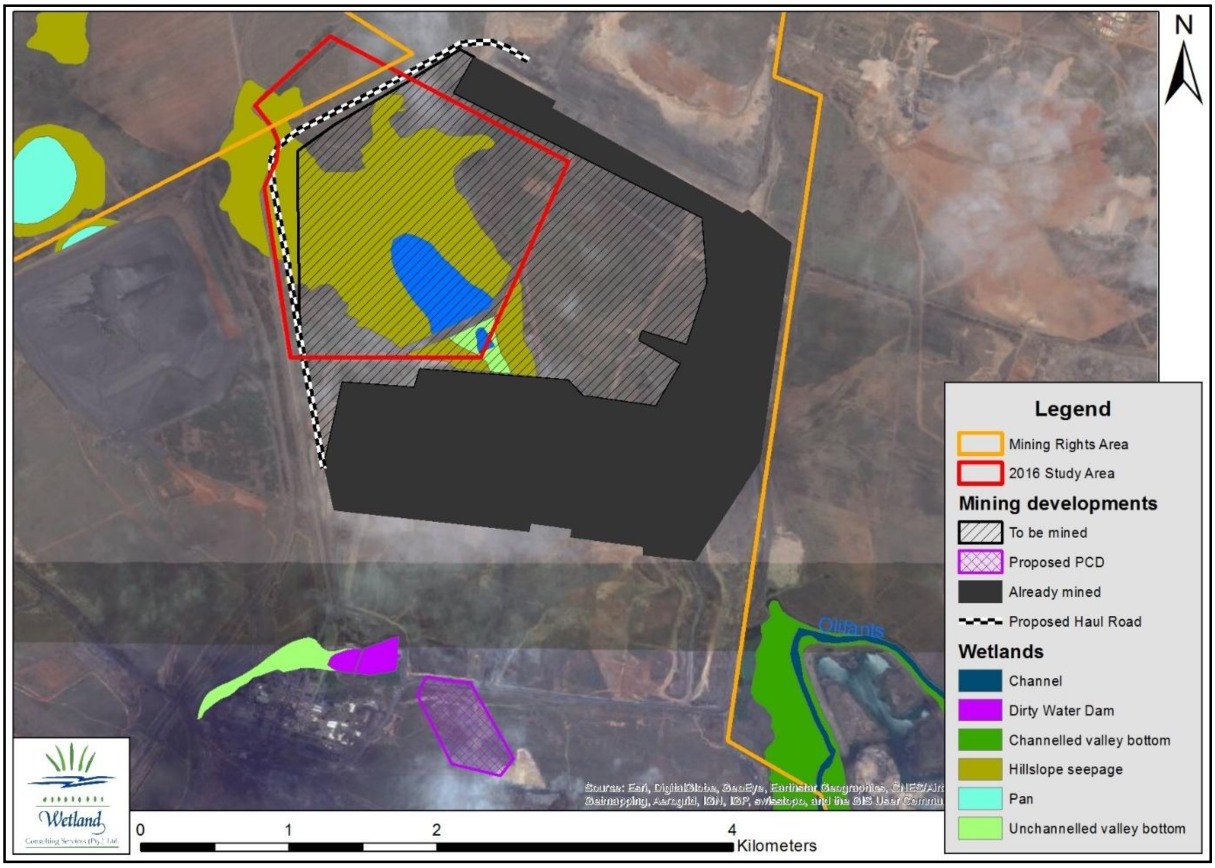

Figure 47: Map showing the delineated and classified wetlands within the study area and surrounds. Delineation of wetlands outside the study area is based on existing information (WCS, 2013) and/or desktop mapping.

3 Present Ecological State (PES) Assessment

The 2A Dam area is located within an active mining area and has been exposed to mining and agricultural impacts for many years. The 2A Dam, the main pollution control dam for Kleinkopje Mine, is located within the hillslope seepage wetland, and the entire system forms part of an isolated dirty water system with no connectivity to downstream water resources. In addition, a number of further impacts were observed on site:

- Mining activities in the direct catchment of the wetland area, as well as downstream of the wetland area;
- Abandoned agricultural activities, including old cultivated fields, within and surrounding the hillslope seepage wetland;
- Contaminated seepage with elevated salinities from the adjacent discard dump enters the hillslope seepage wetland;
- Overflow and discharge of dirty water from reservoirs and pump stations located adjacent to and within the hillslope seepage wetland;
- Numerous trenches cross the hillslope seepage wetland, diverting and intercepting flows;
- A number of old excavations occur within the hillslope seepage wetland;

- Stands of alien vegetation, including stands of *Populus x canescens* and Eucalyptus trees within the wetland area;
- Numerous roads and tracks cross the wetland areas; and
- Impoundment of flow in dams and upstream of road crossings.

The above impacts have resulted in the present ecological state of the wetlands on site departing significantly from the reference condition or un-impacted state of the wetlands. This is reflected in the results of the PES assessment which classes the hillslope seepage wetlands on site as being largely modified (PES D), and the unchannelled valley bottom as seriously modified (PES E). The results of the assessment are provided in Table 39 below.

Given the water quality concerns within the wetlands (being part of a dirty water system) as well as the isolated nature of the wetland system with no connection to downstream water resources, a motivation could be put forward to further increase the PES scores (i.e. lower the PES categories). However, for the purpose of this report the results have been taken as is.

Table 39: Results of the WET-Health Level 1 assessment for the wetlands within the study area.

HGM Unit	Threat descriptions			PES category	Combined score
	Hydrology	**Geomorphology**	**Vegetation**		
Hillslope seepage	4.0	2.4	7.6	D	4.6
Unchannelled valley bottom	10.0	4.0	7.6	E	7.6

Table 40: Table showing the rating scale used for the PES assessment (from Macfarlane *et al*., 2009).

Description	Combined impact score	PES Category
Unmodified, natural.	0-0.9	A
Largely natural with few modifications. A slight change in ecosystem processes is discernable and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2-3.9	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 - 10	F

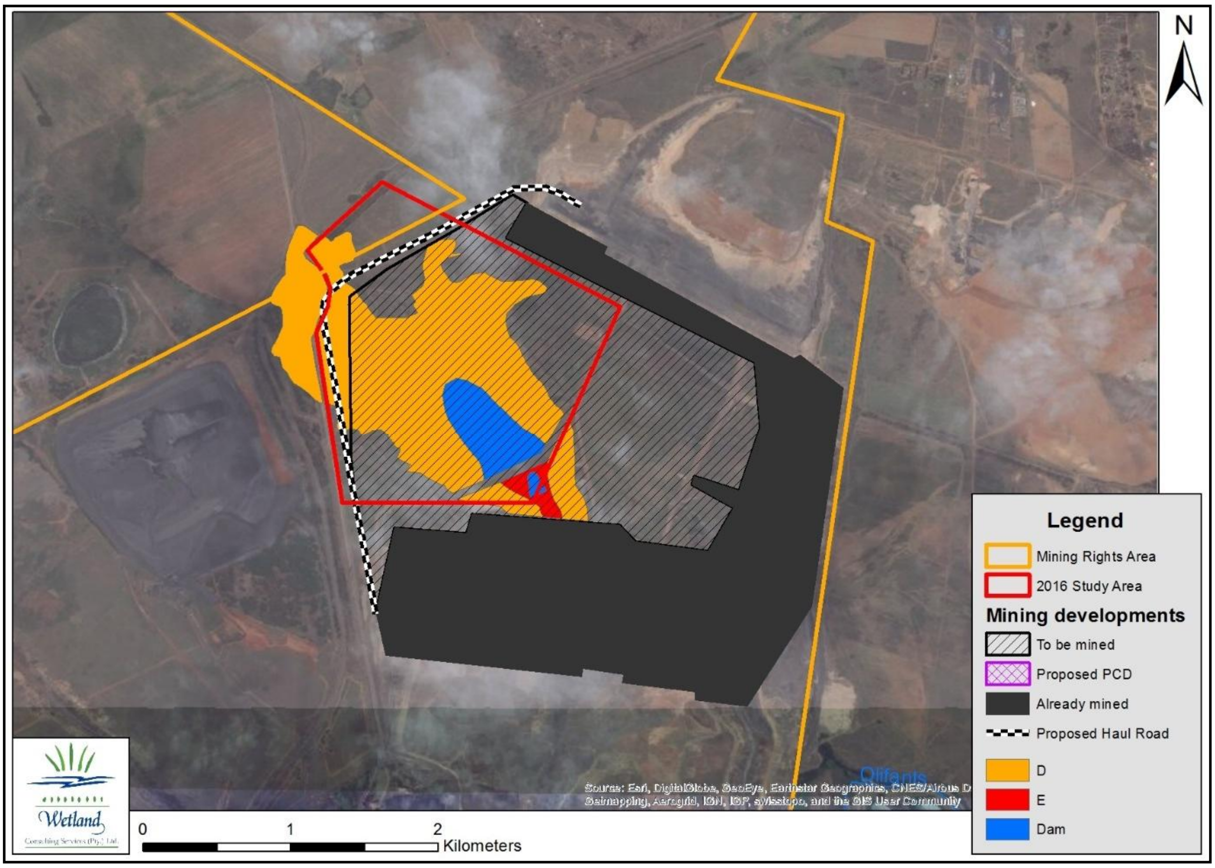

Figure 48: Map showing the results of the PES Assessment (source: Wetland Consulting Services, 2016)

4 Ecological Importance and Sensitivity (EIS) Assessment

"Ecological importance" of a water resource is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. "Ecological sensitivity" refers to the system's ability to resist disturbances and its capability to recover from disturbance once it has occurred. In determining the EIS of a wetland, the following factors are considered:

- Biodiversity – i.e. the presence of rare and endangered species, populations of unique species, species richness, diversity of habitat types, and migration/breeding and feeding sites for wetland species
- Hydrological functionality – i.e. sensitivity to changes in the supporting hydrological regime and/or changes in water quality, Toxins and nitrate assimilation and sediment trapping
- Functionality – i.e. flood storage, energy dissipation and particulate/element removal
- Direct human benefit – i.e. human water use as a harvestable resource, cultivation and cultural heritage

The wetlands within the study area form part of the Olifants River Primary catchment which is a heavily utilised and economically important catchment. Wetlands and rivers within the Olifants River Catchment upstream of Loskop Dam have been greatly impacted upon by various activities, which include mining, power stations, water abstraction, urbanization, agriculture etc. As a result of these impacts serious water quality and quantity concerns have been raised within the sub-catchment. Given this situation, and the fact that wetlands can support functions such as water purification and stream flow regulation, a high importance and conservation value is placed on all wetlands and rivers within the catchment that have as yet not been seriously modified. Within this context an EIS assessment was conducted for every hydro-geomorphic wetland unit identified within the study area. Further considerations that informed the EIS assessment include:

- The location of the study area within a vegetation type (Eastern Highveld Grassland) considered extensively transformed and threatened, having been classed as ***Vulnerable.***
- The wetland vegetation type of the area, Mesic Highveld Grassland Group 6 wetlands, is considered to be ***Endangered***.
- The specific wetland ecosystem type of the hillslope seepage wetland, Mesic Highveld Grassland Group 4, is considered ***Least Threatened*** and the unchannelled valley bottom, also Mesic Highveld Grassland Group 4, is considered as ***Least Threatened.*** Valleyhead seeps in Mesic Highveld Grassland Group 4 are however considered ***Critically Endangered***.
- The level of degradation observed within the wetland systems on site, including the fact that the wetland forms part of a dirty water management system and is isolated from downstream water resources.

It is these considerations that have informed the scoring of the systems in terms of their ecological importance and sensitivity. The results of the assessment and rankings based on our current understanding of the wetlands is summarised in Table 41, while an explanation of the scoring system is presented in Table 42.

Table 41: Table showing the results of the EIS assessment (all figures are in hectares).

SUMMARY	Hillslope Seepage Wetland	Unchannelled Valley Bottom Wetland
Ecological Importance and Sensitivity	1.0	1.0
Hydro-Functional Importance	1.0	0.9
Direct Human Benefits	0.2	0.0
Overall EIS Score	1.0	1.0
Overall EIS Category	Low/Marginal	Low/Marginal

Table 42: Table explaining the scoring system used for the EIS assessment.

Ecological Importance and Sensitivity categories	Range of EIS score
Very high: Wetlands that are considered ecologically important and sensitive on a **national or even international** level. The biodiversity of these systems is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4

High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2
Low/marginal: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these systems is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and <=1

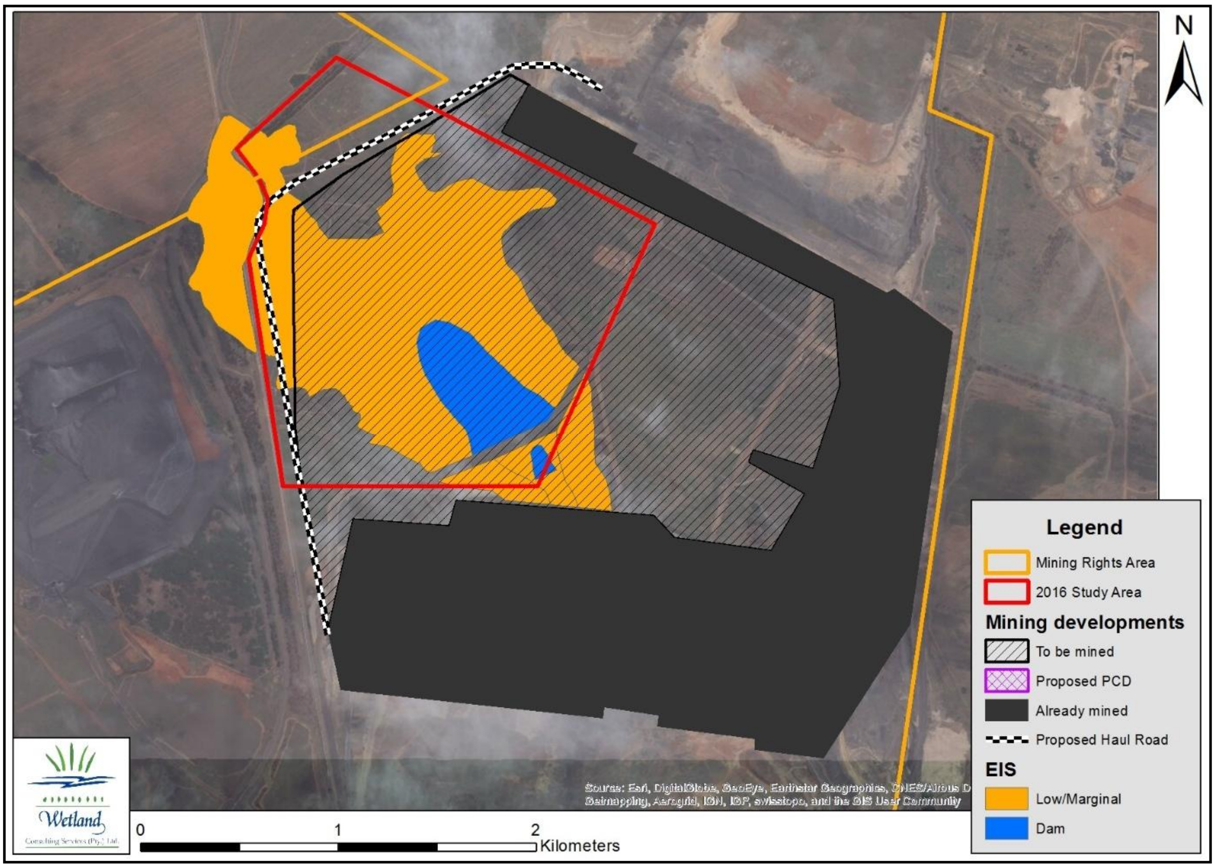

Figure 49: Map showing the results of the EIS assessment (Wetland Consulting Services, 2016)

Chapter I: Groundwater

Shangoni AquiScience conducted a geohydrological study and risk assessment for the Pit 2A Extension. The resultant report titled: '*Geohydrological study and risk assessment for Anglo Operations (Pty) Ltd: Kleinkopje Colliery Pit 2A Extension*", dated August 2016, is attached in Annexure E6[46].

1. Regional hydrogeology and aquifer classification

In a typical geohydrological setting, groundwater flow and aquifer development are closely linked to the geology of an area, which is no different for the aquifers underlying Kleinkopje Colliery. The Department of Water and Sanitation (DWS) has characterised South African aquifers based on the rock formations in which they occur together with its capacity to transmit water to boreholes drilled into specific formations. The water bearing properties of rock formations in South Africa can be classified into four classes defined as:

Class A - Intergranular

- Aquifers associated either with loose and unconsolidated formations such as sands and gravels or with rock that has weathered to only partially consolidated material.

Class B - Fractured

- Aquifers associated with hard and compact rock formations in which fractures, fissures and/or joints occur that are capable of both storing and transmitting water in useful quantities.

Class C - Karst

- Aquifers associated with carbonate rocks such as limestone and dolomite in which groundwater is predominantly stored in and transmitted through cavities that can develop in these rocks.

