪ SANS. ▪ River quality objectives. ▪ South African water quality guidelines for drinking, irrigation and livestock watering.
Subsidence as a result of high extraction	Decommissioning Phase	Groundwater	Lowering of the water table	▪ In order to prevent subsidence during the bord-and-pillar mining in the operational phase, it is required that a safety factor that provides sufficient pillar stability is applied. ▪ The mine should be monitored on an annually basis for subsidence and areas of subsidence should be	▪ SANS. ▪ River quality objectives.

Activity	Phase	Aspect	Potential Impact	Mitigation Measures	Compliance with standards
				rehabilitated by backfilling with waste rock and topsoil thereafter revegetating of the disturbed area. ▪ If possible, concurrent backfilling of the mine voids with fly ash should be conducted to minimise the risk of subsidence and neutralise any acid that might be generated. This should be done to assist with reducing the risk of subsidence and is a means of waste management. Should this occur a separate environmental authorisation will need to be applied for. ▪ Groundwater level and quality monitoring should be conducted on quarterly basis during operation, with special attention given to the subsidence areas. The monitoring frequency can be reduced post-closure depending on the trend of the monitoring results.	
Groundwater contamination as a result of underground mining	Decommissioning Phase	Groundwater	Groundwater contamination	▪ Impact to receptors such as private boreholes and surface water bodies (if proven through monitoring) should be compensated. ▪ Update numerical model every 5 years post closure to calibrate with monitoring results.	▪ SANS. ▪ River quality objectives.
Mine decanting and contamination of surface water bodies *No decant is expected at the shafts however subsidence, sinkholes and unsealed deep boreholes are potential decant locations and monitoring is required*	Decommissioning Phase	Groundwater	Decanting of the closed mine	▪ Decant should be collect and stored at a PCD as a short term solution; ▪ Long term management solutions for decant should be investigated; and ▪ Monitoring groundwater levels and decant (rate and quality) quarterly.	▪ SANS. ▪ River quality objectives.

7 Financial Provision

7.1 Item (i)(1): Determination of the amount of Financial Provision

The financial provision calculation is done in accordance with the requirements of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as amended[1] and associated regulations.[2] These Regulations provide that the holder of a mining right must make full financial provision for rehabilitation of negative environmental impacts.

The regulations for the determination of financial provision for mine rehabilitation and closure were promulgated on 20 November 2015 (GN R1147) under the NEMA, as amended. This assessment of the financial provision did not address any of the requirements of these promulgated regulations.

In terms of the new Financial Provision Regulations, a holder will have 39 months to assess, review and adjust the sum of the financial provision in accordance with Regulation 9 and 11. Failure to do so will mean that the existing approved financial provision will lapse after 45 calendar days after the lapsing of the 39-month period. Thus, the implementation date is extended to February 2019.

7.1.1 Item (i)(1)(a): Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under Regulation 22 (2) (d) as described in 2.4 herein

Closure and rehabilitation is a continuous series of activities that begin with planning prior to the project's design and construction, and end with achievement of long-term site stability and the establishment of a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it will also reduce the financial burden of closure and rehabilitation.

The following points outline the main objectives for rehabilitation and closure:

- Achieve a final land use that is sustainable and meets both legislative requirements and stakeholder needs.
- Maintain and monitor all rehabilitated areas following re-vegetation and, if this monitoring shows that the objectives have been met, make an application for closure;
- Comply with local, district and national regulatory requirements; and

[1] Previously, closure methodology was prescribed in Section 41 (1) of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) and its Regulations, but these provisions have been repealed. Section 24P in NEMA as amended provides that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts arising from mining activities

[2] Environmental Impact Assessment Regulations, 2014, GN R982 in Government Gazette 38282 of 4 December 2014

- Follow a comprehensive consultation and communication process with all stakeholders.

Rehabilitation and closure objectives have been tailored to the consolidation project at hand. This Rehabilitation, Decommissioning and Mine Closure Plan aims to assist Sasol Mining in carrying out successful rehabilitation for the consolidation project.

7.1.2 Item (i)(1)(b): Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties

The Closure report will be made available for public review and comment with this draft EIA and comments will be captured in the final EIA.

7.1.3 Item (i)(1)(c): Provide a rehabilitation plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure

Refer to Appendix O for the complete Rehabilitation Plan associated with the consolidation project.

7.1.4 Item (i)(1)(d): Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives

The Rehabilitation Plan has been compiled in support of the primary closure objectives which are to remove unwanted infrastructure and rehabilitate the land to a suitable mixed end land use which provides a safe and stable environment for surrounding receptors.

7.1.5 Item (i)(1)(e): Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline

Sasol is currently in the process of aligning all their operations (including Twistdraai Colliery: Thubelisha Shaft and the Vaalkop mining) to the new Financial Provision Regulations GN R1147. Sasol indicated that they have a dedicated trust fund that appropriately covers all their operations of which Thubelisha and Vaalkop is a part of.

Table 7-1: Summary of Combined Closure Cost Estimate

	Digby Wells Environmental Sasol Thubelisha: Combined Closure Cost Estimate
Thubelisha Shaft 1 (Jones and Wagener)	R 84 852 749
Section 102 two Ventilation shaft complexes and subsidence	R24 091 430
Grand Total (Excl. VAT)	**R 108 944 179**

Table 7-2: Estimated Financial Provision for Additional Proposed Infrastructure and Subsidence

	Digby Wells Environmental Sasol Thubelisha: Combined Closure Cost Estimate
Section 102 Ventilation shaft complexes (Thubelisha and Trichardtsfontein)	R 20 487 895
Monitoring and maintenance	R17 064 171
Grand Total (Excl. VAT)	**R24 091 430**

7.1.6 Item (i)(1)(f): Confirm that the financial provision will be provided as determined

Sasol is currently in the process of aligning all their operations (including Twistdraai Colliery: Thubelisha Shaft and the Vaalkop mining) to the new Financial Provision Regulations GN R1147. Sasol indicated that they have a dedicated trust fund that appropriately covers all their operations of which Thubelisha and Vaalkop is a part of.

8 Monitoring compliance with and performance assessment

The proposed monitoring requirements have been discussed below.

8.1 Item 1(g): Monitoring of impact management actions

A monitoring programme is essential as a management tool to detect negative impacts as they arise and to ensure that the necessary mitigation measures are implemented.

8.1.1 Air Quality

The findings of this study have shown that the operational phase will lead to minimal impact on the ambient atmosphere. As a result, continuous assessment of ambient level of pollutants will not be recommended. Sasol Mining will be responsible for keeping records of all environmental monitoring undertaken for the consolidation project.

8.1.1.1 PM_{10} Monitoring Programme

Sasol Mining management should conduct once-off biannual PM_{10} monitoring – to establish ambient levels of this pollutant at a representative site during the operational phase. Such data will be useful, if in future the consolidation project comes under scrutiny from regulatory authorities.

8.1.2 Soil, Land use and Land Capability

Soil monitoring plan guidelines should be put in place to ensure that rehabilitation is a success from a soils perspective. Monitoring should always be carried out at the same time of the year. Soils should be sampled and analysed for the following parameters once in a year:

- pH (KCl);
- Phosphorus (Bray 1);
- Cations: Calcium, Magnesium, Potassium, Sodium (mg/kg);
- Soil organic carbon (%); and
- Soil texture (Clay, Silt and Sand).

The following maintenance is required:

- Repair any damage on soils caused by erosion;
- Monitor subsidence and cracks;
- Demarcate no go zones where possible while the vegetation is establishing;
- The consolidation project and rehabilitated area must be fenced and animals should be kept off the area until the vegetation is self-sustaining;
- Fertilize rehabilitated area with nitrogen containing fertiliser after germination of seeds;
- If soil is contaminated, treat the soils by means of in-situ bio-remediation; and
- If in-situ treatment is not possible then the contaminated soil must be classified according to the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Material and disposed at an appropriate, permitted or licensed disposal facility.

8.1.3 Fauna and Flora

The only two aspects requiring monitoring based on the flora and fauna assessment is the establishment of alien invasive plant species and biomonitoring of River/Riparian areas. Further information regarding the monitoring of fauna and flora is discussed in Table 8-5.

8.1.4 Wetlands

Monitoring of the wetlands and mining activities is important to detect any predicted or unforeseen impacts to these sensitive systems and to understand the impact so that a remedial action can be carried out.

It is important to manage impacts to the environment and protect the ecosystem services that it provides; and this is particularly important with regards to wetlands and water resources. The Table 8-5 summarises the recommended monitoring plan for the consolidation project.

8.1.5 Surface Water

TCTS has a surface water monitoring and reporting programme in place and this was revised in June 2016. The existing monitoring and reporting programme is based upon the recommendations made in the environmental monitoring chapter of the Environmental Management Plan (EMP) for the Twistdraai Colliery: Thubelisha Shaft (TCTS) as well as monitoring requirements specified in the approved Water Use License (license no: 04/B11C/ACGIJ/995) issued for the TCTS operation. The monitoring and reporting programme states that the monitoring points, as provided in the Water Use License (license no: 04/B11C/ACGIJ/995) which are points along the conveyor, not regarded as effective use of resources as the impact of the conveyor is perceived to be very low or insignificant. It then recommended that sampling on these 17 points will be continued on a monthly basis until June 2017 to gather sufficient data for a motivation to remove this requirement from the Thubelisha IWUL. Water quality monitoring at the locations where sampling was undertaken during this study is recommended to be continued for a period until the baseline has been established. Table 8-1 and Table 8-2 provide the coordinates of the monitoring locations.

Table 8-1: Surface Water Monitoring Locations (TCTS)

Site name	Latitude	Longitude	Monitoring frequency	Description
F14205W	S 26°28'16.14"	E 29°17'14.76"	Monthly	Upstream monitoring point for conveyor crossing 1 of tributary of Debeerspruit
F14206W	S 26°28'15.81"	E 29°17'20.80"	Monthly	Downstream monitoring point for conveyor crossing 1 of tributary of Debeerspruit

Site name	Latitude	Longitude	Monitoring frequency	Description
R14301W	S 26°28'51.48"	E 29°17'19.97"	Monthly	Monitoring point for conveyor crossing 2 of tributary of Debeerspruit
R14401W	S 26°29'46.79"	E 29°16'54.88"	Monthly	Surface water monitoring point for conveyor crossing 3 of tributary of Trichardtsfontein Dam
R14402W	S 26°29'38.68"	E 29°16'39.89"	Monthly	Surface water monitoring point for conveyor crossing 3 of tributary of Trichardtsfontein Dam
R14403W	S 26°30'29.85"	E 29°16'01.33"	Monthly	Monitoring point for conveyor crossing 4 of tributary of Trichardtsfontein Dam
R14404W	S 26°30'28.72"	E 29°15'48.27"	Monthly	Downstream monitoring point for conveyor crossing 4 of tributary of Trichardtsfontein Dam
T14003W	S 26°30'50.15"	E 29°15'12.68"	Monthly	Monitoring point for conveyor crossing 5 of tributary of Klip Spruit
G58401W	S 26°31'13.84"	E 29°14'56.78"	Monthly	Monitoring point for conveyor crossing 6 of tributary of Klip Spruit
G58402W	S 26°31'32.26"	E 29°14'39.99"	Monthly	Upstream monitoring point for conveyor crossing 7 of tributary of Klip Spruit
G58403W	S 26°31'29.03"	E 29°14'35.21"	Monthly	Downstream monitoring point for conveyor crossing 7 of tributary of Klip Spruit
G29012W	S 26°32'15.02"	E 29°13'44.72"	Monthly	Upstream monitoring point for conveyor crossing 8 of Klip Spruit
D13702W	S 26°32'15.07"	E 29°13'34.14"	Monthly	Downstream monitoring point for conveyor crossing 8 of Klip Spruit
G29013W	S 26°32'47.29"	E 29°12'52.42"	Monthly	Upstream monitoring point for conveyor crossing 9 of tributary of Klip Spruit
D13703W	S 26°32'44.33"	E 29°12'50.78"	Monthly	Downstream monitoring point for conveyor crossing 9 of tributary of Klip Spruit
G29014W	S 26°33'00.44"	E 29°12'35.36"	Monthly	Upstream monitoring point for conveyor crossing 10 of tributary of Klip Spruit

Site name	Latitude	Longitude	Monitoring frequency	Description
G29015W	S 26°32'56.63"	E 29°12'31.77"	Monthly	Downstream monitoring point for conveyor crossing 10 of tributary of Klip Spruit
Site A	S 26°28'34.44"	E 29°17'47.08"	Monthly	Upstream point in the Debeerspruit. Coincide with the upstream biomonitoring point.
Site B	S 26°27'27.58"	E 29°17'53.44"	Monthly	Downstream point in the Debeerspruit. Coincide with the downstream biomonitoring point.
Site C	S 26°27'7.86"	E 29°17'17.35"	Monthly	Downstream of the TCTS in the unnamed tributary of the Debeerspruit.
F14203W	S 26°27'54.03"	29°54'41.01"	Monthly	500 Ml pollution control dam at Thubelisha shaft.
F14204W	S 26°27'34.90"	29°34'30.77"	Monthly	20 Ml pollution control dam at Thubelisha shaft.
Sewage final	S 26°27'35.03"	E 29°17'32.61"	Biweekly	Final effluent from the treated domestic wastewater plant
Storm1	S 26°27'55.61"	E 29°17'18.87"	Ad hoc after rain storms	Clean stormwater discharge to the environment

Geographic Coordinate System WGS84 Datum

Table 8-2: Surface Water Monitoring Locations (Vaalkop, 2017)

Site name	Latitude	Longitude	Monitoring frequency	Description
SASSW01	S 26°24'31.78"	E 29°25'55.97"	Monthly	Upstream point on the Steenkoolspruit
SASSW02	S 26°20'42.32"	E 29°24'6.34"	Monthly	Downstream point on the Steenkoolspruit
SASSW03	S 26°26'0.77"	E 29°24'9.50"	Monthly	Upstream point on the east-Piekespruit
SASSW04	S 26°24'5.40"	E 29°21'9.70"	Monthly	Downstream point on the east-Piekespruit
SASSW05	S 26°22'27.86"	E 29°22'41.51"	Monthly	Unnamed tributary of the Steenkoolspruit within the project area
SASSW06	S 26°26'32.92"	E 29°21'10.61"	Monthly	monitoring point on the west-Piekespruit within project area

Site name	Latitude	Longitude	Monitoring frequency	Description
R 11	S 26°28'27.84''	E 29°21'13.96''	Monthly	Unnamed tributary of the Piekespruit within the project area
Site A	S 26°28'34.44"	E 29°17'47.08"	Monthly	Upstream point in the Debeerspruit. Coincide with the upstream biomonitoring point.
R14402W	S 26°29'38.68"	E 29°16'39.89"	Monthly	Surface water monitoring point for conveyor crossing 3 of tributary of Trichardtsfontein Dam

Geographic Coordinate System WGS84 Datum

8.1.5.1 Sampling variables and frequency

A monthly sampling schedule and analysis followed is indicated in Table 8-3.

Table 8-3 : Surface water quality variables, monitoring frequencies and limits

Variable	Unit	Frequency	Limits (IWUL)
pH		monthly	
Conductivity	mS/m	monthly	70
TDS	mg/ℓ	monthly	-
Dissolved oxygen	mg/ℓ	monthly	6
Suspended Solids	mg/ℓ	monthly	25
$S0_4$	mg/ℓ	monthly	200
Mn	mg/ℓ	monthly	-
Ca	mg/ℓ	monthly	-
Mg	mg/ℓ	monthly	-
Na	mg/ℓ	monthly	-
Cl	mg/ℓ	monthly	-
$N0_3$/ $N0_2$ as N (mg/ℓ)	mg/ℓ	monthly	-
NH_4 as N	mg/ℓ	monthly	-
$P0_4$ as P	mg/ℓ	monthly	-
Alkalinity	mg/ℓ	monthly	-
B	mg/ℓ	quarterly	-
Al	mg/ℓ	monthly	-
F	mg/ℓ	monthly	-

Variable	Unit	Frequency	Limits (IWUL)
Cd	mg/ℓ	quarterly	-
Pb	mg/ℓ	quarterly	-
Ni	mg/ℓ	quarterly	-
Cu	mg/ℓ	quarterly	-
Zn	mg/ℓ	quarterly	-
Total Hardness	mg/ℓ	monthly	-
Fe	mg/ℓ	monthly	-

8.1.5.2 Methods to be followed

The method of surface water monitoring will be undertaken following the procedure outlined below:

- Only grab samples will be collected using a clean sterilised plastic bottles;
- Recording of the time, date and person that collected the sample will be done on each sample collected; and
- Samples will be stored in a cool place prior to delivery to the laboratory.

8.1.5.3 Data quality control

Once the data has been received from the laboratory, error checking will be done, comparing the new set of data with historic records. An ion balance error of ± 10% will be used as an acceptable range. The data is then stored on WISH database.