Intergranular and fractured

- Aquifers that represent a combination of Class A and B aquifer types. This is a common characteristic of South African aquifers. Substantial quantities of water are stored in the intergranular voids of weathered rock but can only be tapped via fractures penetrated by boreholes drilled into it.

Each of these classes is further subdivided into groups relating to the capacity of an aquifer to transmit water to boreholes, typically measured in l/s. The groups therefore represent various ranges of borehole yields (Figure 50).

[46] Groundwater Complete conducted a geohydrological investigation and gap analysis for the Kleinkopje Colliery in November 2011, which was used as source of information during the Shangoni AquiScience Geohydrological study. The Groundwater Complete report titled:" *Geohydrological Assessment and Gap Analysis for Kleinkopje Colliery*", dated November 2011 is available upon request.

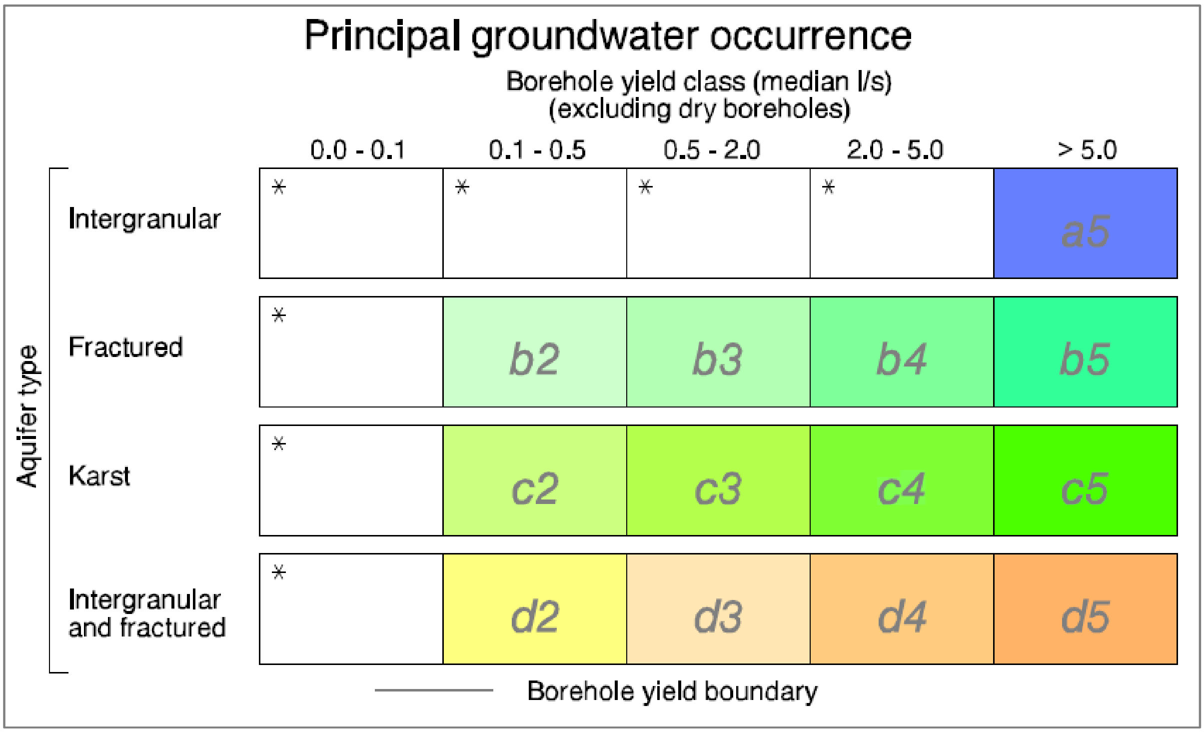

Figure 50: Borehole yield classes

Each of these classes is further subdivided into groups relating to the capacity of an aquifer to transmit water to boreholes, typically measured in l/s. The groups therefore represent various ranges of borehole yields. Kleinkopje Colliery is located in a *d3 aquifer class region*. The groundwater yield potential is classed as low to medium on the basis that most of the boreholes on record in vicinity of the study area produce between 0.5 and 2.0 l/s. Higher yields do sporadically occur where groundwater is held in good water yielding fractures created by intrusive dykes and major faulting zones. However, these are rare and not believed to be present in the Kleinkopje area.

The proposed location of the Pit 2A Extension is directly underlain by rocks of the Vryheid Formation p. The Vryheid Formation consists predominantly of thick beds of yellowish to white cross-bedded sandstone and grit alternating with beds of soft sandy shale. The Ecca Group overlies the Dwyka Group (tillites) of rocks.

According to the regional aquifer classification map of South Africa, the surrounding Karoo aquifer has been identified as a minor aquifer with good groundwater quality (<300 mg/l TDS), a medium to high vulnerability and a medium to high susceptibility towards contamination. Drill logs within the vicinity indicate that the study area is generally underlain by two significant types of aquifers (for classification purposes, the fractured Karoo and pre-Karoo basement aquifer are discussed as one fractured aquifer system). Based on the underlying hydrogeology of the project area the aquifers can be classified according to Parsons Classification System as follows:

i) Shallow unconsolidated weathered/perched unconfined aquifer

  a. Non-aquifer

ii) Fractured confined or semi-confined sandstone aquifer in the Vryheid Formation and pre-Karoo

  a. Minor aquifer

The occurrences and classification of the respective aquifer types underlying the proposed area are shown in Table 43.

Table 43: Principle groundwater occurrences and classification according to the Parsons (1995) classification system (Shangoni AquiScience, 2016)

Aquifer	Type	Lithology	Groundwater occurrence	Depth (m)	Probable yield (l/s)	Classification
Shallow weathered	Unconfined	Unconsolidated material	Alluvium/colluvium /weathered	0 – 15	0.1 l/s	<u>**Non-aquifer**</u>
Intergranular and Fractured	Confined/ semi-confined	Ecca Group: Vryheid Formation shale/sandstone Pre-Karoo basement	Seepage water between host rock particles Discontinuities – fractures, fissures, joints	15 – 200* (Karoo) >200* (pre-Karoo)	0.5 – 2.0	<u>**Minor aquifer**</u>

* Thickness of aquifer given is based upon a generality and could vary significantly given the uneven basement topography

1.1 Aquifer recharge

Recharge is defined as the addition of water to the saturated zone, either by the downward percolation of precipitation or surface water and/ or the lateral migration of groundwater from adjacent aquifers. The groundwater recharge was estimated using the RECHARGE programme, which include using qualified guesses as guided by various schematic maps. The following recharge values as in Table 44 were inferred from the RECHARGE software programme (van Tonder and Xu, 2000).

Table 44: Recharge values inferred for the study area (RECHARGE, van Tonder and Xu, 2000)

Method/reference	Recharge (%)	Recharge (mm/a)
Geology[1]	3.00	20.1
Vegter[2]	4.86	30.56
Acru[3]	4.55	30.49
Harmonic mean	**3.95**	**26.03**

Notes: *Recharge per annum were calculated using a MAP figure of 670 mm.*

[1] Sandstone/shale/mudstone = 80%; hard rock 20%; soil cover <0.5% = 20%, soil cover >0.5% = 80%

[2] Vegter 1995

[3] Agricultural Catchments Research Unit, Schulze, R. 1989

According to the various sources used, the recharge of the study area varies between 3% and 4.86% with an average (harmonic mean) recharge of 3.95% of MAP. In general, recharge into the Karoo sandstones are relatively low with various factors controlling the recharge but typically range between 1 and 4% of MAP. However, the presence of intrusive bodies or faulting zones may exert a significant influence on the rate of recharge to the subsurface since they provide preferential pathways along which water can rapidly infiltrate from surface to the underlying aquifer.

1.2 Aquifer vulnerability

Tables 45 – 48 summarise the aquifer classification vulnerability scores for the aquifer/s in vicinity of the project area.

Table 45: DRASTIC vulnerability scores

Factor	Range/Type	Weight	Rating	Total
D	0 - 15 m	5	8	40
R	10 - 50 mm	4	6	24
A	Fractured	3	6	18
S	Sandy-clay-loam	2	4	8
T	0-2%	1	10	10
I	Karoo (northern)	5	4	20
C	-	3	-	-
DRASTIC SCORE = 120				

Table 46: Ratings for the Aquifer System Management and Second Variable Classifications

Aquifer System Management Classification		
Class	Points	Study Area
Sole Source Aquifer System	6	
Major Aquifer System	4	
Minor Aquifer System	2	2
Non-Aquifer System	0	
Special Aquifer System	0-6	
Second Variable Classification (weathered/fractured)		
High	3	
Medium	2	
Low	1	1

Table 47: Ratings for the Groundwater Quality Management (GQM) Classification System

Aquifer System Management Classification		
Class	Points	Study Area
Sole Source Aquifer System	6	
Major Aquifer System	4	
Minor Aquifer System	2	2
Non-Aquifer System	0	
Special Aquifer System	0-6	
Aquifer Vulnerability Classification		
High	3	3
Medium	2	
Low	1	

The occurring aquifer/s in terms of the above definitions, is classified as *minor*. The vulnerability, or the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer, in terms of the above, is classified as *high*. The level of groundwater protection based on the Groundwater Quality Management Classification:

GQM Index$_{Kleinkopje}$ = Aquifer System Management x Aquifer Vulnerability: *2 X 3 = 6*

Table 48: GQM index for the study area

GQM Index	Level of Protection	Kleinkopje
<1	Limited	
1-3	Low level	
3-6	Medium level	6
6-10	High level	
>10	Strictly non-degradation	

The ratings for the Aquifer System Management Classification and Aquifer Vulnerability Classification yield a Groundwater Quality Management Index of 4 for the study area, indicating that **a medium level of groundwater protection** is required. Reasonable and sound groundwater protection measures are therefore required to ensure that no cumulative pollution affects the aquifer.

In terms of DWS's overarching water quality management objectives which is i) protection of human health and ii) the protection of the environment, the significance of this aquifer classification is that if any potential risk exist, measures must be triggered to limit the risk to the environment, which in this case is the protection of i) the underlying aquifers and ii) the streams/rivers draining the larger project area.

2. Site specific hydrogeology

2.1 Hydrocensus

Aquatico Scientific (Pty) Ltd conducted a hydrocensus/user survey (Aquatico, 2013) during which all groundwater users and uses were identified within a two (2) kilometre radius of Kleinkopje. Contact was made with thirty-two (32) interested and affected parties while various borehole localities were logged (63 localities were surveyed), and water levels were measured where possible. Water quality data for fifty (50) localities were analysed, and water levels from thirty-two (32) boreholes were logged.

Kleinkopje Colliery is surrounded by various farms, small holdings and several other coal mine collieries. These collieries include; Greenside Colliery (to the north), Tweefontein Colliery (to the south west), Phoenix Colliery (to the south), Douglas Colliery (to the south east), and the Sharrighuisen Colliery (to the east).

Kleinkopje Colliery also monitor groundwater quality and water levels from eleven (11) boreholes on a quarterly interval. A summary of hydrocensus and monitoring boreholes located at Kleinkopje Colliery can be viewed in Table 11 of Annexure E6 and Figure 51 below.

2.2 Groundwater quality and hydrocensus boreholes

Water quality results for the hydrocensus localities were compared against the DWS Target Water Quality Guidelines (TWQG) for Domestic Use (DWAF, 1996a) and Livestock Watering (DWAF, 1996b). Results for the monitoring boreholes were evaluated according to the SANS 241: 2011 guidelines.

In terms of Domestic use, the hydrocensus localities can be described as neutral in pH to slightly acidic, non - saline to extremely saline (Smith02), slightly hard to very hard (Smith01, Smith02).

Most of the hydrocensus localities sampled in 2013 comply with the domestic use target water quality guidelines. Localities exceeding the TWQG for domestic use are:

- Smith01 – Sulphate (SO_4), Manganese (Mn)
- Smith02 – Electrical Conductivity (EC), Total Dissolved Solids (TDS), Calcium (Ca), Magnesium (Mg) Sulphate (SO_4), Manganese (Mn), and Hardness
- GS21 – Nitrate (NO_3 as N)
- DUV02 –Manganese (Mn)
- Van Schalkwyk 01 – Fluoride (F)

For livestock watering the hardness of locality Smith01 exceeded the TWQG, while the hardness, total dissolved solids (TDS) and sulphate (SO_4) concentrations exceeded at Smith02 (natural phenomena).

2.3 Groundwater quality in vicinity of Pit 2A Extension

Five boreholes are located in near vicinity to the Pit 2A Extension area. These are KKW11, KKW13, KKW14, KKW41 and KKW42 (refer to Figure 39). The following water quality summary was extracted from the annual report on groundwater monitoring results for 2014/2015 (Groundwater Complete, 2015). The quality datasets discussed are for the 2014/2015 annual period.

Average groundwater TDS concentrations for the past monitoring year vary between ± 360mg/l and 3730 mg/l. The permissible SANS value of 1200 mg/l was frequently exceeded in all monitoring boreholes except for KKW42, which is located downgradient from the Klippan Dump and 2A Dam. No significant increasing or decreasing concentration trends are evident from long-term trends (Groundwater Complete, 2015). The poor groundwater quality is however to be expected since most of the boreholes were developed into the opencast pits or underground mine workings (mine affected groundwater). Groundwater flow and mass transport is towards the actively mined opencast voids. Conceptually, the surrounding aquifer cannot be affected in spite of the poor water quality in the pits and underground workings. Pollution plumes can only form after the water levels in the pits / mines have recovered to near surface elevations.

Sulphate (SO_4) concentrations measured in the majority of monitoring boreholes (except KKW42) exceed the permissible SANS value of 500 mg/l varying between 1792 mg/l and 2752 mg/l (based on yearly averages, 2014/2015). Borehole KKW42 recorded significantly lower SO_4 concentrations with an average of 140 mg/l for the 2014/2015 database period.

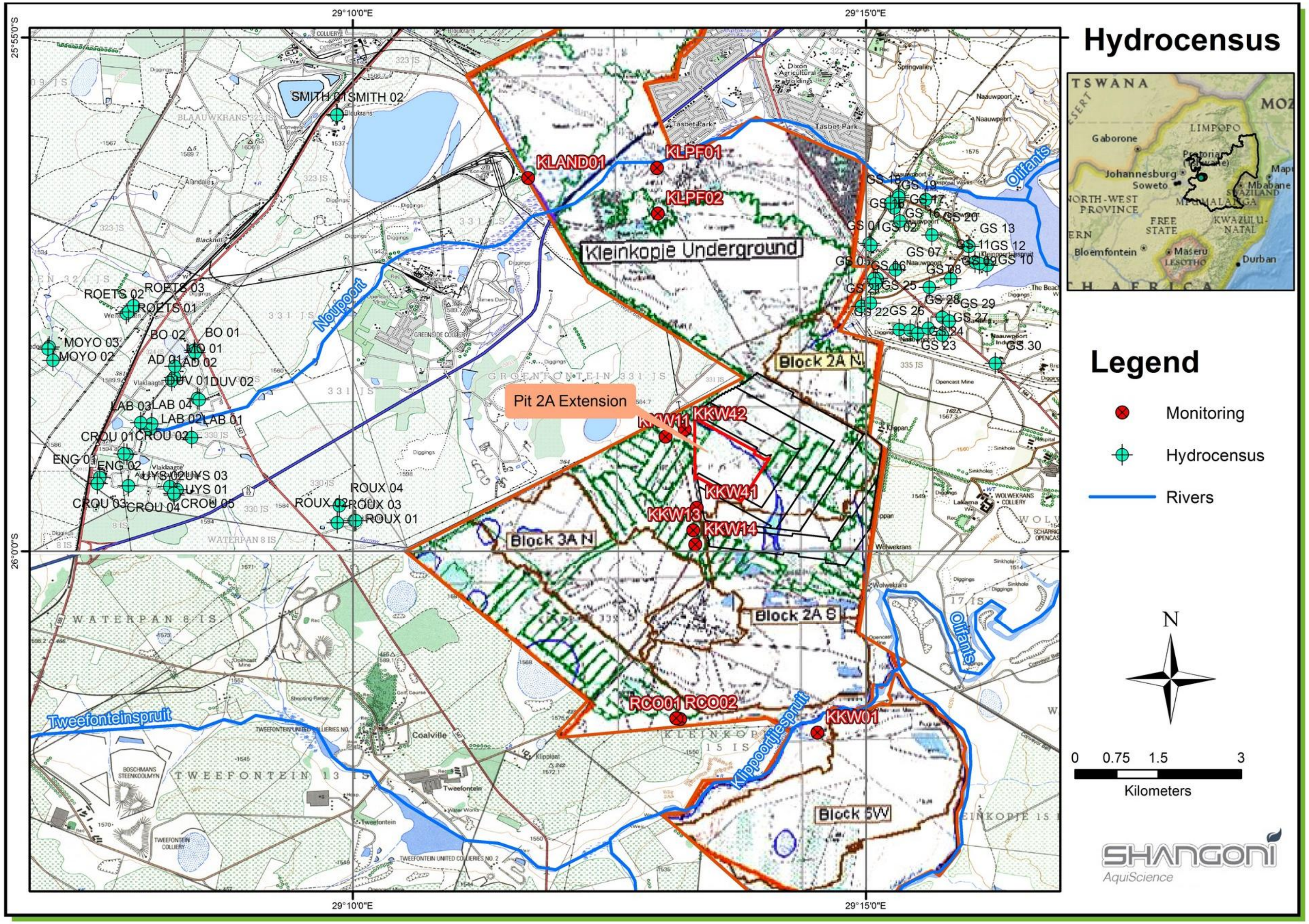

Figure 51: Kleinkopje Colliery hydrocensus and monitoring boreholes (Shangoni AquiScience, 2016)

The time-series graphs provided in Groundwater Complete (2015) indicate a slight decreasing concentration trend in KKW13 for the 2014/2015 monitoring year. Average groundwater pH values for the monitoring year vary between approximately 5.2 and 7.4, which area within permissible SANS ranges for domestic use. However, pH values measured in KKW11 and KKW13 were on occasion lower than the minimum permissible value of 5. Groundwater pH conditions are in general lower compared to background quality, most probably the direct result of significant acid mine drainage (AMD) occurring within the mining areas.