8.1.6 Aquatic Ecology

The monitoring programme should be designed to enable the detection of potential negative impacts brought about by the consolidation project. Table 8-4 highlights some important aspects to monitor in reference to aquatic biota for the duration of the consolidation project. Monitoring should be conducted by a certified aquatic specialist. The parameters in the table below should be monitored at the monitoring points in this study (with the exception of toxicity testing). However, site S2 should be moved further downstream to an area where macroinvertebrate and fish sampling can be conducted.

Table 8-4: Aquatic Ecology Monitoring Programme

Parameters to be monitored	Monitoring objectives	Frequency of monitoring
In Situ water quality	Maintaining within the threshold effect values stipulated by DWAF (1996)	Bi-annual (dry and wet season)

Parameters to be monitored	Monitoring objectives	Frequency of monitoring
IHAS and IHIA (Habitat Indicators)	Determine changes in habitat condition and maintain/improve determined category per reach in this study	Bi-annual for IHAS (dry and wet season) and annually for the IHIA
Macroinvertebrate assemblages using SASS5 and MIRAI	Determine changes in macroinvertebrate assemblages of the associated aquatic systems and maintain/improve determined category per reach in this study	Bi-annual sampling using SASS5 (dry and wet season) with the MIRAI being conducted annually
Fish assessment using FRAI	Determine changes in fish assemblages of the associated aquatic systems and maintain/improve determined category per reach in this study	Fish sampling conducted bi-annually (dry and wet season) with the FRAI being determined annually
Ecostatus determination using the ecostatus model (version 2.0)	Determine changes from the calculated ecostatus for the river reaches of concern in this study and maintain/improve determined category per reach	Ecostatus determination should be done annually
Toxicity Testing (screening)	Determine the toxicity of stored mine or decant water in any PCD associated with aquatic systems	Bi-annual (dry and wet season)

8.1.7 Groundwater

Groundwater monitoring should be undertaken to establish the following:

- The potential impact of mine dewatering on the local aquifers, through monitoring of groundwater levels; and
- Groundwater quality trends, through sampling.
- Deep and shallow aquifer monitoring is recommended:
- Shallow aquifer monitoring boreholes should be drilled to a maximum depth of 30 mbgl; and
- Deep aquifer monitoring boreholes should be drilled to depths ranging between 80 and 200 mbgl, intersecting the mine void.

The recommended groundwater monitoring locations are presented in Table 9 6 of the groundwater specialist study (Appendix N). A total of 65 monitoring locations are proposed, 47 existing boreholes and 18 proposed boreholes to be drilled once the new mining areas begin to be mined.

8.1.7.1 Water Level

Groundwater levels must be recorded on a quarterly basis to detect any changes or trends in groundwater elevation and flow direction.

8.1.7.2 Water Sampling and Preservation

When sampling the following procedures are proposed:

- One litre plastic bottles with a cap are required for the sampling exercises;
- Glass bottles are required if organic constituents are to be tested in areas where hydrocarbon release is expected, such as petrol storage tanks or workshop areas;
- Collected samples must be stored in cooler box or fridge while on site to a temperature of about 4^0C and should be delivered to the laboratory within 24 hours; and
- Sample bottles should be marked clearly with the borehole name, date of sampling, sampling depth and the sampler's name and submitted to a laboratory that analyses in accordance with the methods prescribed by the South African Bureau of Standards in terms of the Standards Act, Act 30 of 1982.

8.1.7.3 Sampling Frequency

Groundwater is a slow-moving medium and drastic changes in the groundwater composition are not normally encountered within days. Considering the proximity of private boreholes and streams to the proposed mine, quality monitoring should be conducted quarterly to reflect influences of wet and dry seasons. The sampling frequency could be adjusted following the trend analysis.

Samples should be collected by using Water Research Commission (WRC) (2007) Groundwater Sampling: Samples should be submitted to a laboratory that analyses in accordance with the methods prescribed by the South African Bureau of Standards in terms of the Standards Act, Act 30 of 1982.

It is suggested that quarterly samples be collected, extending up to two years post closure and based on the result trends it can be adjusted until a sustainable situation is reached and after it has been signed off by the authorities

8.1.7.4 Parameters to be monitored

- TDS, EC, pH, Alkalinity;
- Major ions i.e. Ca, Mg, Na, K, SO_4, NO_3, F, Cl; and

- Minor and trace metals, including As, Al, Co, Cr, Zn, Cd, Cu, Fe, Ni, V, Mn.

8.1.7.5 *Data Storage*

During any consolidation project, good hydrogeological decisions require good information developed from raw data. The production of good, relevant and timely information is the key to achieve qualified long-term and short-term plans. For the minimisation of groundwater contamination, it is necessary to utilize all relevant groundwater data.

The generation and collection of this data is very expensive as it requires intensive hydrogeological investigations and therefore the data has to be managed in a centralised database if funds are to be used in the most efficient way. Digby Wells has compiled a WISH-based database during the course of this investigation and it is highly recommended that the applicant utilise this database and continuously update and manage it as new data becomes available.

8.1.8 Rehabilitation and Closure

The purpose of monitoring is to ensure that the objectives of rehabilitation are met and that the rehabilitation process is followed. The physical aspects of rehabilitation should be carefully monitored during the operational phase as well as during the progress of establishment of the desired final ecosystem.

8.1.8.1 *Final Topography*

The final LUP is essentially the end land use to which Sasol would like to return the land affected by mining activities. The closure objectives set as part of the mine closure planning process aims to ensure that the final LUP is achieved and that the area is sustainable in the long-term from an environmental and social point of view.

It is expected that areas where infrastructure is located, will be areas that the current land use will be impacted upon. For these areas it is recommended that the mine rehabilitate the areas back to the pre-mining land use (Figure 7 1 in the Rehabilitation and Closure Specialist Study Report (Appendix O)), as these footprints are expected to be small in size.

As a result of the mine being an underground operation, the surface land use should not be impacted upon; however subsidence will impact on land use when there is a collapse. It is recommended that ongoing monitoring is undertaken on the surface and modelling is undertaken to predict if subsidence would occur and the risk associated with such. In the event that subsidence does occur, rehabilitation of these areas needs to be undertaken. The level of rehabilitation would be dependent on the risk of collapse and the degree of subsidence. If subsidence is a high risk and occurs on site resulting in a drastic change in topography, these areas may need to be designated as no-go areas and these areas should be fenced off and appropriate signage erected.

8.1.8.2 Soils

8.1.8.2.1 Depth of Topsoil Stripped and Replaced

The recovery and effective use of the usable topsoil available is very important. It is also important to undertake regular reconciliation of the volumes removed and stockpiled for the construction of roads and the shafts, returned to the rehabilitated areas. A topsoil balance can be used to keep track of soil resources. The sensitivity of the soils on site makes this section vital for successful rehabilitation.

8.1.8.2.2 Chemical, physical and biological status of replaced soil

A final rehabilitation performance assessment should be done and information should be adequate for closure applications that involve:

- Assessment of rehabilitated soil thickness and soil characteristics by means of auger observations using a detailed grid;
- Erosion occurrences;
- Soil acidity and salt pollution analyses (pH, electrical conductivity and sulphate) at 0-250 mm soil depth every 10 ha; and
- Fertility analysis (exchangeable cations K, Ca, Mg and Na and PPES) every 16 ha (400 x 400 m).

8.1.8.2.3 Erosion

Erosion monitoring of rehabilitated areas should be undertaken and zones with excessive erosion should be identified. Erosion can either be quantified or the occurrence there-of simply recorded for the particular location.

8.1.8.3 Water

8.1.8.3.1 Surface Drainage Systems

The functionality of the surface water drainage systems should be assessed on an annual basis. This should preferably be done after the first major rains of the season and then after any major storm. An assessment of these structures will ensure that the drainage on the recreated profile matches the Rehabilitation, Decommissioning and Mine Closure Plan as well as to detect early on when any drainage structures are not functioning efficiently. These can then be repaired or replaced before it causes significant erosion damage.

8.1.8.3.2 Ground water

The groundwater levels and quality should be measured and monitored in a similar way to the surface water to determine the impact of the mining activities on the groundwater resources. A hydrogeologist should determine the locations of the monitoring boreholes. The monitoring frequency will be approved by the regulator.

8.1.8.4 Vegetation

8.1.8.4.1 Basal Cover

Basal cover refers to the proportion of ground at root level which is covered by vegetation and by the rooting portion of the cover plants. The line-transect (or the quadrat bridge) method can be used to establish sampling positions. A target of at least 15 % basal cover should be set for fully established vegetation or a basal cover similar to a reference site undisturbed by mining. It is important to note the difference between basal cover and canopy cover, shown in Figure 8-1.

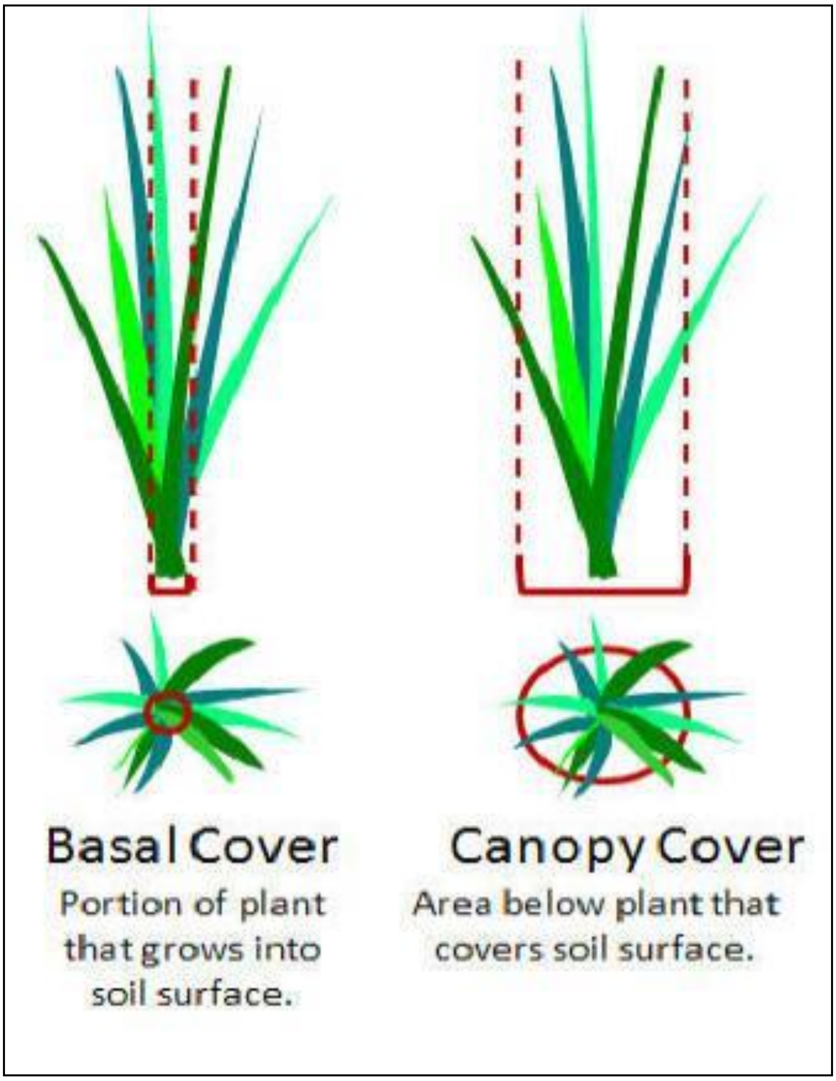

Figure 8-1: Diagram Comparing Basal Cover and Canopy Cover

(Image from Principles of Vegetation Measurement and Assessment and Ecological Monitoring & Analysis http://www.webpages.uidaho.edu/veg_measure/index.htm)

8.1.8.4.2 *Species*

Biodiversity assessments and surveys should be undertaken by external experts to establish the full range of plants that have become established. Summer and winter samplings should be done during these assessments. These rehabilitated areas are to remain as "No Go" areas initially to allow recolonization of the vegetation and all livestock animals must be kept out. Ensure continual monitoring and maintenance. Basal cover should be 10-15 %. Assessments should be carried out after each growing season. Bare areas of >4 m^2 need to be reseeded with the grass species.

8.1.8.4.3 *Alien Invasive Plant Monitoring*

The following monitoring measures are recommended in order to prevent the future introduction or spread of alien species, and to ensure the rehabilitation of transformed areas:

- Annual surveys, aimed at updating the alien plant list and establishing and updating the invasive status of each of the alien species, should be carried out (can be done by Sasol staff); and
- Follow-up control of alien plant seedlings, saplings and coppice regrowth is essential to maintain the progress made with initial control work, and to prevent suppression of planted or colonizing grasses. Before starting new control operations on new infestations, all required follow-up control and rehabilitation work must be completed in areas that are originally prioritized for clearing and rehabilitation.

8.2 Item 1(h): Monitoring and reporting frequency

Table 8-5 discusses the monitoring and reporting frequency.

8.3 Item 1(i): Responsible persons

The roles and responsibilities associated with the monitoring programme are set out in Table 8-5.

8.4 Item 1(j): Time period for implementing impact management actions

Table 8-5 captures the time period for implementing impact management actions.

8.5 Item 1(k): Mechanism for monitoring compliance

Table 8-5 sets out the method of monitoring, the implementation of the impact management actions, the frequency of monitoring the implementation of the impact management actions, an indication of the persons who will be responsible for the implementation of the impact management actions, the time periods within which the impact management actions must be implemented and the mechanism for monitoring compliance with the identified impact management actions.

Table 8-5: Monitoring and Management of Environmental Impacts

Activities	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions
All activities	Monitoring of Air Quality	▪ Sasol management should conduct once-off biannual PM_{10} monitoring – to establish ambient levels of this pollutant at a representative site during the operational phase. Such data will be useful, if in future the consolidation project comes under scrutiny from regulatory authorities.	Independent air quality specialist should conduct the required monitoring. A report should be compiled identifying any potential impacts and any additional mitigation measures required.	Once-off biannual sampling of PM in the vicinity of the consolidation project is recommended.

All activities	Monitoring of Soil, Land Use and Land Capability	▪ Monitor the soils one a year at the same time each year. The soil monitoring parameters are discussed in Section 8.1.2;
		▪ The following maintenance is required to preserve the soil and land capability:
		  ▪ Repair any damage on soils caused by erosion;
		  ▪ Monitor subsidence and cracks;
		  ▪ Demarcate no go zones where possible while the vegetation is establishing;
		  ▪ The consolidation project and rehabbed area must be fenced and animals should be kept off the area until the vegetation is self-sustaining;
		  ▪ Fertilize rehabbed area with nitrogen containing fertiliser after germination of seeds;
		  ▪ If soil is contaminated, treat the soils by means of in-situ bio-remediation; and
		  ▪ If in-situ treatment is not possible then the contaminated soil must be classified according to the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Material and disposed at an appropriate, permitted or licensed disposal facility.
			Soil monitoring should be undertaken by an independent soil, land use and land capability specialist. However maintenance activities should be undertaken by the Environmental Control Office (ECO) appointed by the mine.	Annual basis at the same time each year.

All activities	Monitoring of Fauna and Flora	▪ Implement alien plant monitoring to prevent the establishment of alien invasive plant species	Alien invasive species monitoring should be undertaken by a qualified botanist.	Quarterly monitoring for two years
		▪ Riparian and River biomonitoring specifically aimed at river vegetation and fauna species dependant on it	Biomonitoring must be undertaken by a qualified aquatic scientist	Quarterly monitoring for life of mine
All activities	Monitoring of Wetlands All impacts and threats to wetlands, predicted or not.	▪ Monitoring of activities through all phases to ensure all impacts are remediated as soon as possible; thus preventing any long term residual impacts to the system that compromises wetland functionality. ▪ The wetlands immediately adjacent to the vent shafts should be demarcated in the field as they are at particular risk of impacts.	Maintenance monitoring activities should be undertaken by the Environmental Control Office (ECO) appointed by the mine.	Internal monitoring should be done as often as possible according to the management practices of the mine.
			Wetland monitoring should be undertaken by an independent wetland specialist.	Regularly and when needed, i.e. after an incident.