Nitrate (NO_3) concentrations measures during the 2014/2015 monitoring year remained well below the permissible SANS value of 11 mg/l and displayed no significant increasing or decreasing trends (Groundwater Complete, 2015). Average groundwater magnesium (Mg) concentrations for the 2014/2015 monitoring year vary between approximately 40mg/l and 440 mg/l. Greater concentrations were recorded for KKW13, which also displayed the highest groundwater sulphate concentrations.

The hydrochemistry reveals that groundwater from the monitoring boreholes is a mixture of different types – either clean fresh water that has undergone SO_4 and sodium chloride (NaCl) mixing. contamination or old stagnant NaCl dominated water that has mixed with clean water. These characteristics are the direct result of AMD reactions occurring within the backfilled mine workings and consequently polluting the groundwater with SO_4.

2.4 Groundwater levels

The groundwater levels available from the hydrocensus and monitoring boreholes in and around the mining areas were used in the generation of static groundwater level elevations with the use of a steady state numerical groundwater flow model. The steady state groundwater flow model (Groundwater Complete, 2011) can be viewed in Figure 52.

Regional static groundwater levels around the Kleinkopje mining area generally vary between 1 mbs in the topographically lower lying areas to approximately 15 mbs for the higher lying topographies. Some groundwater levels measured in the monitoring boreholes are significantly deeper than the general trend as a result of mine dewatering. Due to the generally low aquifer transmissivities the dewatering causes deep drawdown of the groundwater levels/piezometric heads and depression cones form that are deep, but very limited in lateral extent. Some of these boreholes have also been drilled into existing underground mining compartments. Water levels in these boreholes are also deeper since the water level has not yet recovered (Groundwater Complete, 2011).

The highest static water level elevations are approximately 1610 mamsl and occur in the topographically higher region towards the north of the mining area. The highest elevation to the west of the mining area is 1600 mamsl. The lowest static water level elevations where no impact from abstraction occurs are at approximately 1515 mamsl in the valley bottoms towards the east and south of the mining areas.

The water levels confirm the limited extent of the depression cones in that some levels near to the mined areas are clearly unaffected by the mining.

In vicinity of the Pit 2A Extension area, the hydraulic head elevation is expected to be between 1540 and 1565 mamsl, increasing from east to west (± 2 to 5 mbs).

Contours of the steady state (pre-mining) static water level or piezometric heads in and around the Kleinkopje mineral rights area are also presented in Figure 52. Path lines or flow lines of groundwater particles are lines perpendicular to the contours, as indicated with arrows. Flow occurs faster where contours are closer together and gradients are thus steeper.

2.5 Aquifer types

In an attempt to characterise and predict the movement of water in the subsurface, a conceptual geohydrological model of the area was postulated. The basis of such a model is the structural geological make-up, water strikes, yields and water level depths of the study area.

It is suspected that the geohydrological regime in the Kleinkopje mining area is made up of three aquifer systems, although they are regarded as the same type of aquifer (double porosity aquifer). For the purpose of this study an aquifer is defined as a geological formation or group of formations that can yield groundwater in economically usable quantities. According to this definition of an aquifer, only the weathered-fresh interface or fractures in the hard rocks below the weathered zone can be defined as aquifers. The shallow aquifer in the weathered zone is however very important from the perspective of environmental water balance and water movement through the landscape. The weathered zone and its interaction with the unsaturated zone (e.g. soil water and vadose) is still an important contributor to water problems at Kleinkopje Colliery.

An aquifer is comprised of a geological formation, or group of geological formations, or part of a formation that contains sufficient saturated permeable material to store and transmit water and to yield economical quantities of water to boreholes or springs. It is the storage medium from which groundwater is abstracted. *It should be managed properly and at all times be protected from over-exploitation and contamination.* The thickness and extent of an aquifer is influenced by fracture extent, orientation, aperture, as well as the thickness of the geological layers. Aquifer tests concluded for adjacent collieries reveal that the aquifers do not have the potential for yielding large volumes of water.

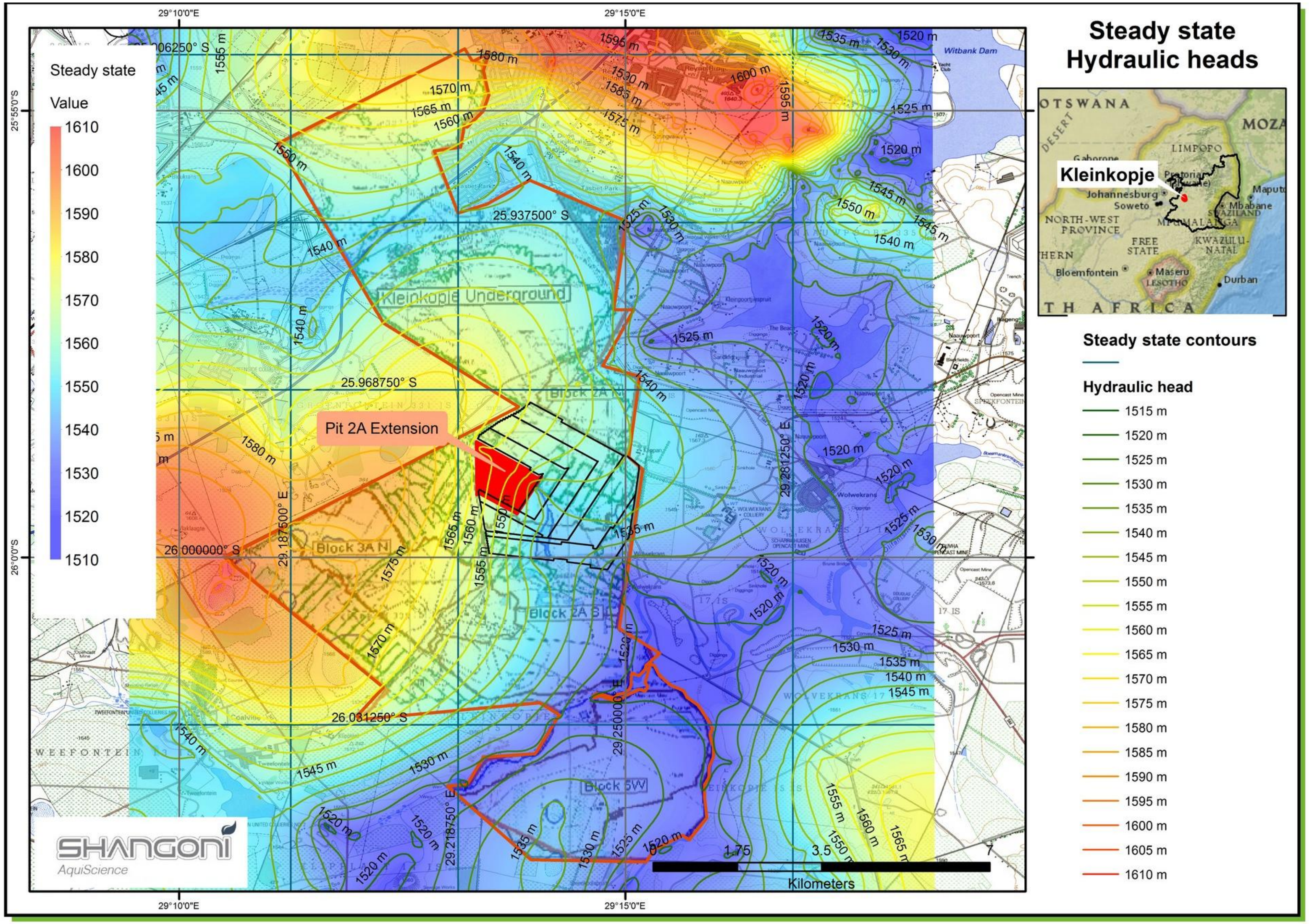

Figure 52: Steady state calibrated water level contours ((adapted from Groundwater Complete (2013)

The three probable aquifers[47] that can be distinguished within the study area are:

i) Shallow perched and weathered unconfined or semi-confined aquifer.
ii) Fractured confined or semi-confined aquifer in the Ecca Vryheid Formation.
iii) Fractured Pre-Karoo aquifer.

2.6 Aquifer transmissivity and storativity

No site specific data with regards to aquifer transmissivity or storativity is available for Kleinkopje Colliery. However, aquifer tests conducted by Groundwater Complete (2013) on the fractured Karoo aquifer reveal the following:

The aquifer can be regarded as heterogeneous having a good fracture network formed in the consolidated and mostly impervious matrix as a result of tectonic and depositional stresses. Movement of groundwater is mostly restricted to fracture and aperture flow although the sandstone / shale matrix may also contribute as seepage, albeit very little. Aquifer pump test data performed on the monitoring boreholes drilled at Landau Colliery Navigation Section was made available. The transmissivity for the Karoo fractured aquifer is relatively low with a matrix transmissivity (Tm) ranging between 0.14- and 0.35 m^2/d, a fracture transmissivity (Tf) ranging between 1.0- and 2.29 m2/d with probable yields of between 0.5 – 1.0 l/s. The hydraulic conductivity (K) for the aquifer was calculated using the transmissivity and an aquifer thickness (b) of 15m. Bu substituting the equation for calculating transmissivity, i.e. T = Kb to read K = T/b hydraulic conductivity ranges was calculated between 0.009- and 0.023 m/d for the matrix. The hydraulic parameters as calculated by Groundwater Complete (2013) can be viewed in Table 49.

Table 49: Summary of pump test data at the proposed Navigation West project (data from Groundwater Complete, 2013)

Borehole Number	Tf (m^2/day)	Tm (m^2/day)	K (m/d)	Sf*	Sm*
Geometric mean	2.29	0.35	0.023	0.0006	0.0011
Harmonic mean	1.08	0.14	0.009	0.0002	0.0003
Mean of Geo and Harmonic	1.69	0.24	0.016	0.0004	0.0007

2.7 Hydraulic head vs. topography

Figure 53 correlates recorded hydraulic heads with the surface topography (in mamsl). The data indicates that there is a strong correlation of 98% between the topography and the hydraulic heads implying that groundwater flow directions mimic surface drainage. Dynamic water levels, i.e. boreholes pumping during the time of the investigation were excluded from the correlation.

[47] Refer to Annexure E6 for more information on the three aquifers

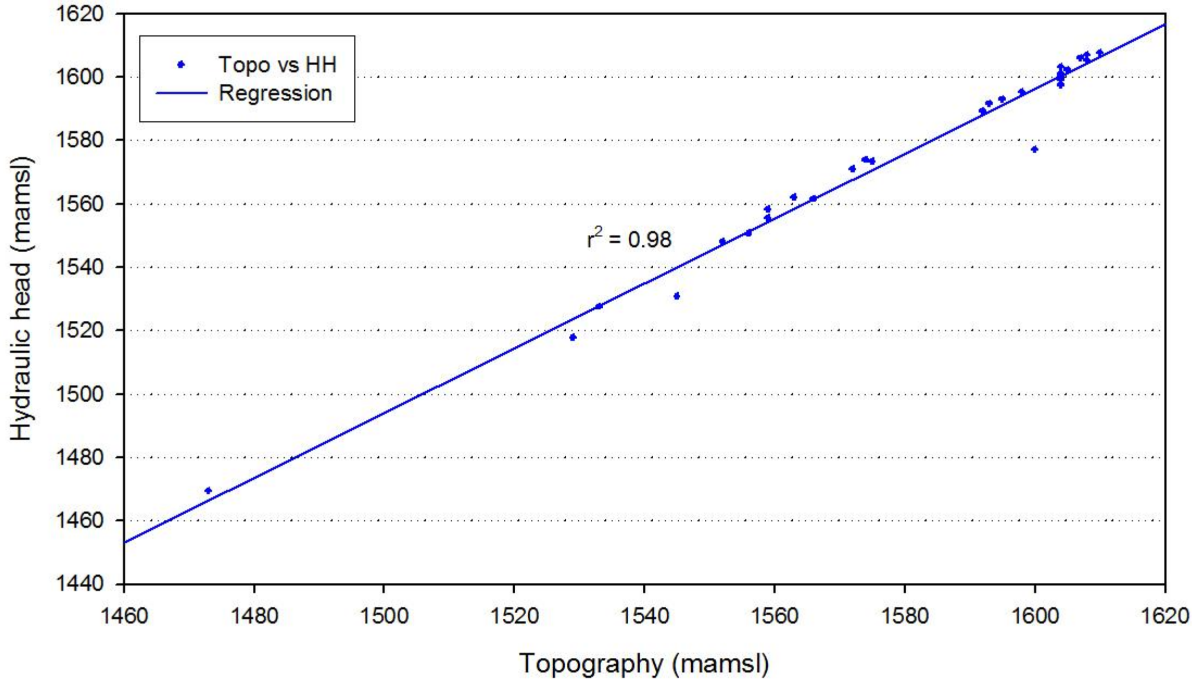

Figure 53: Correlation between the hydraulic head elevation and the corresponding topography (r^2 = 98%)

2.8 Groundwater velocity

The rate of movement of ground water is important in many problems, particularly those related to pollution. For example, if a harmful substance is introduced into an aquifer up-gradient from a supply borehole, it becomes a matter of great urgency to estimate when the substance will reach the borehole. The velocity at which groundwater (and pollutants) move can be calculated using a combination of i) Darcy's Law, ii) the velocity equation and iii) effective porosity (water can only move through the openings of rocks). Combining the above, an equation for the seepage velocity can be obtained:

$$\mathrm{v} = \frac{Ki}{\emptyset}$$

where: v = seepage velocity

K = hydraulic conductivity

i = hydraulic gradient

ø = effective porosity (probable)

Inferred hydraulic conductivities for the secondary, semi-confined weathered Karoo aquifers were used in the calculation while a conservative hydraulic conductivity and effective porosity of 0.05 m/d and 0.05 were used, respectively, to obtain a worst case scenario for seepage velocity. The expected groundwater seepage rate for the weathered aquifer is shown in Table 50.

Table 50: Groundwater gradients and seepage rates (based upon average values)

Aquifer	Hydraulic conductivity (m/d)	Hydraulic gradient (avg)	Effective porosity	Seepage velocity (m/d)	Seepage velocity (m/a)
Secondary semi-confined	0.05	0.0114	0.05	0.011	4.2

It should be noted that because of the heterogeneity of fractured rock environments resulting from preferential flow paths formed by intrusive dykes and other igneous intrusions, the transport velocities could be orders of magnitude greater than the average velocities shown above. However, it is based upon conservative values and therefore imply worse case scenarios.

3. Numerical groundwater model

This section on numerical groundwater flow modelling was extracted from the report titled *Geohydrological Assessment and Gap Analysis for Kleinkopje Colliery*, compiled by Groundwater Complete (2011). Although the Pit 2A Extension area was not included in the Shangoni AquiScience modelling exercise, the fact that its immediate surroundings were included as opencast sections and seams immediately below the area are mined using underground methods, it can be assumed with relative confidence that predicted scenarios as contained within the Geohydrological Assessment conducted by Groundwater Complete (2011) will not vary significantly.

Numerical flow and mass transport groundwater models were constructed to simulate current aquifer conditions and impacts and to provide a tool for the evaluation of different management options for the future. A risk analysis could also be performed where effects of different flow and concentration parameters as well as the impacts of nearby existing operations and management options could be evaluated. It should be noted that the numerical model in this study merely acts as a presentation of what is expected to occur in the Kleinkopje area. Information that can aid in obtaining results that represents the reality as close as possible include aquifer parameter estimation from pump test results and mining history of the Kleinkopje mine. If any new or additional information becomes available, the numerical model should be updated.