<table>
<tr><th>Activities</th><th>Impacts requiring monitoring programmes</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities
(For the execution of the monitoring programmes)</th><th>Monitoring and reporting frequency and time periods for implementing impact management actions</th></tr>
<tr><td rowspan="3">High extraction underground mining</td><td rowspan="2">Monitoring of Wetlands
Hydrological and geomorphological impacts to wetlands and catchment.</td><td rowspan="2">▪ As mining progresses, wetlands that have the potential to be impacted on should be monitored for evidence of loss of functionality due to groundwater changes.
▪ Monitoring for all risks including uncontrolled erosion, hydrocarbon spills etc. and remediated where needed.
▪ Monitor subsidence.
▪ Fixed transects should be set up (5) over different wetland areas to monitor changes in wetlands through the mining process</td><td>Maintenance monitoring activities should be undertaken by the Environmental Control Office (ECO) appointed by the mine.</td><td>Monitoring as often as possible according to the management practices of the mine during operation. Subsidence should be monitored annually.</td></tr>
<tr><td>Wetland monitoring should be undertaken by an independent wetland specialist.</td><td>Annually and when needed, i.e. after an incident. Independent groundwater specialist: groundwater quality should be monitored quarterly.</td></tr>
<tr><td>Monitoring of Wetlands
Water levels</td><td>▪ Installation of piezometers to monitor water levels and wetland hydrology.
▪ Prior to piezometer installation, a thorough soil survey of the wetland is needed. This will enable the correlation of soil wetness with the monitored water levels and will inform the optimal locations for the piezometers.
▪ A vegetation assessment will also be required so that correlations between the vegetation composition/structure and the soil morphological features. This will allow an assessment of changes in the wetlands hydrological functioning.</td><td>Groundwater levels must be recorded on a quarterly basis to detect any changes or trends in groundwater elevation and flow direction</td><td>Groundwater levels must be recorded on a quarterly basis to detect any changes or trends in groundwater elevation and flow direction</td></tr>
<tr><td>Mine closure and post-mining environmental status</td><td>Monitoring of Wetlands
Possible post-mining water decant and potential decant</td><td>▪ Monitor for all risks and remediate. If a greater extent of wetlands are destroyed due to decant, passive treatment of water will need to be considered along with rehabilitation and a wetland offset strategy.</td><td>Wetland monitoring should be undertaken by an independent wetland specialist.</td><td>Monitoring should be done annually and when needed, i.e. after an incident.</td></tr>
<tr><td>All activities</td><td>Monitoring of surface water</td><td>▪ Water quality monitoring at the locations where sampling was undertaken during this study is recommended to be continued for a period until the baseline has been established. Table 8-1 and Table 8-2 provide the coordinates of the monitoring locations.</td><td>Continuous monitoring can be done by an in-house Environmental Control Office (ECO) as it has been done for TCTS monitoring.</td><td>Monitoring frequency has been discussed in more detail in Table 8-3.</td></tr>
<tr><td rowspan="2">All Activities</td><td rowspan="2">Monitoring of Aquatic Ecology</td><td>▪ In Situ water quality
  ▪ Maintaining within the threshold effect values stipulated by DWAF (1996)</td><td>Monitoring should be conducted by a certified aquatic specialist.</td><td>Bi-annual (dry and wet season)</td></tr>
<tr><td>▪ IHAS and IHIA (Habitat Indicators)
  ▪ Determine changes in habitat condition and maintain/improve determined category per reach in this study</td><td>Monitoring should be conducted by a certified aquatic specialist.</td><td>Bi-annual for IHAS (dry and wet season) and annually for the IHIA</td></tr>
</table>

Activities	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions
		▪ Macroinvertebrate assemblages using SASS5 and MIRAI ▪ Determine changes in macroinvertebrate assemblages of the associated aquatic systems and maintain/improve determined category per reach in this study	Monitoring should be conducted by a certified aquatic specialist.	Bi-annual sampling using SASS5 (dry and wet season) with the MIRAI being conducted annually
		▪ Fish assessment using FRAI ▪ Determine changes in fish assemblages of the associated aquatic systems and maintain/improve determined category per reach in this study	Monitoring should be conducted by a certified aquatic specialist.	Fish sampling conducted bi-annually (dry and wet season) with the FRAI being determined annually
		▪ Ecostatus determination using the ecostatus model (version 2.0) ▪ Determine changes from the calculated ecostatus for the river reaches of concern in this study and maintain/improve determined category per reach	Monitoring should be conducted by a certified aquatic specialist.	Ecostatus determination should be done annually
		▪ Toxicity Testing (screening) ▪ Determine the toxicity of any water discharged into rivers, especially the decant	Monitoring should be conducted by a certified aquatic specialist.	Bi-annual (dry and wet season)
Audit Reports	Auditing against the conditions outlined within the approved EMP and EA (EMP Performance Assessment)	To determine compliance to EMP conditions	Environmental Officer/Independent Third Party	Performance Assessment completed at least every five years
	Annual update of financial provision	To ensure that the mine is compliant with the financial provision regulations and that there is sufficient funding provided by the mine for closure and rehabilitation cost and meets the requirements as stipulated in Regulation 11 (1) of the New Financial Provision Regulations.	Environmental Officer/Independent Third Party	Annually and must be audited by an independent auditor.

Activities	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions
All activities	Monitoring of Groundwater	▪ The monitoring boreholes are recommended to be equipped with piezometers to enable monitoring of both aquifers at the same borehole. The recommended groundwater monitoring locations are presented in Table 9.6 in the Groundwater Specialist Report (Appendix N). A total of 65 monitoring locations are proposed, 47 existing boreholes and 18 proposed boreholes to be drilled once the new mining areas begin to be mined. ▪ Groundwater levels must be recorded on a quarterly basis to detect any changes or trends in groundwater elevation and flow direction. ▪ Parameters to be Monitored ▪ TDS, EC, pH, Alkalinity; ▪ Major ions i.e. Ca, Mg, Na, K, SO4, NO3, F, Cl; and ▪ Minor and trace metals, including As, Al, Co, Cr, Zn, Cd, Cu, Fe, Ni, V, Mn.	Samples should be submitted to a laboratory that analyses in accordance with the methods prescribed by the South African Bureau of Standards in terms of the Standards Act, Act 30 of 1982.	▪ Considering the proximity of private boreholes and streams to the proposed mine, monitoring should be conducted quarterly to reflect influences of wet and dry seasons. The sampling frequency could be adjusted following the trend analysis. ▪ It is suggested that quarterly samples be collected, extending up to two years post closure and based on the result trends it can be extended until a sustainable situation is reached and after it has been signed off by the authorities.

9 Item 1(l): Indicate the frequency of the submission of the performance assessment report

An independent EAP must be appointed to conduct an audit, as a minimum, at least every five years throughout the life of the mine. This is done to monitor the EIA and EMPr process and to determine the level of compliance. Should non-compliances be identified mitigation measures can be provided to ensure compliance to the conditions are achieved.

The audit will be conducted according to the following Acts and Regulations:

- National Water Act (NWA), Act No. 36 of 1998;
- Minerals and Petroleum Resource Development Act (MPRDA), Act No. 28 of 2002;
- National Environmental Management Act (NEMA), Act No. 107 of 1998;
- National Heritage Resources (NHRA), Act No. 25 of 1999; and
- Mine Health and Safety Act (MHSA), Act No. 29 of 1996.

The audit will take into consideration the management principals and strategies stated in the EMPr and assess whether this strategy is providing the required results. Any flaws found in the Amendment and Basic Assessment Process will be included in the report along with the recommended measures.

A report will be to mine management, who may then decide the appropriate actions to be taken, along with an updated financial provision. As per the Regulation in the MPRDA, the performance assessment report will be submitted to the DMR who will review the report and pass comment. The report will comply with the format as set out in the EIA 2014 Regulations (Appendix 7).

10 Item 1(m): Environmental Awareness Plan

10.1 Item 1(m)(1): Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work

An internal and external communication strategy; as part of the Environmental Management System (EMS) of the mine, has been developed and will be implemented as part of this consolidation project. The environmental awareness plan forms a major part of the communication strategy, together with other issues such as health, safety, operations, productions, etc. The communication strategy is reviewed on an annual basis and revised if necessary. This strategy will be updated to include the consolidation project to ensure that the internal and external stakeholders that have been registered are included in all communication going forward.

10.1.1 Objectives

The environmental awareness plan aims at:

- Outlining the network of communication used to inform employees of environmental risks;
- Promoting general environmental awareness at the Twistdraai Thubelisha which includes TCTS, Trichardtsfontein and Vaalkop;
- Informing all personnel of environmental policies, procedures and programmes applicable to the Twistdraai Thubelisha which includes TCTS, Trichardtsfontein and Vaalkop;
- Providing general training on the implementation of environmental management actions;
- Providing job specific environmental training to ensure the protection of the environment; and
- Promoting environmental awareness and communication with surrounding communities.

10.1.2 Inclusion of New Mining Areas

It is recommended that Sasol Mining incorporates the new mining areas (Trichardtsfontein and Vaalkop) into their existing environmental training and awareness programme developed for the TCTS mine. This specifically applies to the company's general induction training as well as any specialised job specific training for staff involved in the mining activities. All members of the workforce are to be subject to job specific training. This may include but not be limited to:

- Preventing pollution;
- Spill prevention and clean-up procedures;
- The location and purpose of MSDSs;
- Managing wastes; and
- Incident reporting.

Training on Environmental Awareness should include all employees and be job specific where possible. Training should include the identification of environmental risks and potential impacts that may result from the specific work undertaken in specific areas on the site. By training in specific sectors of the mine, specific corrective actions can be taught for particular non-compliances that may occur. This training should occur for the work force currently employed and then when new employees are transferred or employed in different sectors on the mine. The training protocols are to be revised on an annually based for the outcomes of the Environmental Performance Assessment process.

Inductions should be compulsory for contractors, service providers and visitors on the mine and must be appropriate for short term work. This is a legal commitment for Twistdraai Thubelisha and should be integrated in with the Health & Safety inductions on the mine. This can be in the form of a presentation to simply highlight the sensitivities of the area, the potential environmental risks and the responsibilities of the people involved. Measures from the Emergency Response plan can also be included where relevant.

10.1.3 Induction and Training

10.1.4 General Environmental Awareness

The purpose of the general environmental awareness programme is to promote on-going environmental awareness amongst the workforce and even amongst the community. It must focus on addressing particular environmental issues which have been identified as problematic through the Performance Assessment Programme as well as current topical or relevant issues.

Monthly environmental topics can be discussed or illustrated in a poster format around the site or in the surrounding communities. These topics can include water resource conservation (i.e. How to Save Water), waste management (i.e. Reuse, Reduce, Recycle) and the biodiversity around Trichardt, Secunda and Bethal.

10.1.5 Internal Communication and Awareness Campaign

The mine will identify employees, which includes the management team, to form an EMS Committee that discusses all relevant environmental issues on a quarterly basis or when deemed necessary. EMP action plans are drafted and progress made is followed up during these meetings.

10.1.6 External Communication and Awareness Campaign

The mine must develop a stakeholder register that includes any person or group of people who are interested and/or affected by the Health, Safety, Environmental, Community (HSEC) or Operational performances of the activities or operations undertaken by the mine, excluding employees. The register will contain a list of all stakeholders and includes the name of the stakeholder organisation, contact name, address, e-mail address, as well as telephone, cell phone and fax numbers. This register will be maintained by the Environmental Practitioner and updated annually.

Ad hoc meetings will be held with major stakeholders to present and/or discuss HSEC issues regarding the company's operations. A register of attendees will be kept and minutes will be taken during the proceedings, which will be distributed to all the major stakeholders, whether they attended or not. To encourage feedback and facilitate stakeholder participation, feedback sheets will be handed to each stakeholder on registration and collected after the forum. This will allow the stakeholders to change their contact details and to comments or ask questions on HSEC matters. Any feedback sheets received will be dealt with in accordance with fixed operating procedure and any actions taken are recorded for reference purposes.

A log book will be kept by SMRD and a copy kept with the mine environmental practitioner and any complaints from external parties will be logged in this book. Regular contact will be kept with the complainant until the complaint has been addressed satisfactorily.

10.2 Item 1(m)(2): Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment

An Emergency Response Plan has been developed as discussed and is the approach used by Twistdraai Thubelisha to respond to risks that may pollute or degrade the environment during the operational phase.

The unplanned events that may happen at the project site are listed in Table 10-1.

Table 10-1: Unplanned Events, Risks and Their Management Measures

Unplanned event	Mitigation/ Management/ Monitoring
Temporary, localised drawdown of shallow groundwater during construction of vent shafts	▪ Seal shaft walls timeously to reduce drawdown timeframe
Runoff from bare soil areas during construction of vent shafts	▪ Maintain 100 m buffer between construction footprint and wetland ▪ Minimise construction area ▪ Major earthworks to take place in dry season
Poaching of animal species on site due to increase activity on site.	▪ Ensure continuous environmental awareness training takes place. This must be monitored and reported on and the appropriate actions should take place dependant on the results.
Hazardous substance spillage from pipelines or waste or water storage Hydrocarbon spill from vehicles and machinery or hazardous materials or waste storage facilities	▪ Prevent any spills from occurring. Machines must be parked within hard park areas and must be checked daily for fluid leaks; ▪ All vehicles are to be serviced in a correctly concrete area or at an off-site location; ▪ Leaking vehicles will have drip trays place under them where the leak is occurring; ▪ Pipeline must be checked on a weekly basis for leaks; ▪ If there are leaks the pipelines must be repaired immediately; ▪ Hydrocarbons and hazardous substances must be stored in bunded areas and refuelling should take place in contained areas; ▪ The fuel, lubricant and explosives storage facilities must be located on a hard standing area (paved or concrete surface that is impermeable), roofed and bunded in accordance with SANS1200 specifications. This will prevent mobilization of

Unplanned event	Mitigation/ Management/ Monitoring
	leaked hazardous substances; ▪ Ensure that the bunded areas can contain 110% of the largest container and are constructed according the necessary SANS standards; ▪ An emergency spillage response plan should be in place and accessible to the responsible monitoring team. The Material Safety Data Sheets (MSDS) should be kept on site for the Life of Mine for reference to anytime in terms of handling, storage and disposal of materials; ▪ The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to the appropriate disposal sites; ▪ A spill response kit must be available at all times. Should a spillage occur the incident must be reported on with mitigation and recommendations to prevent further spillages happening again. Areas of high risk must be managed with particular care and impact must be kept to the smallest area possible; for example areas where planned inspection of vehicles is carried out; ▪ Ensure that oil traps and skimmers are well maintained; ▪ All employees must be aware of the procedure for dealing with spills and leaks on site; ▪ If a significant (> 5L) spill occurs is to be cleaned up immediately, reported to the appropriate authorities and recorded; and ▪ Contaminated soils must be disposed in a registered and licensed waste landfill facility.
Contamination of waterbodies utilised by terrestrial fauna.	▪ Spillages of magnitude should also be reported to the authorities within 24 hours and an internal incident reporting system implemented. ▪ The incident must be reported on and if necessary an aquatic ecology specialist must investigate the extent of the impact and provide rehabilitation recommendations
Uncontrolled erosion	▪ Erosion control measures must be put in place and provide rehabilitation recommendations.
PCD overflow	▪ Spill protection berms must be in place to manage such an event and protect the water resources. The overflow must be stopped immediately as soon as possible and the impacted area remediated; and ▪ Monitoring of the impact to determine the level of success of the remediation actions must be carried after a spillage event.

Unplanned event	Mitigation/ Management/ Monitoring
Failure in the functioning of the clean-dirty water separation and stormwater management plan leading to uncontrolled spilling of polluted from the infrastructure areas	▪ The spilling of the contaminant must be stopped immediately and the impacted area remediated. Spill protection berms must be in place as well. An investigation into the spillage must be undertaken where recommendations and mitigation measures are provided.
Community expectations and actions	▪ Expectations of communities must be managed by informing them what to expect from the Project in terms of Local Economic Development (LED) and/or community development projects; and ▪ Continuously involve community and municipal structures in the development of any LED or community development projects.
	▪ Establish grievance mechanism which is accessible to aggrieved members of the surrounding communities.
Spills / leaks from the pipelines.	▪ On a weekly basis pipelines should be inspected and checked for any leaks. Leaking pipelines should be sealed; ▪ Ensure that stormwater management structures are put in place to capture all spills and to convey to the PCD; and ▪ Should a pipeline rupture the emergency procedure must be implemented.
Runoff from emergency stockpile area	▪ Ensure facility is appropriately lined and bunded ▪ Monitor to ensure that no runoff is entering wetland areas ▪ Ensure that there is adequate separation of dirty and clean water systems

10.2.1 Risk of subsidence on heritage resources

This section considers the potential risks to protected heritage resources.

Considering the specified mining activities, high-extraction methodologies increase the risk of subsidence in areas where the depth to coal is below 100 m. In these areas, subsidence that may impact on protected heritage resources (*Refer* to *Table 10-3 for list of relevant identified protected heritage resources*). Where an impact on heritage resources manifests, this may have social repercussions or result in litigation where no proactive management measures were undertaken.

A summary of the potential risk to protected heritage resources is presented in Table 10-2.