A steady state flow model visualising the regional groundwater flow directions in an un-mined scenario and a transient flow model predicting impacts during and post-mining were developed. The baseline conditions for the steady state model were the water levels from the hydrocensus boreholes and rainfall recharge figures, while for the transient model the conditions as summarised in the Table 17 in Annexure E6, were used to predict operational and closure scenarios.

According to the model simulations the simulated maximum drawdown in Block 2A S is expected to be 75 meters. In Block 5W the maximum drawdown will be approximately 40 meters and in Block 2A N approximately 65 meters. According to the model simulation, the cone of depression will not exceed a distance of 1 000 m from the pits and does not include any privately owned boreholes or natural drainage lines. It does however include the 2A PCD but this facility will be demolished and relocated.

It should be noted that this distance is seen as absolute worst case scenario and after aquifer parameters have been determined with pumping tests, the model can be updated to get the most probable estimate. The flow scenario predicted 50 years post-closure (Figure 56) indicates that although some recovery has occurred, the simulated water levels have not yet recovered to within steady state/equilibrium levels in the opencast mining areas.

4. Contaminant transport model

A contaminant transport model applies mathematical expressions to represent a regional or site-specific groundwater contamination problem which simulates the movement of a contaminant through the subsurface. These models also depict the movement of contamination with time and as such are important tools in the management and remediation of contaminated groundwater sites. A groundwater contamination plume generally contains numerous contaminants. Each contaminant within the plume may migrate differently, and some will react with each other. In transport predictions one normally concentrates on the contaminant that is considered the most conservative for the investigated transport problem to reflect worst case scenarios. Since sulphate (SO_4) is regarded as a non-reactive and conservative ion and also an expected pollutant within the mining industry, it was used as the modelled parameter.

During active mining and until a new groundwater equilibrium has been reached, the mining voids / pits act as groundwater sinks and groundwater will move radially inwards towards it. This means that during this period poor quality leachate generated, if any, will move towards the mine voids and cannot drain towards the immediate surroundings. However, in case of opencast mining, where rehabilitation has occurred at lower elevations the water level can somewhat recover and cause leachate to move away from the rehabilitated areas.

The mass transport model was constructed by assigning higher transmissivity and recharge values to the defunct opencast pits. Several potential sources of groundwater pollution were simulated in the mass transport model. The opencast pits, dumps and the plant area were simulated with the use of contaminated recharge since these are seen as dry sources. The unlined 2A Dam and Plant RWD were simulated as contaminated river nodes since these are wet sources. At dry sources (rock dumps and the plant area) poor quality leachate occurs during periods of rainfall while at wet sources (unlined RWD and pollution control dam) poor quality seepage occurs on a continuous basis if unlined.

A SO_4 concentration of 100% was applied to the potential source areas. Figure 57 indicates that contamination at mine closure has not yet started to spread since the water levels in the opencast mining area have not recovered yet and still act as a groundwater sink. The plant area is situated on an ‘island’ between the Block 3A and Block (Pit) 2A South pits. Since these two pits still act as groundwater sinks, the pollution plume from the plant will flow into the pits. Pollution from the other sources (except the Klipfontein Dump) will also flow into the pits and will not affect groundwater downgradient of the sources.

The source concentrations 50 years after closure (Figure 58) indicate that the concentrations at the main pollution sources would have diminished to approximately 30%. The water level has not recovered completely in the pits and the plumes from the other sources still partially flow into the pits but have also started to move downgradient. The plume from the plant, unlined dams, backfilled pits and other source areas will dilute as time progresses since the source is removed after mine closure. No privately owned boreholes or natural drainage feature will be significantly affected during operation of the Pit 2A Extension area or post-closure thereof.

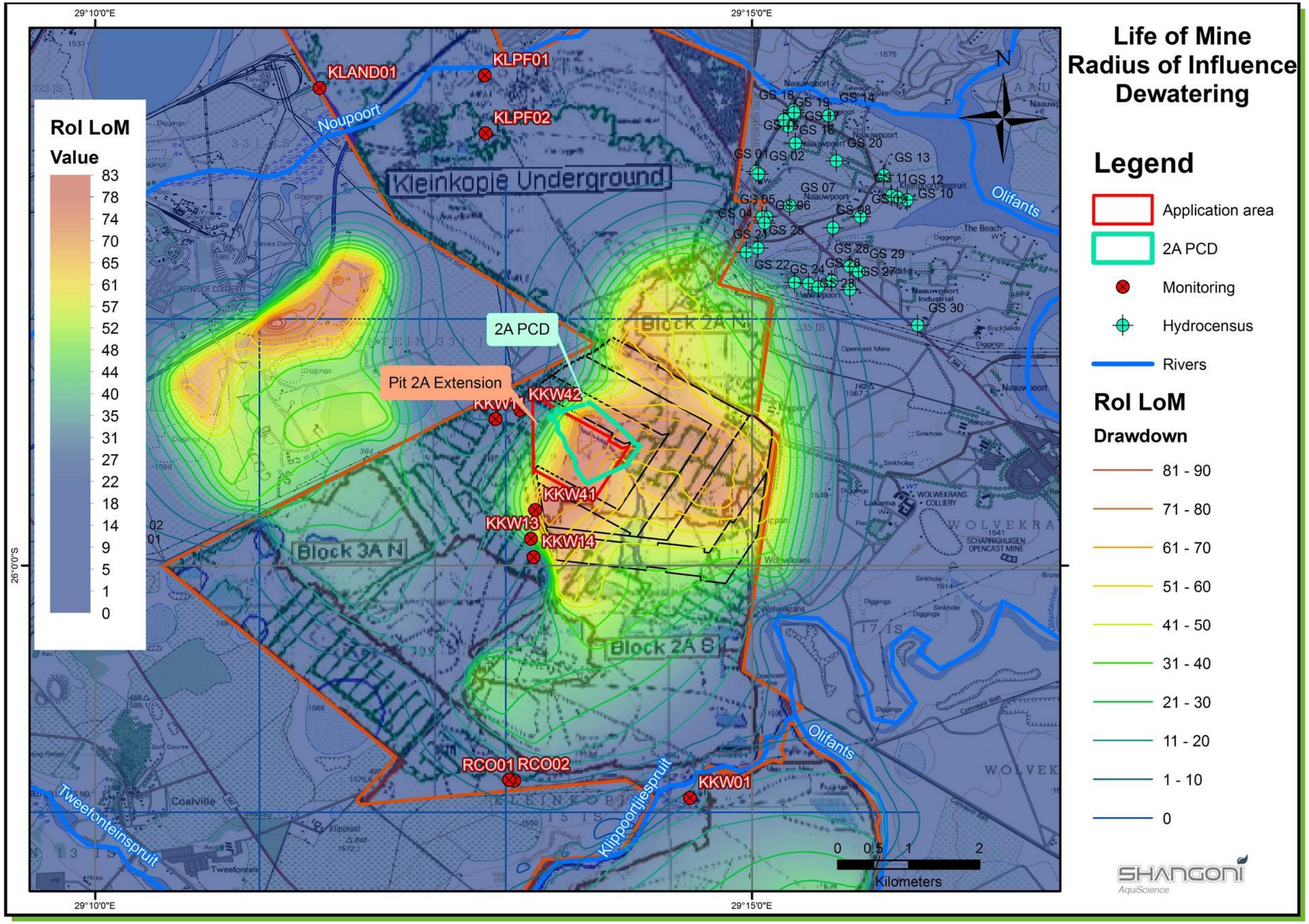

Figure 54: Simulated maximum drawdown at the end of life-of-mine (Shangoni AquiScience, 2016)

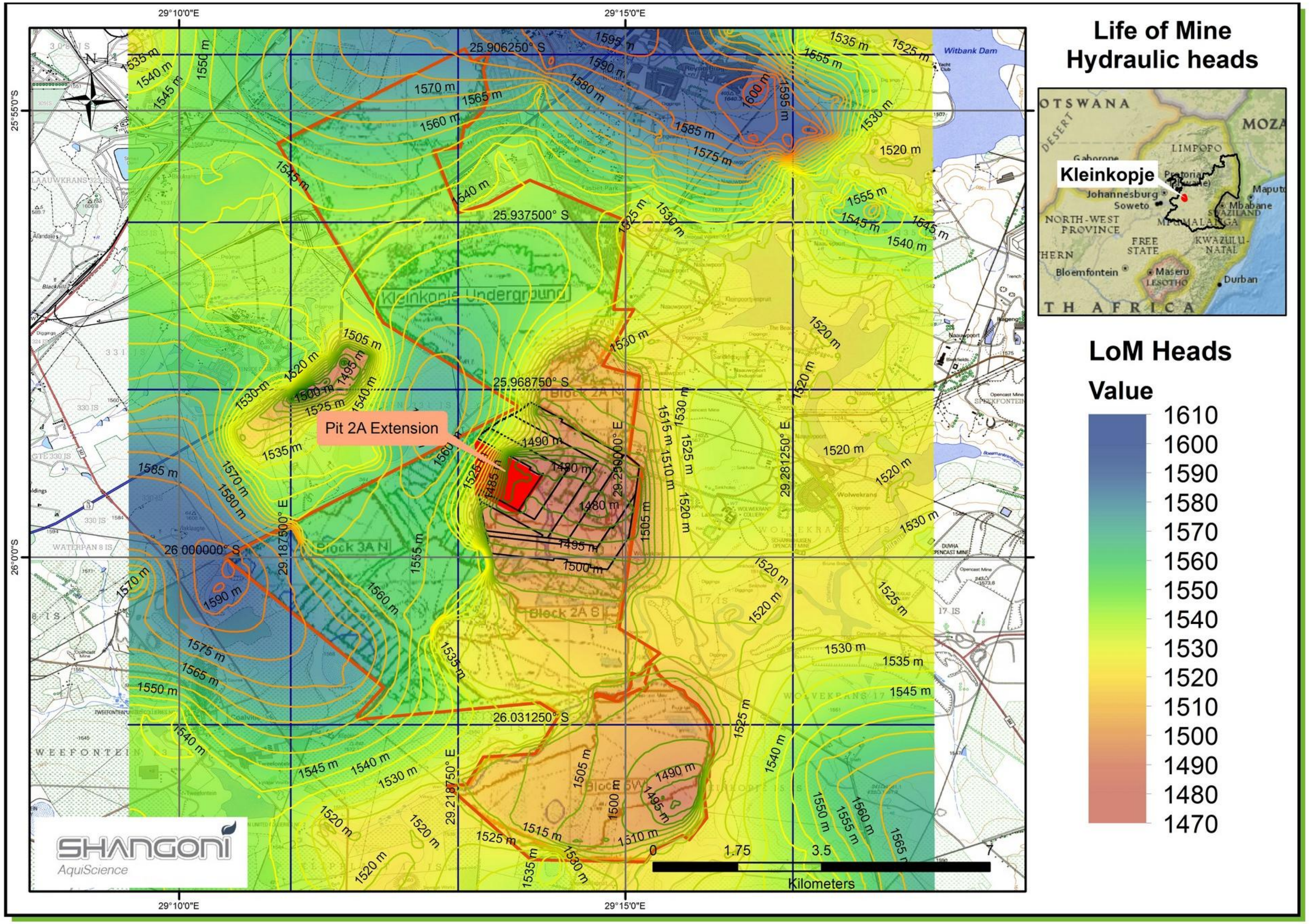

Figure 55: Simulated maximum drawdown at the end of life-of-mine (Shangoni AquiScience, 2016)

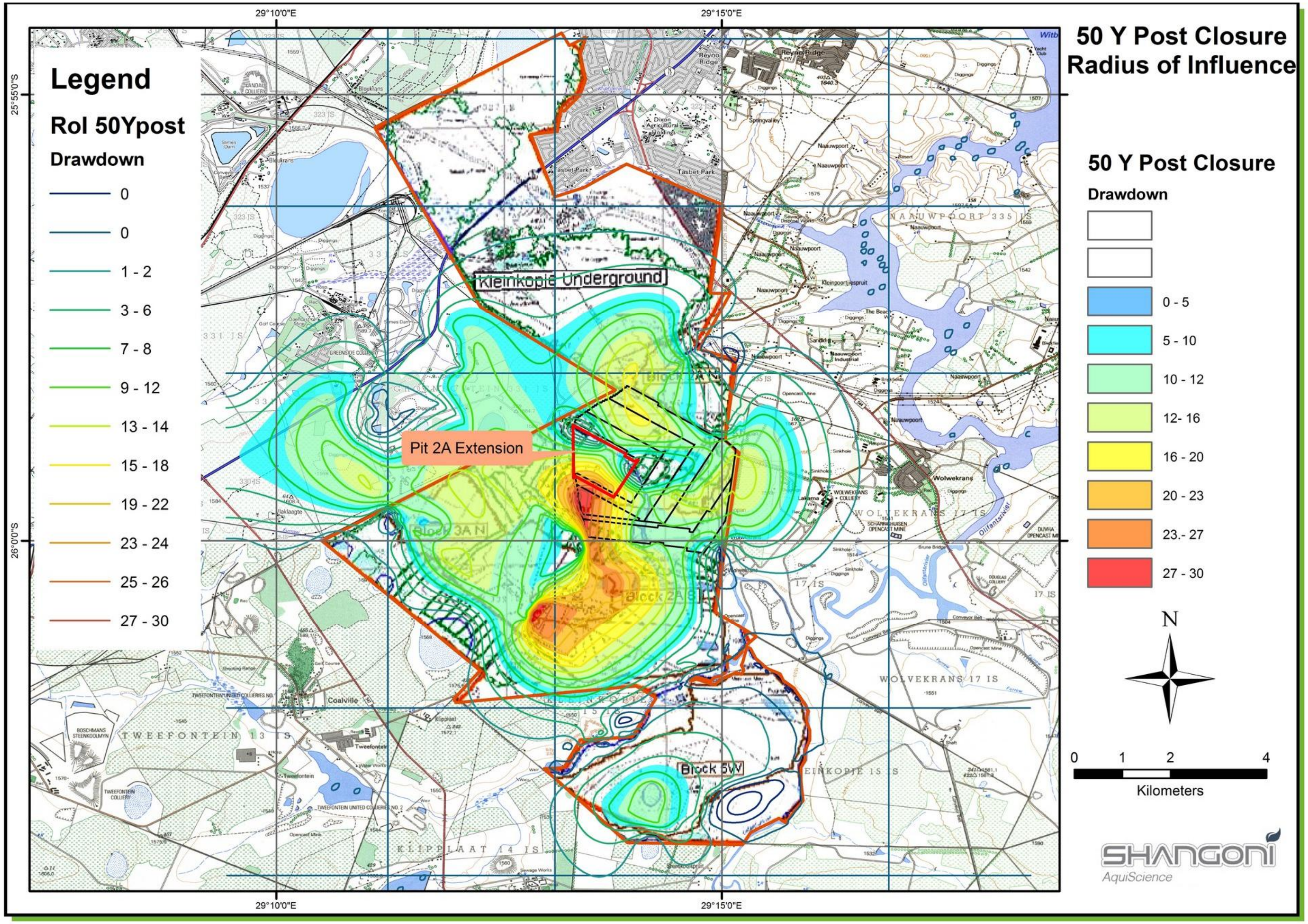

Figure 56: Simulated hydraulic heads 50 years post-closure (Shangoni AquiScience, 2016)