Table 10-2: Potential risk to identified protected heritage resources

Phase	Activity	Risk	Potential Impact
Operational	High extraction mining method where depth to coal is below 100 m.	High extraction mining method may result in subsidence Considering the distribution, identified heritage resources at the greatest risk of subsidence include: ▪ Ste-001 (Figure 10-1); ▪ BGG-005 (Figure 10-1); and ▪ 4919/1998-SAHRA-0029/2629AD7 (Figure 10-2)	Damage or destruction of NHRA Section 34 resources, i.e. structures and built environment resources older than 60 years.
			Destruction of or disturbance to NHRA Section 35 resources, i.e. archaeological and/or palaeontological resources.
			Damage or destruction of, and loss of access to, NRHA Section 36 resources, i.e. burial grounds and graves.
Decommissioning	Closure	Underground mining voids may result in subsidence	Destruction or alteration of NHRA Section 34 resources, i.e. structures and built environment resources older than 60 years.
			Destruction of or disturbance to NHRA Section 35 resources, i.e. archaeological and/or palaeontological resources.
			Damage or destruction of, and loss of access to, NRHA Section 36 resources, i.e. burial grounds and graves.

Figure 10-1: Location of Ste-001 and BGG-005 in relation to proposed undermining

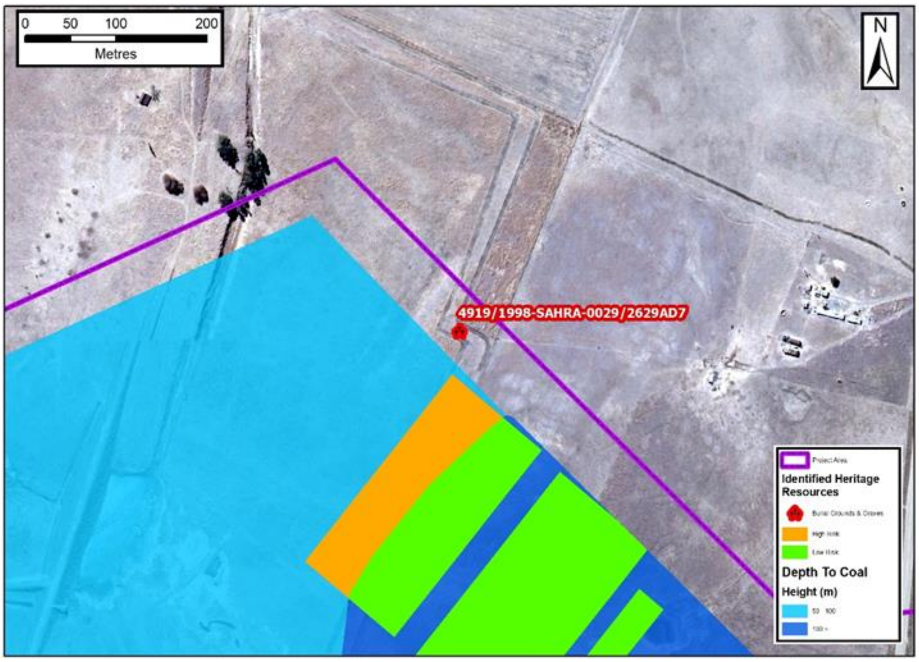

Figure 10-2: Location of 4919/1998-SAHRA-0029/2629AD7 in relation to proposed undermining

Table 10-3: Identified heritage resources at risk of possible subsidence

LoM Year	Heritage Category	Site ID	Description
Undefined	Burial Grounds & Graves	4919/1998-SAHRA-0029/2629AD42	Informal cemetery with approximately 5 graves, one of which has a headstone.
		4919/Van Schalkwyk-2007/17	An informal cemetery with about five graves, one of which has a headstone.
	Historical Built Environment	4919/1998-SAHRA-0029/2629AD43	Old farmstead with outbuildings. Currently occupied by farm labourers. It seems to be older than 60 years and is therefore protected.
		4919/Van Schalkwyk-2007/18	An old farmstead with outbuildings. Currently occupied by farm labourers. It seems to be older than 60 years and is therefore protected.
		Ste-002	Remnant foundation of historic structure. No other features identified.
2017	Archaeological - LFC	4919/1998-SAHRA-0029/2629AD41	Circular structures of stone affiliated with the LIA.
	Burial Grounds & Graves	4919/1998-SAHRA-0029/2629AD9	Four graves marked with cairns.
		4919/Van Schalkwyk-2007/2	Four graves marked with cairns. Just east of that, there are a number of circular stone structures that might be the foundations of old houses. These probably date to the early art of the century and can be related to the graves.
2018	Archaeological - LFC	4919/1998-SAHRA-0029/2629AD13	Circular structures of stone typical of the LIA.
		4919/Van Schalkwyk-2007/27	Circular structures of stone, typical of Late Iron Age structures. The Late Iron Age walling probably dates to the last 200 years and can possibly be related to the Sotho/Tswana speaking people.
		4919/Van Schalkwyk-2007/6	Circular structures of stone, typical of Late Iron Age structures. The Late Iron Age walling probably dates to the last 200 years and can possibly be related to the Sotho/Tswana speaking people.

LoM Year	Heritage Category	Site ID	Description
	Historical Built Environment	4919/1998-SAHRA-0029/2629AD15	Old homestead, with a number of other structures, possibly labourer houses, in the vicinity. Not much information would be gained from this structure.
		4919/Van Schalkwyk-2007/8	An old homestead, with a number of other structures, possibly labourer houses, in the vicinity. Not much information would be gained from this structure.
2019	Burial Grounds & Graves	4919/1998-SAHRA-0029/2629AD11	Informal cemetery containing approximately 50 graves, five of which have headstones.
		4919/Van Schalkwyk-2007/4	An informal cemetery containing about 50 graves, of which five have headstones.
2021	Archaeological - LFC	4919/Van Schalkwyk-2007/26	Circular structures of stone, typical of Late Iron Age structures. The Late Iron Age walling probably dates to the last 200 years and can possibly be related to the Sotho/Tswana speaking people.
2022	Burial Grounds & Graves	4919/1998-SAHRA-0029/2629AD36	Informal cemetery containing approximately 5 graves, one with a headstone dating to 1980.
		4919/Van Schalkwyk-2007/11	An informal cemetery with about five graves. One of these have a headstone dating to 1980.
2024	Historical Built Environment	4919/1998-SAHRA-0029/2629AD40	Remains of houses occupied by farm labourers.
		4919/Van Schalkwyk-2007/15	Remains of houses occupied by farm labourers.
2025	Burial Grounds & Graves	4919/1998-SAHRA-0029/2629AC3	Informal cemetery containing approximately 10 graves, three of which have headstones.
		4919/Van Schalkwyk-2007/21	An informal cemetery containing about ten graves, of which three have headstones. Inscriptions are basically illegible.
	Historical Built Environment	4919/1998-SAHRA-0029/2629AD38	Remains of houses occupied by farm labourers.

LoM Year	Heritage Category	Site ID	Description
		4919/Van Schalkwyk-2007/13	Remains of houses occupied by farm labourers.
2028	Burial Grounds and Graves	4919/1998-SAHRA-0029/2629AD7	Formal cemetery containing approximately 100 graves, some with headstones. Majority have been relocated during Sasol Mining developments.
2034	Archaeological - LFC	672/2629AD105	A number of ash middens, probably the remains of old cattle kraals.
	Historical Built Environment	4919/2003-SAHRA-0075/2629AD105	A number of ash middens, probably remains of old cattle kraals. Short sections of stone walling occur among the middens.
2035	Burial Grounds & Graves	4919/1998-SAHRA-0029/2629AC19	Informal cemetery with approximately 80 graves, 8 of which have headstones.
		4919/Van Schalkwyk-2007/25	An informal cemetery with about 80 graves. Most are marked with cairns and eight have headstones.
2036	Historical Built Environment	4919/Van Schalkwyk-2007/30	An old farmhouse. Stylistically it dates to the 1920s, but can even be older.
2042	Burial Grounds & Graves	BGG-006	Historic farmstead cemetery associated with the Steynberg family. The cemetery comprises three graves with granite surface dressing. The identifiable inscriptions include: - Johannes L Steynberg 17-2-1876 22-6-1953 - Magdalena S Steynberg (geb. Hamman)
2043	Burial Grounds & Graves	BGG-001	Historic farmstead cemetery on the farm Yzervarkfontein associated with the Erasmus family. The cemetery comprises four graves with granite surface dressing. The identifiable inscriptions include: - Lourens J Erasmus 11-06-1864 25-10-1901 - (Illegible)

LoM Year	Heritage Category	Site ID	Description
2045	Burial Grounds & Graves	BGG-005	Historic burial ground comprising of a single grave associated with the Meyer family. The grave has granite tombstone. Identifiable inscriptions on the tombstone include: - Carolus Johannus Meyer 1-1-1915 13-12-1937
2048	Historical Built Environment	Ft-002	Large square stonewalling at the base of a hill. Presumed to be historic in nature associated with farming activities.
2052	Historical Built Environment	Ste-001	Historic structure associated with the Erasmus family. Recorded as the original dwelling of Danie Erasmus burnt by the British during the Second Anglo-Boer War, presumed during skirmishes associated with the Battle of Bakenlaagte. Structure is abandoned.