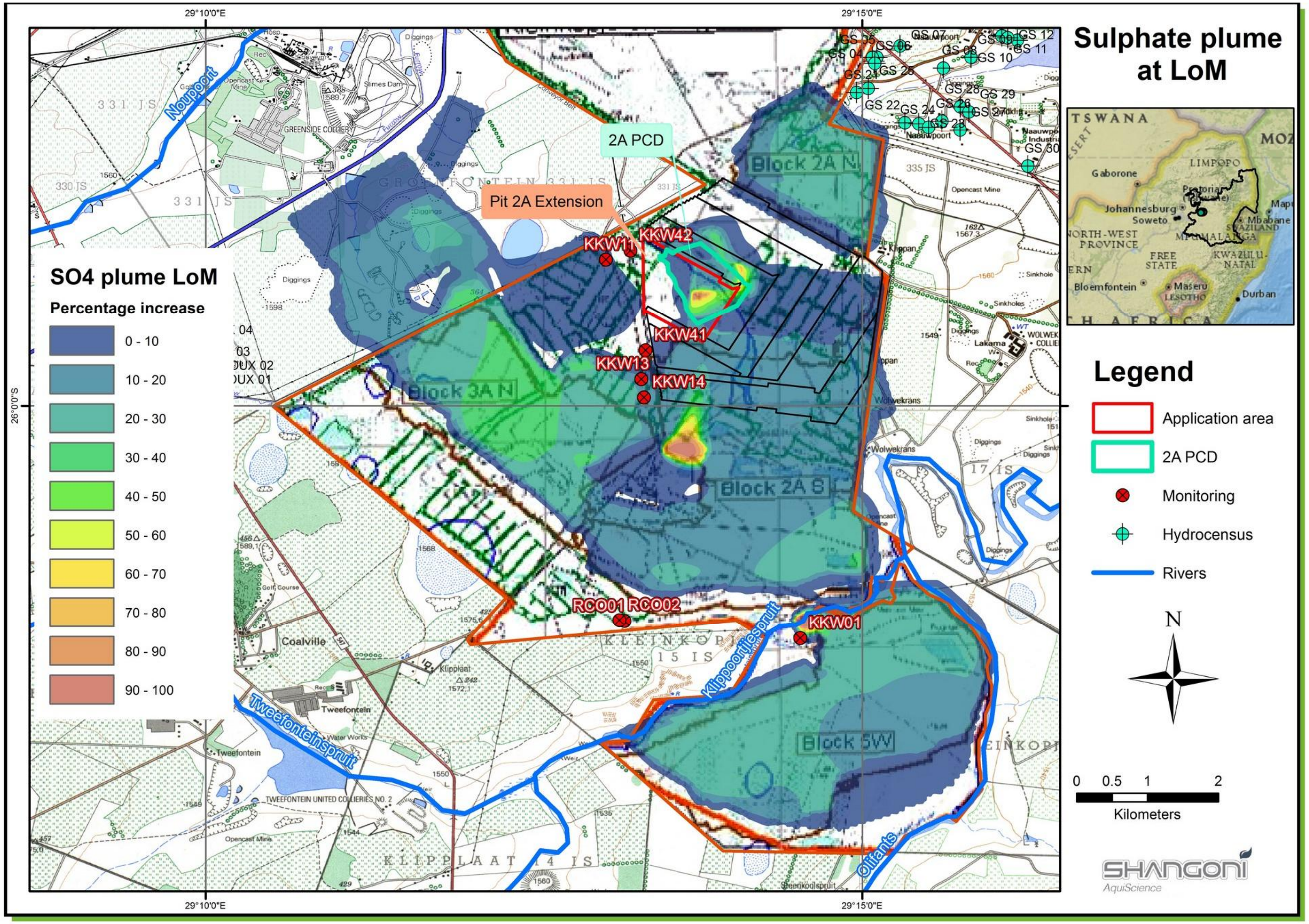

Figure 57: Simulated sulphate plume contours at Life of Mine (Shangoni AquiScience, 2016)

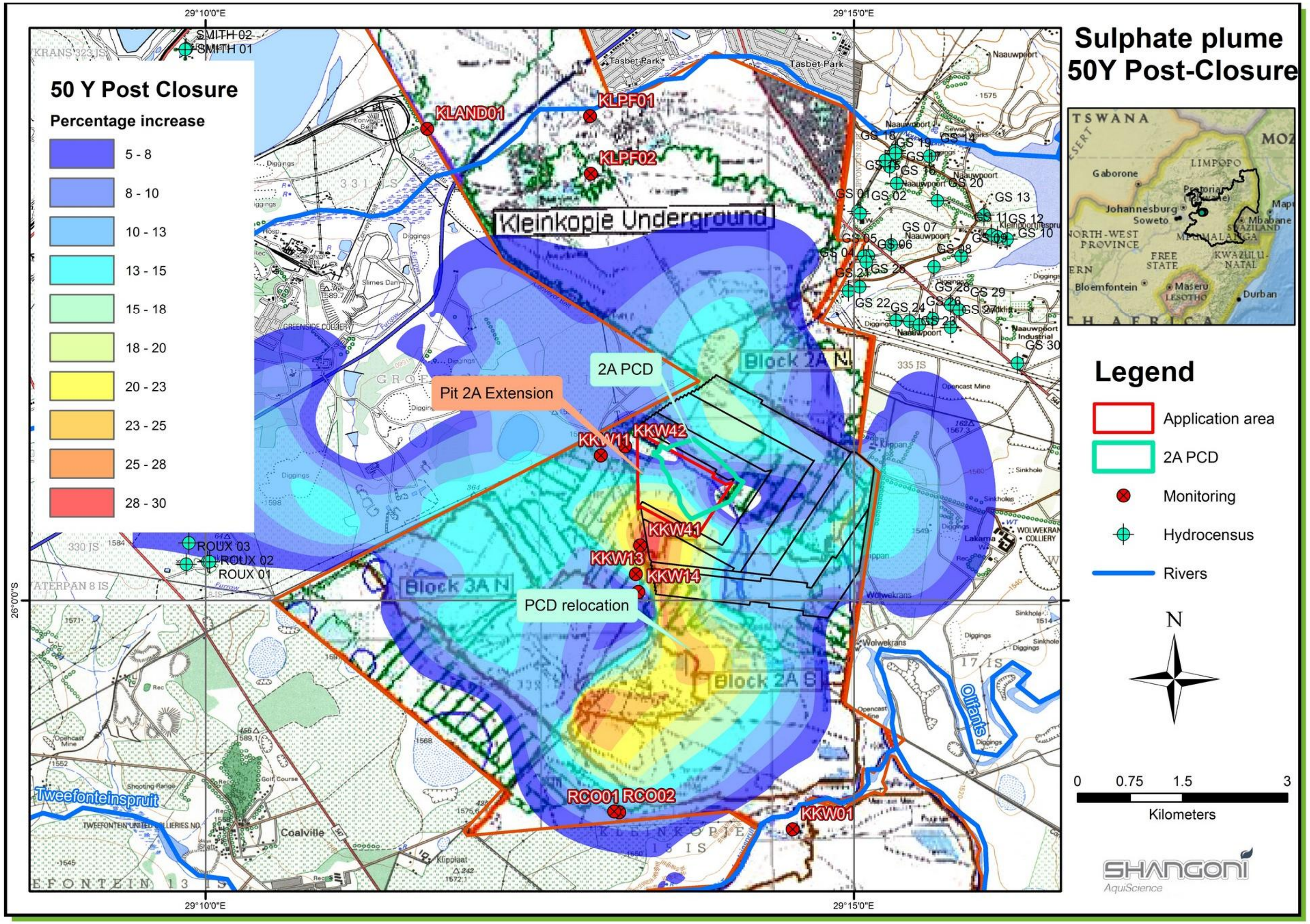

Figure 58: Simulated SO_4 plume 50 years post-closure (Shangoni AquiScience, 2016)

Chapter J: Air Quality

WSP Environmental (Pty) Ltd has been appointed by Anglo American Coal SA to monitor particulate concentrations and maintain a dust fallout network in and around Kleinkopje Colliery. The air quality monitoring report for July 2016 is attached in Annexure E7.

The dust fallout (DFO) monitoring network located in and around the Kleinkopje Colliery, enables the assessment of the current levels of nuisance dust against the National Environmental Management: Air Quality Act (NEM: AQA) National Dust Control Regulations (GNR 827). The ASTM D1739 reference method, as required in the National Dust Control Regulations, makes use of fallout gauges (dust buckets) which are essentially open containers, filled with distilled water and algaecide, and left at designated sites for a stipulated timeframe to collect deposited particles. Important to note is that compliance with the National Dust Control Regulations is only assessed with fallout levels obtained from single fallout units and not with directional units as motivated in Annexure E7.

Reporting of dust fallout, PM_{10} and $PM_{2.5}$ concentrations is conducted on a monthly basis.

1 Dust deposition

Air quality standards and guidelines are specified in the National Environmental Management: Air Quality Act (NEM: AQA); the South African National Standards (SANS) Framework for Setting and Implementing National Ambient Air Quality Standards; as well as the SANS 1929:2005 Ambient Air Quality - Limits for Common Pollutants. The priority pollutants as defined by the Act are sulphur dioxide (SO_2), nitrogen dioxide (NO2), particulate matter (PM_{10} and $PM_{2.5}$), ozone (O3), benzene (C6H6), lead (Pb) and carbon monoxide (CO). On 01 November 2013, the legislated standards for dust fallout were promulgated by the Minister of Water and Environmental Affairs in the form of the NEM: AQA National Dust Control Regulations (NDCR) (GNR 827). These newly promulgated regulations are based on the SANS standards and present acceptable/allowable dust fallout rates for both residential and non-residential areas. These dust fallout rates, as applied in the Kleinkopje Colliery air quality monitoring reports for compliance assessment purposes, are presented in Table 51.

Table 51: Acceptable Dust Fallout Rates as per the National Dust Control Regulations (GN.R 827, 01 November 2013)

Restriction areas	Dust fallout rate (D) ($mg/m^2/day$) 30 day average	Permitted frequency of exceeding dust fallout rate	Reference method
Residential area	D < 600	Two within a year; not sequential months	ASTM D1739
Non-residential area	600 < D < 1200	Two within a year; not sequential months	ASTM D1739

2 Particulate matter

With regard to the setting of limit values for particulate matter, the following is recognised:

- Different types of particles can have different harmful effects on human health;
- There is evidence that risks to human health associated with exposure to man-made PM_{10} and now $PM_{2.5}$ are higher than risks associated with exposure to naturally occurring particles in ambient air; and
- As far as they relate to PM_{10} and $PM_{2.5}$, action plans and other reduction strategies should aim to reduce concentrations of fine particles as part of the total reduction in concentrations of particulate matter.

Stringent Limit and Target Values for particulate matter (expressed in μg/m³) have been suggested as guidelines in SANS 1929:2005, and revised in 2009 and 2012 as part of the NEM:AQA ambient air quality standards. These were developed by a panel of experts on the basis of best international practice. The latest regulations pertaining to $PM_{2.5}$, emanating from NEM:AQA (GNR 1210), were promulgated in June 2012 and stipulate a phased approach towards the implementation of national ambient air quality standards. The PM_{10} and $PM_{2.5}$ standards as applicable to this assessment are tabulated below (Table 52 and Table 53).

Table 52: Rollout of National Ambient Air Quality Standards for PM_{10}

Averaging period	Concentration	Permissible exceedances (per calendar year)	Compliance date
24-hour	180 μg/m³	4	Prior to 1 April 2010
24-hour	120 μg/m³	4	1 April 2010 – 31 December 2014
24-hour	75 μg/m³	**4**	**1 January 2015**
Annual	60 μg/m³	0	Prior to 1 April 2010
Annual	50 μg/m³	0	1 April 2010 – 31 December 2014
Annual	40 μg/m³	**0**	**1 January 2015**
Note: Standards indicated in bold are the current standards			

Table 53: Rollout of National Ambient Air Quality Standards for $PM_{2.5}$

Averaging period	Concentration	Permissible exceedances (per calendar year)	Compliance date
24-hour	65 μg/m³	**4**	**Immediate – 31 December 2015**
24-hour	40 μg/m³	4	1 January 2016 – 31 December 2029
24-hour	25 μg/m³	4	1 January 2030
Annual	25 μg/m³	**0**	**Immediate – 31 December 2015**

Averaging period	Concentration	Permissible exceedances (per calendar year)	Compliance date
Annual	20 µg/m^3	**0**	1 January 2016 – 31 December 2029
Annual	15 µg/m^3	0	1 January 2030
Note: Standards indicated in bold are the standards relevant to the air quality report period (December 2015)			

It must be noted that from a legal standpoint, only standards promulgated under the National Environmental Management Air Quality Act (Act 39 of 2004) are applicable during the relevant timeframes as stipulated above. In addition, the ambient air quality standards are to be used to identify priority areas which require the attention of the regulatory authorities.

3 Highveld Priority Area

On 4 May 2007 the Minister of Environmental Affairs and Tourism formally declared the eastern part of Gauteng and western part of Mpumalanga an air pollution hotspot, to be known as the "The Highveld Priority Area", a National air pollution hotspot in terms of Section 18(1) of the NEM:AQA. By declaring a priority area, authorities recognise that air quality within these areas are generally regarded as being poor, and frequently meet or exceed ambient air quality standards.

The Highveld Priority Area extends from the eastern parts of Gauteng, to Middelburg in the north and the edge of the escarpment in the south and east. Major towns occurring within this region include eMalahleni (Witbank), Middelburg, Secunda, Standerton, Edenvale, Boksburg, Benoni and Balfour. The area incorporates portions of the Gauteng and Mpumalanga Provinces. The area is contained within 1 Metropolitan Municipality (Ekurhuleni) and 3 District Municipalities (Sedibeng, Gert Sibande and Nkangala) and more specifically 9 local municipalities: Lesedi Local Municipality (Sedibeng); Govan Mbeki Local Municipality (Gert Sibande); Dipaleseng Local Municipality (Gert Sibande); Lekwa Local Municipality (Gert Sibande); Msukaligwa Local Municipality (Gert Sibande); Dr. Pixley Ka Isaka Seme Local Municipality (Gert Sibande); Victor Khanye Local Municipality (Nkangala); eMalahleni Local Municipality (Nkangala); and Steve Tshwete Local Municipality (Nkangala).

The Kleinkopje Colliery is located in eMalahleni, which forms part of the eMalahleni Local Municipality in the Nkangala District, therefore falls within the boundaries of the Highveld Priority Area. This implies that authorities may impose measures on the Kleinkopje Colliery and other mines and industries within this area in order to allow for improvements in the air quality of the region.

4 Monitoring network

Dust fallout monitoring at the Kleinkopje Colliery is conducted at 21 locations, nineteen of which are single units and two are directional units. Figure 59 illustrates all monitoring locations, distinguishing between single buckets and monitoring trailer.

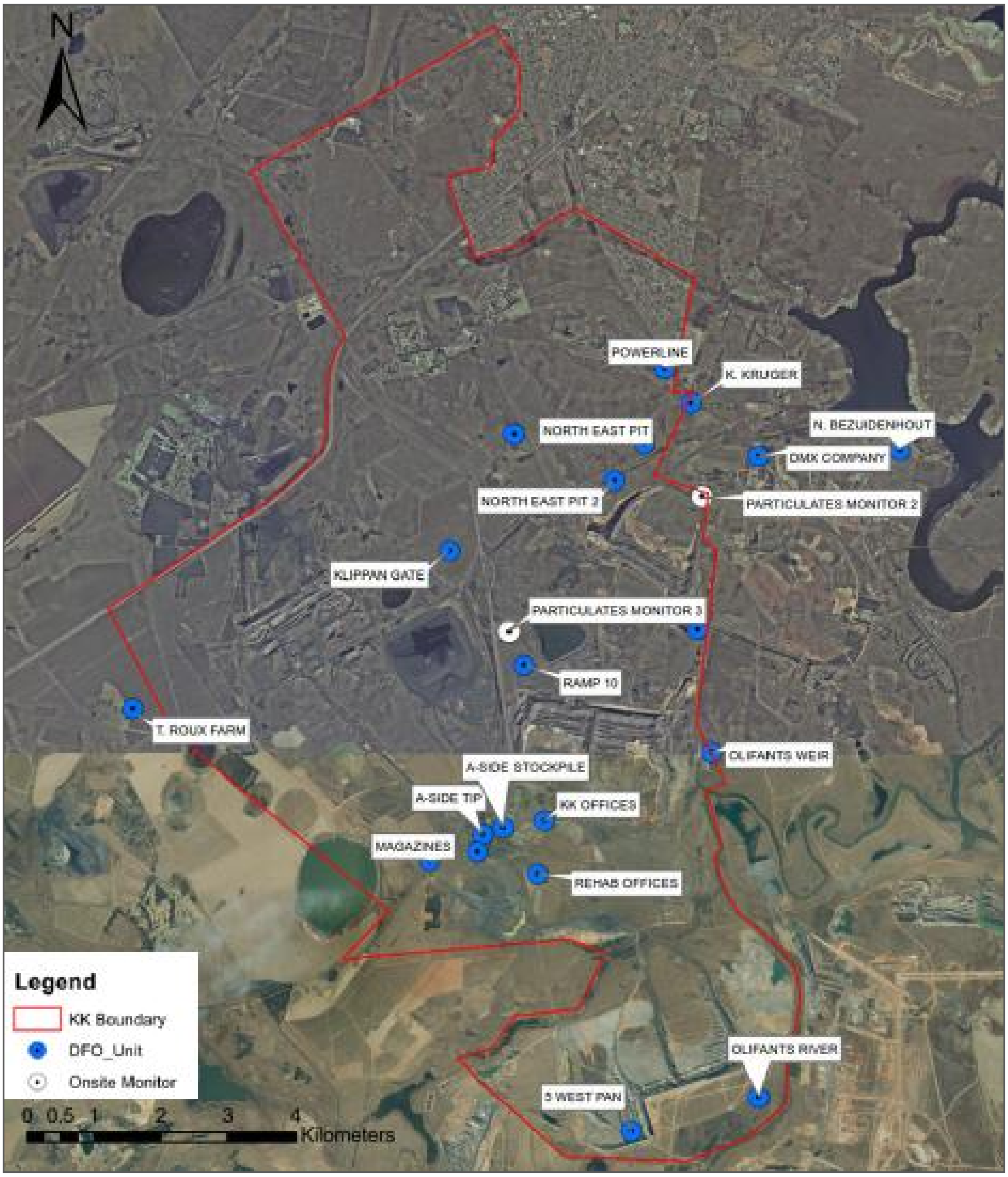

Figure 59: Kleinkopje Colliery dust fallout monitoring locations (source: WSP Environmental; April 2016)

4 Monitoring results for ambient monitoring locations

4.1 Dust fallout results

Table 5 of the July 2016 monitoring report in Annexure E7 presents the dust fallout results for 2016. Refer also to Figure 48.