10.2.1.1 Mitigation and Management Measures

Portions of the site-specific study area are underlain by the *Vryheid Formation* with a high palaeontological sensitivity and very high CS. The fossiliferous material commonly occurs in the shale lenses between coal seams at sub-surface levels. Digby Wells acknowledges the significance of the Vryheid Formation but is of the opinion that a detailed palaeontological assessment at this stage will not add value. On a similar project completed for Digby Wells, Bamford (2016) notes that field assessments would not reveal any additional information until excavation of the coal seams themselves take place.

Digby Wells therefore requests exemption from further palaeontological assessment on the basis of the aforementioned motivation and on condition that a Fossil Chance Find Procedure is included in the final EMPr. It is recommended that a Fossil Chance Find Procedure is utilised which has been completed below. The recommended procedure developed by Bamford (2016) comprises the following.

Table 10-4: Recommended fossil finds procedure

Phase	Procedure
Construction	Surface excavations should be monitored by the geologist and any fossil material disturbed should be put aside and the palaeontologist called to inspect the material within a reasonable timeframe to minimise delays to the consolidation project. The geologist should also review visual references and descriptions of palaeontological material. A schedule of monitoring must be set up between the mine and palaeontologist and the agreement letter submitted to SAHRA. If it is not feasible for the palaeontologist to visit the mine timeously then digital photographs of good quality and resolution should be sent to the

Phase	Procedure
	palaeontologist to assess and make recommendations. From visits or photographs supplied the palaeontologist must make the following recommendations: ▪ Material is of no value so development can proceed, or ▪ Fossil material is of some interest so a representative sample should be carefully collected and put aside for further study and incorporated into a recognised repository (e.g. Ditsong Museum, Council for Geosciences, Pretoria; Evolutionary Studies Institute, University of the Witwatersrand, Johannesburg) and a permit obtained from SAHRA for the removal of the fossils, then development may proceed, or ▪ Fossils are scientifically important and the palaeontologist must obtain a SAHRA permit to excavate the fossils and put them into a recognised repository, then development may proceed.
Operational	Once the mine is operational and the coals and shales are exposed the palaeontologist should visit the mine to see if fossils are present. Then the above procedure can be followed. ▪ At each stage a report should be sent to SAHRA by the palaeontologist detailing the fossil finds and where they are being kept.
Decommissioning	A palaeontologist should search through the dumps and exposed shales and seams, rescue any fossil material of scientific interest, store it in a recognised repository so it is available for future research, and then the land must be rehabilitated.

To mitigate against the identified potential risk of subsidence to known heritage resources, it is recommended that a Conservation Management Plan (CMP) is developed and implemented which includes the following information:

- Site definitions;
- Descriptions and defines CS of the known heritage resources;
- Ownership structures;
- Management structures;
- Responsibility matrices;
- Objectives, targets and strategies;
- Monitoring procedures
- Define regulated permitting activities as encapsulated in GN R 548 that may be applicable in the event of impact manifestation; and

- Reporting requirements.

Further to the proposed recommendations, Sasol must complete a detailed surface survey of the proposed undermining areas prior to the operation phase to:

- Accurately delineate the extent of the potential subsidence area;
- Confirm the presence to identified heritage resources that may be impacted upon;
- Record any additional previously unidentified heritage resources that must be included in the developed CMP.

11 Item 1(n): Specific information required by the Competent Authority

The financial provision for the environmental rehabilitation and closure requirements of mining operations is governed by NEMA, as amended, which provides in Section 24P that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts. The financial provision will be reviewed annually.

12 Item 2: Undertaking

The EAP herewith confirms:-

- 2(a) the correctness of the information provided in the reports
- 2(b) the inclusion of comments and inputs from stakeholders and I&APs ;
- 2(c) the inclusion of inputs and recommendations from the specialist reports where relevant; and
- 2(d) the acceptability of the consolidation project in relation to the finding of the assessment and level of mitigation proposed.

13 Reference

Acusolv, 2007, Twistdraai Colliery: Thubelisha Shaft Predictive noise impact study

Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute. 2013. Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector. Pretoria

Development of an Integrated Water Quality Management Plan for the Vaal River System, Integration of Resource Water Quality Objectives, September 2009.

Digby Wells Environmental. (2013). *Environmental Impact Assessment and Environmental Management Programme for Xstrata SA South Africa's Trichardtsfontein Project* (DMR Reference: MP 30/5/1/2/2/10056 MR).

Digby Wells, 2014. Ecological wetland assessment for the proposed Trichardtsfontein mining project, Mpumalanga Province.

Earth Science Solutions, 2008, Twistdraai Colliery: Thubelisha Shaft (Tcts) Soils And Land Capability Impact Assessment

EkoInfo CC, 2008, Flora Specialist Report: Vegetation Assessment on Twistdraai Colliery: Thubelisha Shaft (TCTS) – North and Northeast of Trichardt, Mpumalanga

Oryx Environmental, April 2008. Surface Water Inputs to the EMPr for Twistdraai Colliery Thubelisha Shaft (TCTS) Report No.: JW51/08/A815

Institute of Groundwater Studies, 2014, Acid-Base Accounting Report for Twistdraai Thubelisha Shaft;

Jones and Wagner, 2016: Jones and Wagner Signed off Cost Sheet for the 2016 Financial year.

JMA Consulting, 2008, Compilation Of Geology And Ground Water Inputs For The Twistdraai Colliery: Thubelisha Shaft (TCTS Project);

Mucina, L.and Rutherford, M.C. (eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Nepid Consultants CC, 2008, Sasol Mining Limited Twistdraai Colliery: Thubelisha Shaft Project Environmental Impact Assessment Specialist Study Baseline And Impact Assessment - Aquatic Ecology

National Cultural History Museum, 2007, Heritage Impact Assessment For The Planned Twistdraai Colliery: Thubelisha Shaft In The Highveld Ridge And Bethal Municipal Districts, Mpumalanga Province

Pistorius, J. C., 2011. *Phase I Heritage Impact Assessment (HIA) study for the Consolidated Environmental Management Program Report (Consolidated EMPr) for Arnot Coal on the*

Eastern Highveld in the Mpumalanga Province, Pretoria: Unpublished Report (CaseID: 6251).

Soil Classification Working Group. 1991. Soil Classification, A Taxonomic System for South Africa. Soil and Irrigation Research Institute, Department of Agricultural Development, Pretoria.

Statistics South Africa. (2013). *Census 2011: Interactive data. Retrieved July 25, 2017, from* http://www.statssa.gov.za/community_new/content.asp?link=interactivedata.asp

Tanner, P. 2007. Guidelines for the Rehabilitation of Mined Land. Chamber of Mines South Africa and Coaltech.

Twistdraai Colliery: Thubelisha Shaft, June 2016. Monitoring and Reporting Programme, Revision 1. Sasol Mining

Van Wyk Rowe, C., 2014. Phase 1 Archaeological and Heritage Impact Assessment for the Proposed Bahlangene Residential Township established on Portion 2 of the Farm Langverwacht 293, Ermelo, Mpumalanga Province, Pretoria: Unpublished Report (CaseID: 6810).

WRC (Water Research Commission) , 2009, “Water Resources of South Africa, 2012 Study (WR2012)”, Water Research Commission, Pretoria.

Wetland Consulting Services (Pty) Ltd, 2007. Wetland Assessment Study: Twistdraai Colliery:Thubelisha Shaft (TCTS) Project.

Xstrata SA Coal. (2012a). *Trichardtsfontein Social and Labour Plan Submission. Prospecting* Right Ref Number: MP 30/5/1/2/2/180PR

Xstrata SA Coal South Africa. (2012b). *Mining Work Programme: Trichardtsfontein project* (MP 30/5/1/1/2/180PR; MPT 550/2006-PR) - Mining Right Application.

Appendix A: CV

Appendix B: Plans

Appendix C: PPP

Appendix D: Impact Assessment

Appendix E: Air Quality Specialist Study

Appendix F: Noise Specialist Study

Appendix G: Social Specialist Study

Appendix H: Heritage Specialist Study

Appendix I: Soils, Land Use and Land Capability Specialist Study

Appendix J: Fauna and Flora Specialist Study

Appendix K: Wetlands Specialist Study

Appendix L: Surface Water Specialist Study

Appendix M: Aquatic Ecology Specialist Study

Appendix N: Groundwater Specialist Study

Appendix O: Rehabilitation and Closure