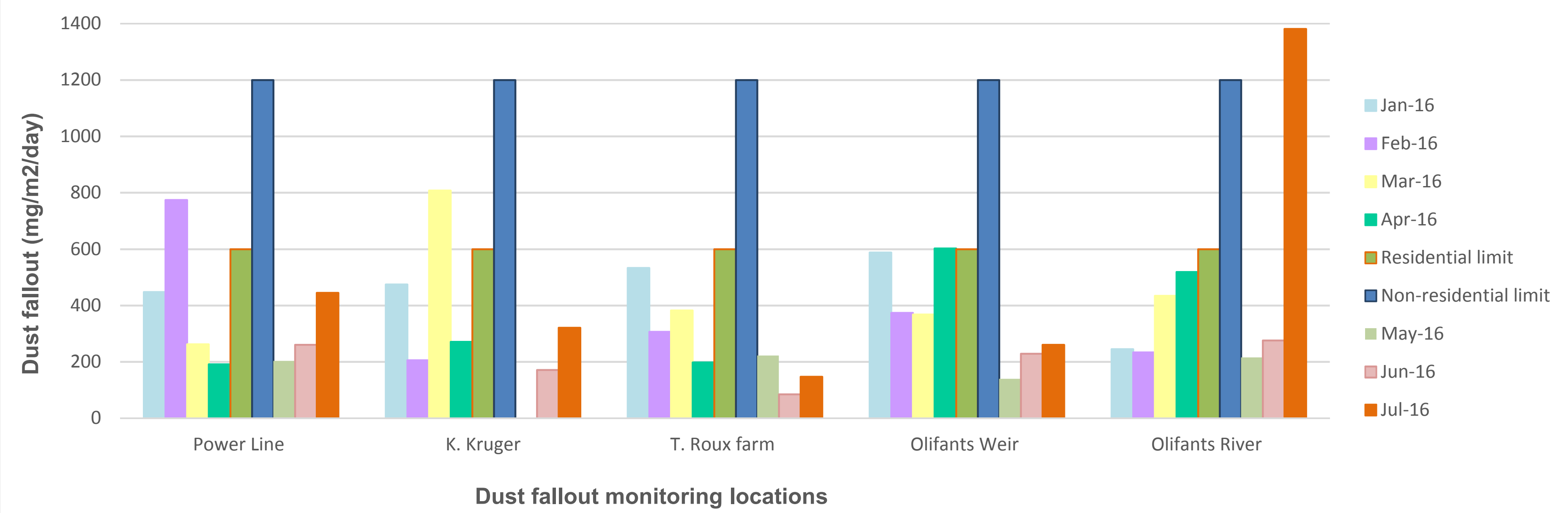

Figure 60: 2016 Dust fallout results for perimeter monitoring locations (adapted from: WSP Environmental; July 2016)

4.1 Particulate matter

4.1.1 Du Plessis TOPAS Monitor

- Data recovery from the Du Plessis Topas Monitor was 34.47% for the monitoring period, well below the minimum requirement of 90% set by the Department of Environmental Affairs. Such poor recovery is a result of power issues at the unit. Kleinkopje Colliery is busy investigating these issues; and
- Due to the low data recovery on the unit, the data presented here should be viewed with caution.

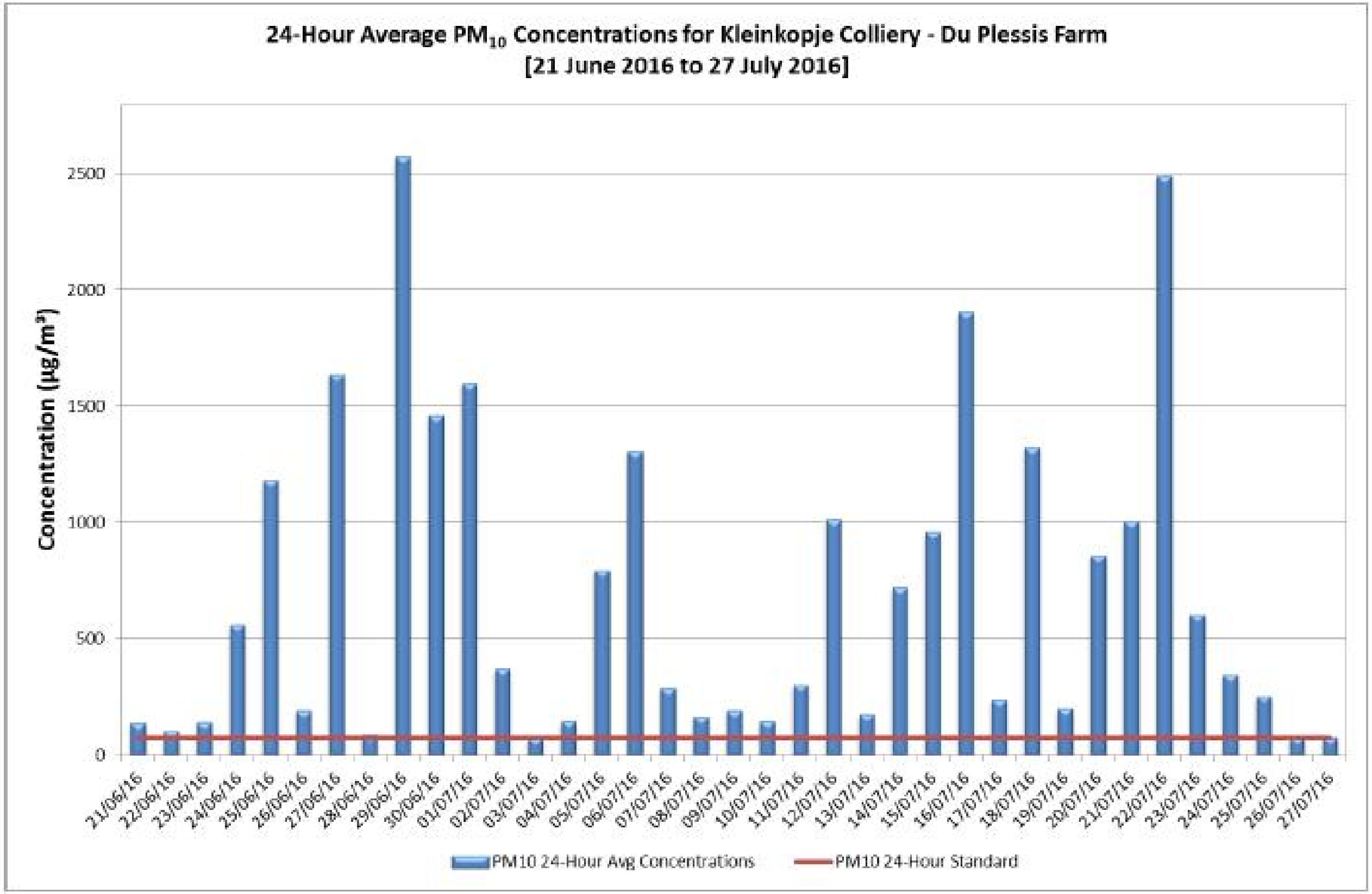

Figure 61: Daily average PM_{10} measured at the Du Plessis Topas Monitor for the monitoring period (source: WSP Environmental; July 2016)

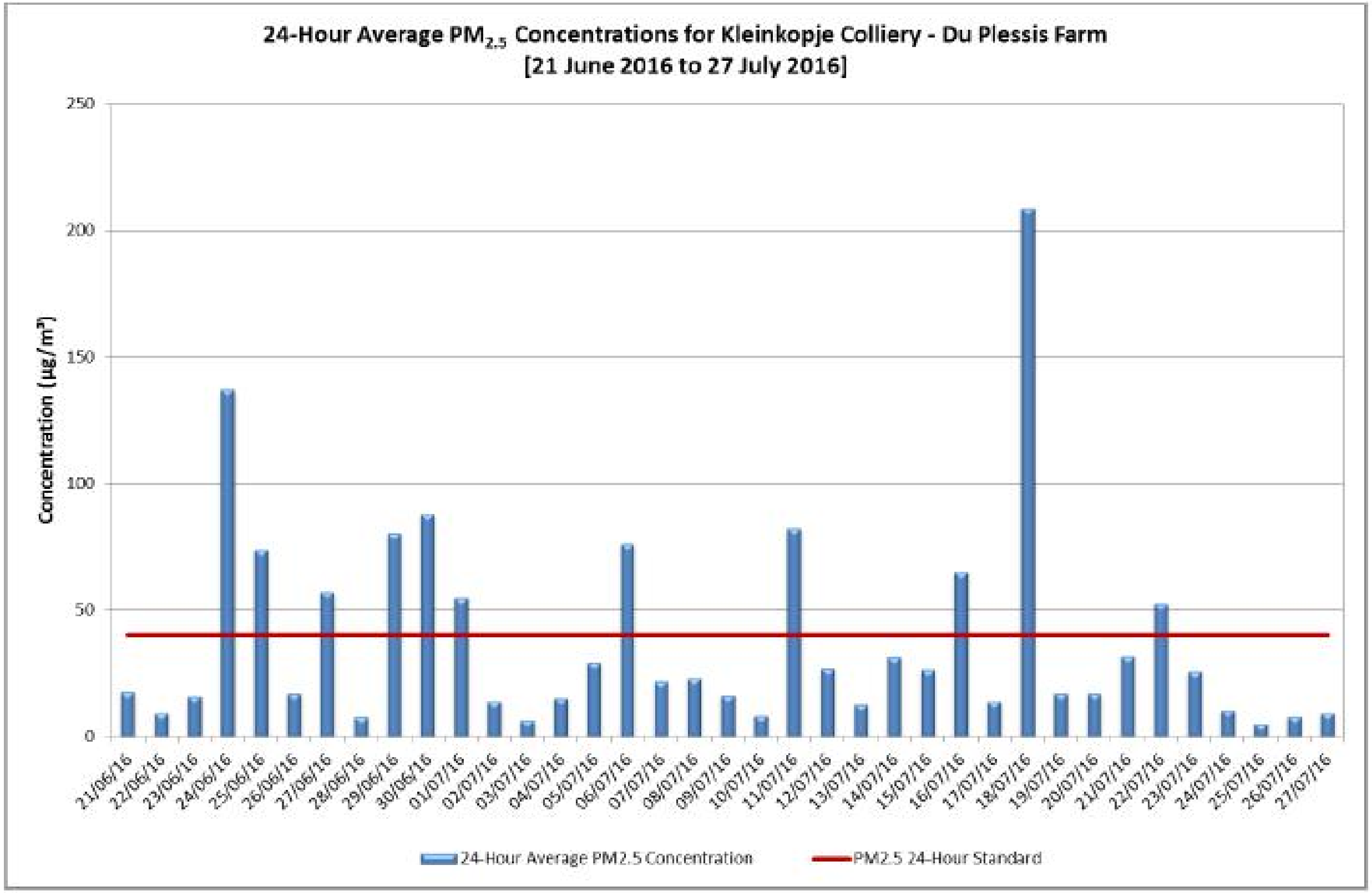

Figure 62: Daily average $PM_{2.5}$ measured at Du Plessis Topas Monitor for the monitoring period (source: WSP Environmental; July 2016)

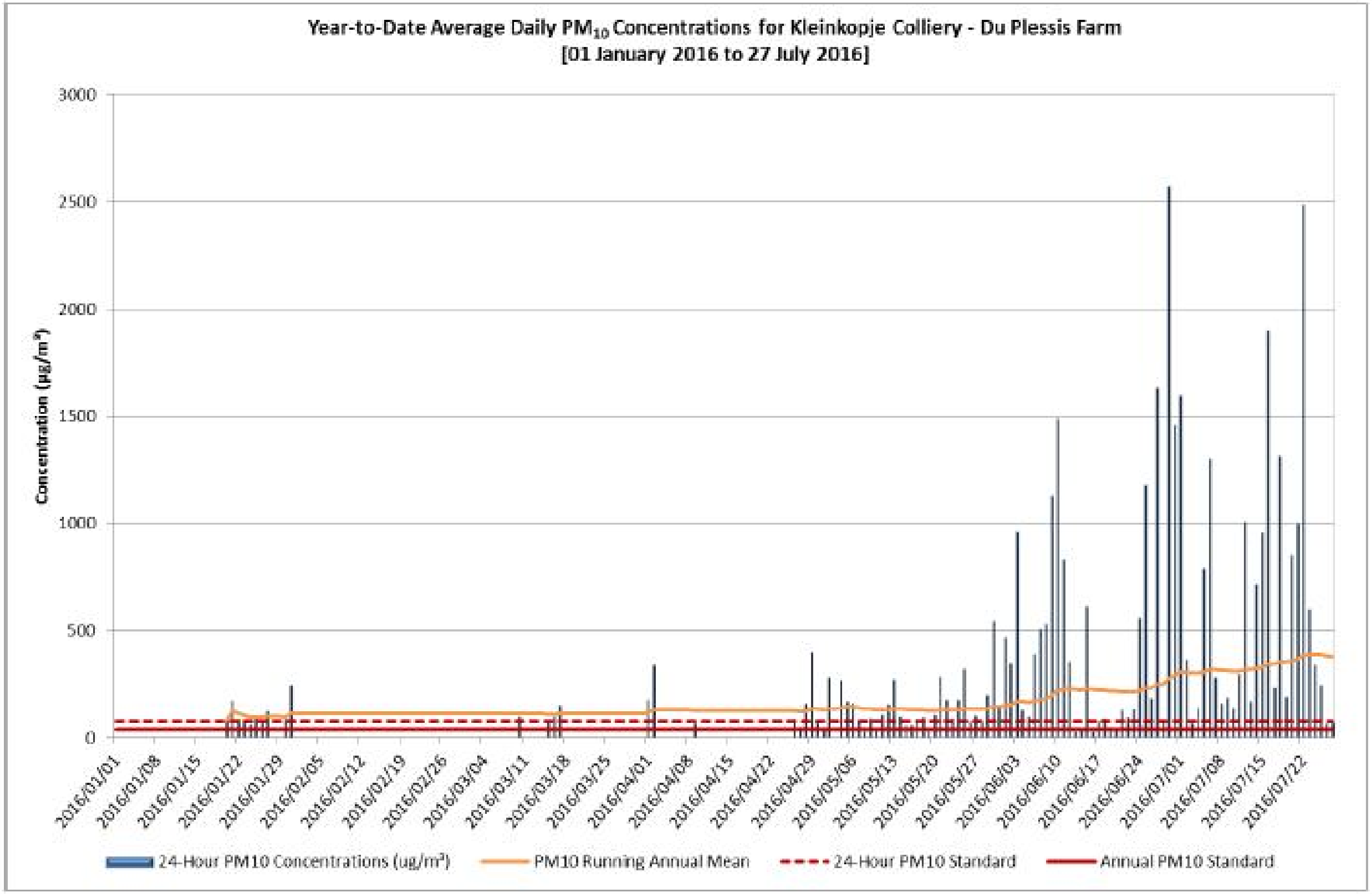

Figure 63: Year-to-date daily average PM_{10} concentrations at the Du Plessis Topas Monitor (source: WSP Environmental; July 2016)

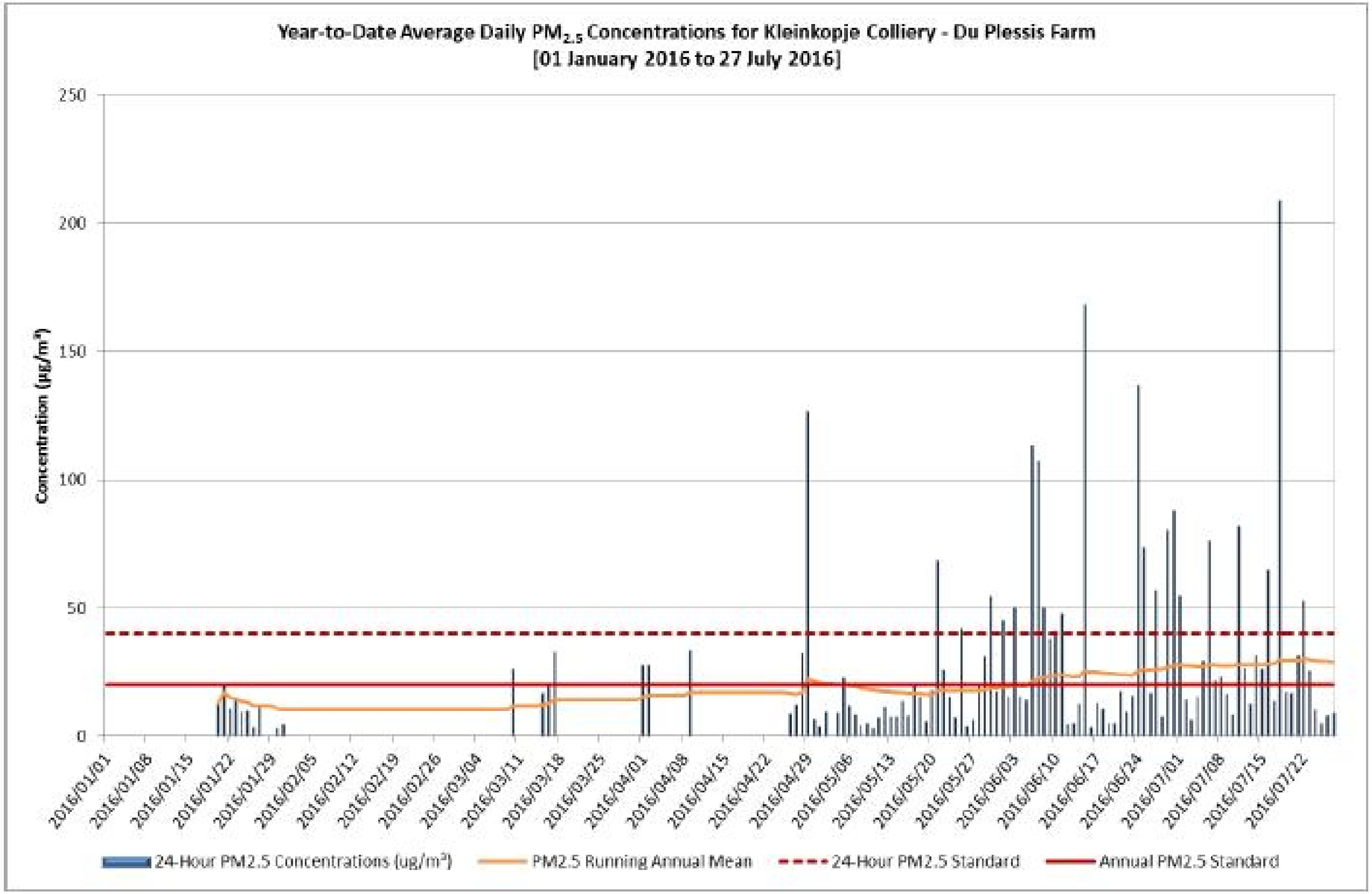

Figure 64: Year-to-date daily average $PM_{2.5}$ concentrations at the Du Plessis Topas Monitor (source: WSP Environmental; April 2016)

4.1.2 Erikson dam TOPAS Monitor

The Erickson Dam TOPAS Monitor is still in for repairs and replacement of its photometer, thus there is no data presented for this location for July 2016.

Chapter K: Noise, air blast and ground vibration

Information contained in this section of this report was sourced from the following documents:

- The report titled: "*Kleinkopje Colliery revised and consolidated EIA and EMP, report prepared for Anglo American Operations Limited – Thermal Coal*", with report No 414908, compiled by SRK Consulting and dated April 2012 (here after referred to as the revised EMPr, dated April 2012);
- The report titled: "*Kleinkopje Colliery 2A Pollution Control Dam Relocation Project: Draft Environmental Impact Assessment and Environmental Programme Report*"; dated May 2012 and compiled by WSP Environmental; and
- The report titled: "*Report: Ground Vibration and Air Blast Monitoring: Anglo American, Thermal Coal – Kleinkopje Colliery"*; dated September 2016, compiled by Blast Management and Consulting (refer to Annexure E8).

Routine monitoring of blast noise and vibrations emanating from opencast blasts is conducted at strategic points along mine boundaries and at selected residences of neighbouring farms. No major issues have been noted or experienced. Due to the distance between the Kleinkopje operations and the southern suburbs of Emalahleni (Witbank), the potential impact of noise and vibration on surrounding residents is low (WSP Environmental; 2012).

1 Noise

High ambient noise levels exist in the area due to several major noise emitters including:

- Major coal mining activities;
- The N12 highway;
- The R547 road;
- Road connecting the R544 and R547 past Kleinkopje Colliery; and
- Residential areas with villages associated with the mines.

2 Ground vibration and air blast

Blast Management and Consulting (Pty) Ltd has been contracted to monitor ground vibration and air blast on a continuous basis at Kleinkopje Colliery. Six Instantel Seismographs are fitted to permanent position stations on the Kleinkopje Colliery property and surrounding area.

The monitoring positions are seen in Table 54 and Figure 65.

Table 54: Ground Vibration and Air Blast monitoring locations

Seismograph Location Description	Seismograph Serial Number
Benicon Offices	BE14856
Dam wall	BE14854
Du Plessis farm	BE14852
Greenside Village	BE14855
Kruger House	BE16080
West Side Perimeter	BE10257

Figure 65: Ground Vibration and Air Blast monitoring locations (source: Blast Management and Consultin, September 2016))

Ground vibration:

Ground vibration levels recorded were lower than to the previous month. The results recorded for these events can be summarized as follow:

- The Peak Particle Velocity levels ranged between 0.06 and 25.53 mm/s. The Resultant Peak Particle Velocity levels ranged between 0.07 and 27.20 mm/s. The Frequencies of these recordings ranged between 3.61 and 85.33 Hz.
- The events recorded were analysed according to the United States Bureau of Mines (USBM) criteria (Residential Structures) and Vibration Amplitude and Frequency Chart (Specific to Dam Wall) for safe blasting. Events recorded on monitors close to structures showed no to high activity on the analysis and confirm that levels were within criteria for safe blasting, except for one event at the Dam Wall that just exceeded the limit and the safe blasting criteria.

- Twenty five events were recorded at the Dam Wall and were within the recommended limit of 25 mm/s and the 0.35 g's limit, except for one event recorded, one on the 13th of August which just exceeded the limit of 25 mm/s. Levels showed medium to very high activity on the Vibration Amplitude and Frequency Chart analysis and confirm that levels were just higher than the criteria for safe blasting.
- Refer to Annexure E8 for more detailed information.

Air blast:

Events registered showed air blast levels to be lower than the previous month. The air blast levels recorded ranged between 88.00 and 147.10 dB. Air blast levels recorded were within the recommended limit of 134 dB currently applied in South Africa, except for eleven events that were greater than the limit; all eleven at the Dam Wall monitor. Although there are no structures in the direct vicinity of the Dam Wall monitor that would have been influenced by the high air blast levels, all attempts must be made to ensure all levels are within the limits at the Du Plessis, Benicon and Kruger monitors, as to avoid complaints from the public.

Damage:

In view of the results and analysis done, there is no reason to believe that damage was induced by the ground vibration and / or air blast recorded during the month at privately owned structures (Blast Management and Consulting, July 2016).

Chapter L: Visual

The Kleinkopje Colliery mining areas (and thus also the proposed Pit 2A Extension area and PCD location) are not situated immediately adjacent to any recognised tourist routes. Ongoing rehabilitation activities reduce the visual impact of the mine, and dust suppression techniques are employed on all coal transfer points to reduce dust visibility from the N12 route (WSP Environmenal, 2012).

Chapter M: Protected areas and conservation planning

Information on protected areas and conservation planning as contained under this section has been obtained from the following:

- South African National Biodiversity Institute (SANBI).

1 Mpumalanga C-plan and Biodiversity Sector Plan

The Mpumalanga Biodiversity Sector Plan (MBSP) is a high-resolution biodiversity plan that identifies a network of Protected Areas, Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) that:

- Achieve national and provincial biodiversity targets on the least amount of land possible;
- Minimise conflict between conservation and other forms of land use;

- Favour areas that are important for water security;
- Promotes connectivity and adaptation to climate change across the landscape; and
- Can be used at a scale suitable for local and district-level planning.

The purpose of the biodiversity sector plan is to ensure that spatial biodiversity priorities are effectively incorporated into land use and development planning, environmental assessments and authorisations, and natural resource management within provincial and local levels of government.

Categories relevant to the MBSP, include:

- **Modified areas:** Those areas that have undergone a significant and often irreparable degree of transformation that has lead to a near-complete loss of biodiversity and ecological functioning. Common agents of modification include mining, arable agriculture and infrastructure development.
- **Modified Old lands:** This sub-category of Modified relates to areas that have been altered by cultivation and other activities within the last 80 years and subsequently abandoned. The biodiversity and ecological functioning in such areas is compromised but may still play a role in the provision of ecosystem services.
- **Other natural areas:** These are areas that have not been selected to meet biodiversity conservation targets, yet they are likely to provide habitat for flora and fauna species and a range of ecosystem services.
- **CBA – Optimal**: Areas selected to optimally meet biodiversity targets. Although these areas have a lower irreplaceability value than the CBA – Irreplaceable category, collectively they reflect the smallest area required to meet biodiversity conservation targets.

The natural vegetation of the study area as well as the surrounding areas have been heavily impacted by existing mining activities on site, extensive agricultural activities (i.e. maize cultivation) as well as impacts associated with linear infrastructures (e.g. roads, powerlines and railways). All of these activities have resulted in the extensive transformation of the natural habitats within the general area, as portrayed in the Mpumalanga Biodiversity Sector Plan terrestrial biodiversity assessment which classifies large parts of the study area as having no natural habitat remaining (Wetland Consulting Services, 2016). An area classified as CBA Optimal (Critical Biodiversity Area Optimal) is however indicated as occurring within the northern corner of the proposed opencast pit and portions of the proposed haul road.

Refer also to Figure 84 below for the latest MBSP categories depicted on a sensitivity map of Kleinkopje Colliery's Pit 2A Extension.

Chapter N: Sites of archaeological, cultural and palaeontological importance

Information contained in this section of this Scoping Report was sourced from the following documents:

- The report titled: "*Kleinkopje Colliery: Phase 1 Identification survey of historical sites*", dated July 1993 and compiled by A.C. van Vollenhoven;
- The report titled: "*Phase 1 Archaeological Impact Assessment of the farms Klippan 332 JS, Groenfontein 331 JS, and Klipfontein 322 JS near Witbank, Mpumalanga Province*", dated September 2010 and compiled by Khudzala Antiquity (J.P. Cilliers);
- The report titled: "*A report on a Phase 1 Heritage Impact Assessment (HIA) for a proposed pipeline and two dams to be constructed at Kleinkopje Colliery close to Emalahleni*", dated January 2012, compiled by A.C. van Vollenhoven;
- The report titled: "*A Phase 1 Heritage Impact Assessment (HIA) Study for Anglo Operations (Pty) Ltd (Kleinkopje Colliery) proposed Pit 2A Extension Project near Emalahleni in the Mpumalanga Province"*, dated August 2016 and compiled by Dr Julius Pistorius (refer to Annexure E2); and
- The report titled: "*Phase 1 Palaeontological heritage impact assessment report on the site of the construction of a proposed haul road, proposed extension of mining activities beneath 2A Pollution Control Dam and the site of the new Pollution Control Dam on Kleinkopje Colliery*", dated September 2016, compiled by Professor Barry Millsteed (refer to Annexure E2).

1 Correspondence with SAHRA

The Scoping Report for the Kleinkopje Colliery Pit 2A Extension Project (containing the results of a combination of heritage reports previously conducted within and around Kleinkopje Colliery) was uploaded onto the SAHRIS website, as per the South African Heritage Resources Agency's (SAHRA's) requirements. Subsequently, an interim comment (Case No. 9753), was received from SAHRA (refer to Annexure C8), which required the following:

1) That all the previous SAHRA comments and permits that were issued to the mine should be uploaded to the case.
2) A Letter of Recommendation for Exemption from Heritage Studies to be written by a suitably qualified archaeologist. The letter should also contain a map of the location of heritage resources still conserved in situ overlaying the proposed expansion plans and PCD Dam area.
3) The mine will be mining out very highly sensitive fossiliferous shale rocks of the Vryheid Formation, which the impacts to these rocks have not been considered in both heritage reports submitted to SAHRA. As such, SAHRA requires or the developer to commission a Palaeontological Impact Assessment (PIA) that comprises a field assessment to be conducted by a suitably qualified palaeontologist.

With reference to the above comments received from SAHRA, please note the following:

Point No 1 above: The applicant / EAP are not aware of any previous SAHRA comments and permits that were issued to the mine. Therefore, these cannot be uploaded to the case. Neither was any comments found on SAHRIS.

Point No 2 above: Although SAHRA required a letter of recommendation from a specialist for exemption from conducting Heritage Studies, the EAP and applicant decided that a Phase 1 Heritage Impact Assessment (HIA) should be undertaken, instead of the compilation of a letter of recommendation for exemption from conducting such a study for the project (especially due to the location off Graveyard 01 (GY01) being located within the project (application) area (refer to discussions below). A specialist was therefore appointed and the resultant report titled: "*A Phase 1 Heritage Impact Assessment (HIA) Study for Anglo Operations (Pty) Ltd (Kleinkopje Colliery) proposed Pit 2A Extension Project near Emalahleni in the Mpumalanga Province"*, dated August 2016 was compiled by Dr Julius Pistorius (refer to Annexure E2). The attached report also contains a map indicating the identified heritage resources still conserved in situ within the Project Area (as per SAHRA's requirement No. 2 above). Refer to Annexure E2 as well as Figure 84 below.

Point No 3 above: A Palaeontologist was appointed to conduct the required Palaeontological Impact Assessment (PIA), the results of which are contained in the report included in Annexure E2. Refer also to Section 3 below for a discussion of the results.

2 Archaeology

2.1 Sites of archaeological importance identified during previous studies conducted within and around Kleinkopje Colliery

2.2.1 Sites of archaeological importance identified as part of a Heritage Survey, dated 1993

The following sites were identified within the Kleinkopje Colliery mine boundary area (specifically within the vicinity of the Block (Pit) 2A mining area) during the survey conducted by A.C. van Vollenhoven in 1993:

- **Farm houses:**

A number of farm houses were identified situated on the eastern side of Block (Pit) 2A. The farm houses were (at that time) used as residences. Although older than 50 years (at that time), none of the houses were architectural features of particular importance.

- **Graves:**

A neat graveyard was found just east of the farm houses. All the graves were (at the time of the survey) marked and most of them were older than 50 years.

The remainder of the heritage sites were identified in the 5 West Block (refer to Figure 84) and include graves and a kraal.

All the above-mentioned heritage sites are however situated outside of the proposed Pit 2A Extension area (application area). Furthermore, the closest heritage site (farm house) to the proposed PCD location is approximately 1.0 to 1.5km away. Refer to Figure 84.

2.2.2 Sites of archaeological importance identified as part of the Phase 1 Archaeological Impact Assessment of the farms Klippan 332 JS, Groenfontein 331 JS, and Klipfontein 322 JS, dated 2010

Six sites were documented which has characteristics of previous human settlement or activity. None of these are however considered to be of archaeological value. All the documented sites are located on small portions of the farms Klippan 332 JS and Groenfontein 331 JS. Site WK 1 is a formal graveyard with approximately 147 marked and unmarked graves. This site is considered to be of high significance. Sites WK 2 – WK 6 are regarded as being of low significance primarily because they are not regarded as being of archaeological or historic significance, they were observed however, and assessed.

Site WK 1

This is the location of a formal graveyard which contains approximately 147 graves. Most of the graves are marked (have tombstones with inscriptions) but there are also unmarked graves present.

The oldest marked grave is that of a 14 year old "Msiza' who was buried here in 1948. Most of the graves are of people who were buried here in the 1960's. The most represented families in the graveyard include amongst others Tsoba, Shoba and Mahlangu.

Site WK1 is situated outside the proposed Pit 2A Extension application area and more than 3km away from the proposed PCD location – refer to Figure 84).

Figure 66: Site WK1 (source: Khudzala Antiquity, 2010)

Site WK 2

This is a site where scattered remains and the foundation remains on the soil surface indicate the probable presence of a dwelling. It is located some 300 metres south of the graveyard (Site WK 1) and is possibly linked to the graveyard. The dwelling is estimated to have occupied an area of approximately 10x15m. Objects found on the surface include the remains of an old iron folding chair, shoes and other iron objects such as tins, drums etc.

Site WK2 is situated outside the proposed Pit 2A Extension application area and more than 3km away from the proposed PCD location – refer to Figure 84).

Figure 67: Site WK2 (source: Khudzala Antiquity, 2010)

Site WK 3

The location of another ruined dwelling. Very small surface scatter of iron material.

Site WK3 is situated outside the proposed Pit 2A Extension application area and more than 3km away from the proposed PCD location – refer to Figure 84).

Figure 68: Site WK3 (source: Khudzala Antiquity, 2010)

Site WK 4

This is the location of a number of old concrete structures. Many of which may have served as floors of previous buildings. There are also stretches of tarmac road and other remains which suggest that this used to serve as a recreational area. *Site WK4 is situated within the Pit (Block) 2A (already authorised) area, and falls outside the proposed Pit 2A Extension application area – refer to Figure 84). The site is also located more than 2km away from the proposed PCD location.*

Figure 69: Site WK4 (source: Khudzala Antiquity, 2010)

Site WK 5

Small retaining wall, associated with Site WK 4. *Site WK5 is situated within the Pit (Block) 2A (already authorised) area, and falls outside the proposed Pit 2A Extension application area – refer to Figure 84). The site is also located more than 2km away from the proposed PCD location.*

Figure 70: Site WK5 (source: Khudzala Antiquity, 2010)

Site WK 6

This is the location of a building. Probably erected in the late 20th century.

Site WK6 is situated within the Pit (Block) 2A (already authorised) area, and falls outside the proposed Pit 2A Extension application area – refer to Figure 60). The site is also located more than 2km away from the proposed PCD location.

Figure 71: Site WK6 (source: Khudzala Antiquity, 2010)

Table 55: General significance of located sites (source: Khudzala Antiquity, 2010)

Site No.	Description	Type of significance	Degree of significance	Sphere of significance
WK1	Formal graveyard	High, Social	High, Local community	Local, Witbank
WK2	Demolished dwelling	None	Not significant, Local community	Local
WK3	Traces of previous settlement	None	Not significant, Local community	Local
WK4	Ruins	None	None	Late 20th Century Local
WK5	Ruins	Historic	Archaeological: Low potential Historic: Low	Late 20th Century Local
WK6	Building	Historic	Archaeological: Low potential Historic: Medium	Late 20th Century Local

Table 56: Significance allocation of located sites (source: Khudzala Antiquity, 2010)[48]

Site No.	Unique nature	Integrity of archaeological deposit	Wider context	Relative location	Depth of deposit	Quality of archaeological / historic material	Quantity of site features	Preservation condition of site
WK1	Unique graveyard	N/A		Witbank; Klippan 332 JS	N/A	Archaeologically: Not known. Historically: Good	147	Fair
WK2	None	Poor, much disturbed, scattered iron remains, difficult to define	None	Witbank; Klippan 332 JS	Not known, possibly only surface material	Archaeologically: Poor Historically: Poor	1	
WK3	None	Poor, much disturbed, scattered iron remains, difficult to define	None	Witbank; Klippan 332 JS	Not known, possibly only surface material	Archaeologically: Poor Historically: Poor	1	Poor
WK4	None	N/A	None	Witbank; Klippan 332 JS	N/A	Archaeologically: None Historically: Poor	Scattered clunks of concrete and road	Poor
WK5	Ruined brick structure	Not known, probably poor	Not known	Witbank; Klippan 332 JS	Not known	Archaeologically: Low Historically: Low	Small brick built structure, part of remaining wall	Poor

48 All sites located outside the Kleinkopje Pit 2A Extension application areas

Site No.	Unique nature	Integrity of archaeological deposit	Wider context	Relative location	Depth of deposit	Quality of archaeological / historic material	Quantity of site features	Preservation condition of site
WK6	Brick building	N/A	Not known	Witbank; Klippan 332 JS	N/A	Archaeologically: Low Historically: Low	Single building	Good

2.2.3 Sites of archaeological importance identified as part of the Phase 1 Heritage Impact Assessment for the proposed pipeline and two dams project, dated 2012

During the above-mentioned survey, no sites of cultural heritage significance was located in the area(s) associated with the proposed pipeline and dams (one of which is associated with the location of the PCD – as proposed as part of this Environmental Authorisation Application and EIAR / EMPr.

2.2.4 Sites of archaeological importance identified as part of the Phase 1 Archaeological Impact Assessment for the proposed Pit 2A Extension Project, dated August 2016

Specialist's reference and statement on heritage sites identified as part of previous archaeological studies conducted (as per Section 2.2.1 – 2.2.3 above).

Three earlier HIA studies were done in and near the current Project Area, namely:

- A 1993 survey (Section 2.2.1 above) revealed the presence of two graveyards, a cattle enclosure and farmhouses (4) to the east and north-east of the Project Area (Van Vollenhoven, 1993). None of the remains, except the graveyards, had any heritage signinifance. These remains also have no bearing on the Pit 2A Extension Project as they are located more than 1.5km to the east and north-east of the Project Area.
- A 2010 survey (Section 2.2.2 above) for the proposed Khanyisa Power Station revelead six localities with possible heritatge resources (WK1 to WK6) (Cilliers, 2010). Only site WK1 had heritage significance as it represented a graveyard. Site WK1 equals the now labeled "Graveyard 02" (GY02) which was identified during the latest study. Sites WK2 to WK6 comprised remains dating from the recent past and hold no heritage significance. These remains also do not exist any longer as they have fallen into disrepair and/or have been demolished.
- A 2012 survey (Section 2.2.3 above) for a proposed pipeline and two dams revealed no heritage resources of significance (Van Vollenhoven, 2012).

None of these heritage resources, except GY02 (WK1), have any relevance to the project specific heritage study. As stated above these remains either occur outside the project area; did not have any heritage significance when they still existed and now have fallen into total disrepair and/or have been demolished. The sensitivity map illustrates the former presence of these heritage resources (Figure 84).

Relevant heritage sites with significance identified during the latest project-specific archaeological assessment

The Phase I Heritage Impact Assessment (HIA) (Pistorius, 2016) for the proposed Pit 2A Extension Project revealed the following types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999) in and near the Project Area, namely:

- One graveyard located within the project area (GY01).
- Two graveyards located directly outside the project area (GY02, GY03).

One graveyard was recorded in the project area (GY01) and two graveyards (GY02, GY03) in close proximity of the project area.

Graveyard 01 (GY01)

This graveyard (GY01) is located in open veld in the project (application) area. It is demarcated with a fence which has collapsed. GY01 holds five visible graves which are all covered with bricks and ferricrete stone. Four are fitted with sandstone headstones with no decipherable inscriptions. Some of the graves are edged with cement strips.

It is highly likely that all the graves are older than sixty years.

Figure 72: Photograph showing GY01

Graveyard 02 (GY02)

Graveyard 02 (GY02) is located under Eskom’s existing power lines outside the project area. It is a large graveyard which holds as many as 150 individual graves. Many of the graves are decorated with cement, sandstone or granite headstones and other trimmings.

It is most likely that most of the graves in GY02 are older than sixty years. The graveyard may have been associated with a small village which has now disappeared as it was abandoned long ago and its remains have disintegrated. It is also possible that the remains have deliberately been demolished for security purposes.

Figure 73*: Photograph showing GY02*

Inscriptions on some of the headstones read as follow:

- *'In loving memory of Vusi 15-03-1979, 08-07-1979 lala ngoxolo'*
- *'Jan Mkwisi Died 26-10-69 Rip Mahlangu'*
- *'Lala ngoxolo baba Lucas M Shoba 1869-1974'*
- *'M SS Mlokika Paulina Mahlangu 22-11-1911'*

Graveyard 03 (GY03)

Graveyard 03 (GY03) is located outside the project area and next to a national road. GY03 holds approximately ten graves (one of which is a double grave). The majority of the graves are decorated and fitted with granite headstones and trimmings. The double grave is fitted with a marble headstone and marble strips. The graveyard is fenced in and fitted with an access gate but is in a neglected state. Most of the graves in GY03 are older than sixty years.

Inscriptions on some of the headstones read as follow:

- *'Ter nagedagtenis aan PDG Coetzer Geb 3-02-1870 Oorl 16-09-1942 Rus in vrede'*
- *'Hier rus vader Johannes Janubus du Toit Geb 3 Okt 1872 Oorl 14 Okt 1926 Hier rus moeder Maria Cornelia du Toit Weduwee van Wyk Geb Jacobs Geb 23 Jun 1874 Oorl 22 Maart 1933'*
- *'Rus sag Dionisius Tot Jesus ons kom haal Du Toit familie 1 Des 1950'*

Figure 74: Photograph showing GY03

Coordinates and level of significance

The coordinates and levels of significance for the graveyards which were recorded in and outside the project area are as per Table 57 below.

Table 57: Coordinates and significance rating for graveyards in and outside the Project Area (above).

Graveyards	Coordinates	Significance
Inside the project area		
GY01. Small graveyard with five graves in open veld.	25º 59.358'S 29º 13.615'E	**HIGH**
GY02. Large graveyard with approximately 150 graves under Eskom's existing power lines. Associated with demolished remains of a former village.	25º 58.427'S 29º 13.542'E	**HIGH**
Outside the Project Area		
GY03. Located next to national road. Approximately 10 graves	25º 59.013'S 29º 13.131'E	**HIGH**

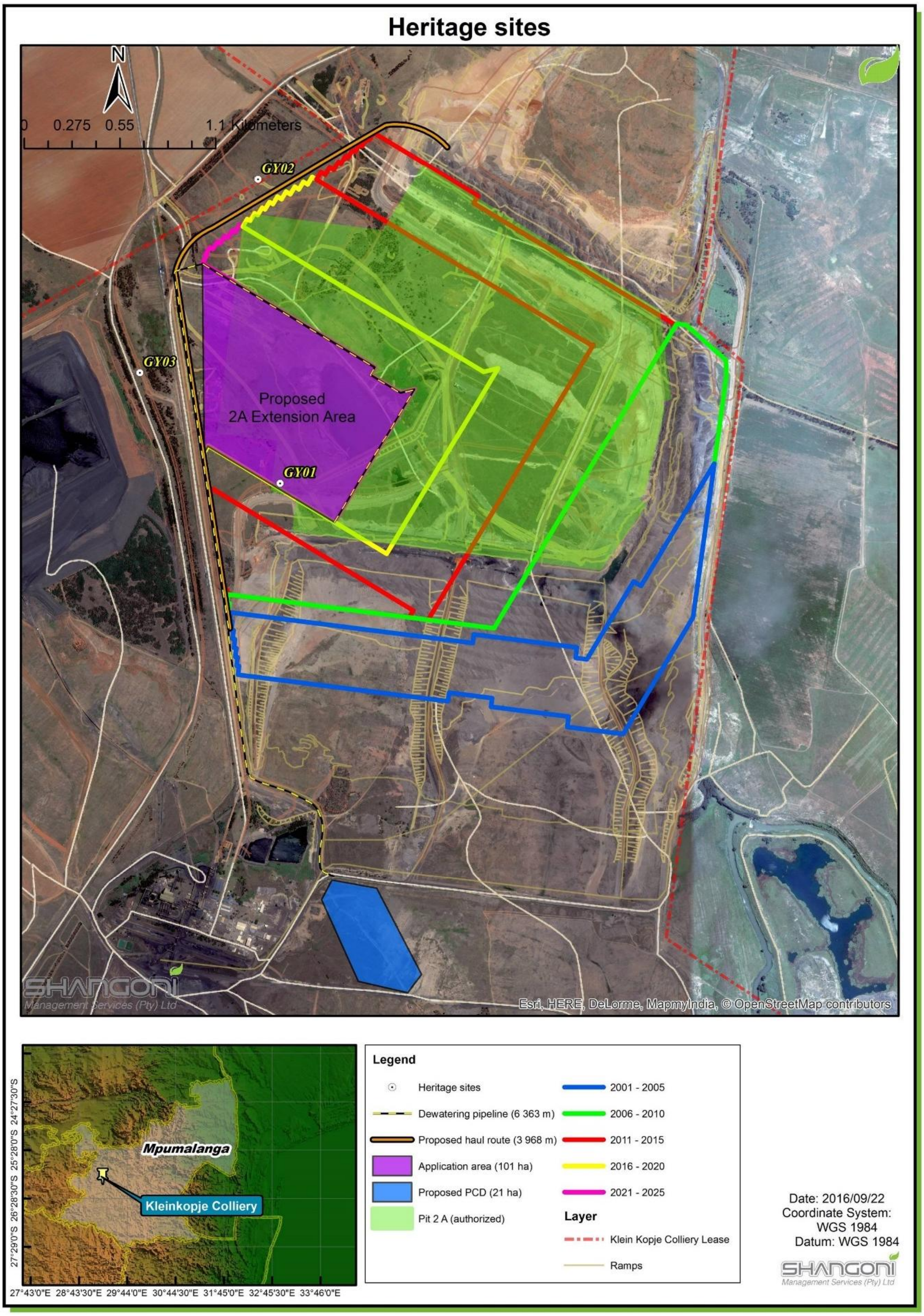

Figure 75: Map showing the location of the three graveyards identified during the August 2016 project-specific Archaeological Assessment (Heritage Impact Assessment)

3 Palaeontology

The most conspicuous and common components of the palaeontological record of the Ecca Group in general are the plant macrofossils of the *Glossopteris* flora. Two large and conspicuous leaf form taxa dominate the *Glossopteris* flora; these being *Glossopteris* and *Gangamopteris*. Within the upper Ecca (containing the Vryheid Formation) *Gangamopteris* has ceased to occur with only *Glossopteris* present (Anderson and McLauchlan, 1976). The palaeobotanical record of the Ecca Group is diverse and the literature describing it is voluminous (numerous papers having been published by E. Plumstead, H. Anderson, J. Anderson, E. Kovaks-Endrıdy and M. Bamford amongst others). A comprehensive review of the flora in the Karoo Basin literature is, accordingly, beyond the scope of this study, but a thorough review of the palaeobotanical content of the Ecca Group in general and the Vryheid Formation in particular is presented in Bamford (2004). In that summary it is indicated that the Vryheid Formation can be expected to contain the plant macrofossils *Buthelezia*, *Sphenophyllum*, *Rangia*, *Phyllotheca*, *Schizoneura*, *Sphenopteris*, *Noeggerathiopsis*, *Taeniopteris*, *Pagiophyllum* and *Benlightfootia* and the wood taxa *Australoxylon* and *Prototaxoxylon*. In addition to the above records can be added the observations of Tavener-Smith *et al*., (1988) where it was noted that both *Glossopteris* and *Vertebraria* occur within the palaeontological record of the formation.

In portions of the formation that are typified by low thermal alteration abundant assemblages of palynomorph plant microfossils (including acritarchs) can be expected (Anderson, 1977).

Jubb and Gardiner (1975) report the presence of fragmentary fish fossils within the Ecca sequence of southern Africa; these being *Coelacanthus dendrites* from the Somkele coalfield of northern Natal and *Namaicthys digitata* from correlative strata in the Senge Coalfieldsof Zimbabwe. While fish faunas are obviously rare and none have been reported from the Vryheid Formation the possibility remains that they may be present.

Animal body fossils are rare within the Ecca Group in general (excepting the time equivalent faunas of the Whitehill Formation). However, no reptile fossils have been identified within the Vryheid Formation.

Hobday and Tavener-Smith (1975) reviewed trace fossil assemblages identified within the Vryheid Formation. Within that fossil assemblage they identified two forms (*Helminthiopsis* and *Taphrelminthopsis*) within horizontally laminated siltstones and mudstones that represent part of the deep water *Nerites* community.

No in situ fossil materials were located during the conduct of the survey. However, at Waypoints KK3 and KK4 (see Figures 76 and 77) scattered carbonaceous stem compressions and fragmentary *Glossopteris* leaves were identified in loose blocks of rock that were not *in situ.* The material is highly fragmentary, unidentifiable to species level and is not *in situ*, thus, has little scientific significance. However, Mr Ncima (of Kleinkopje Colliery) informed Prof Millsteed that the site underlying the proposed

PCD had previously been Ramp 1 of the initial colliery pit void and had been subsequently rehabilitated. The rock material that had been used for the infilling of the void had been sourced from later excavations of the mine pit void. Thus, while the fossil materials are not *in situ* they indicate that the Vryheid Formations rocks that are being mined in the colliery are indeed fossiliferous.

Figure 76: Photograph of pale, micaceous sandstone bearing carbonaceous compressions of plant stem segments (Waypoint KK3). The stem segments are up to 10 cm in length.

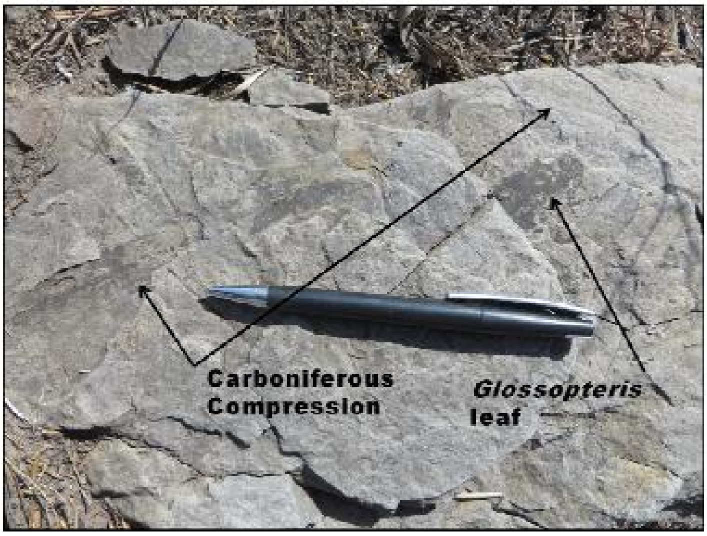

Figure 77: Photograph of pale, micaceous sandstone bearing carbonaceous compressions of plant stem segments (Waypoint KK4) are up to 15 cm in length and 2cm

Chapter O: Regional socio-economic structures

The information provided under this section has been sourced from the Social and Labour Plan (SLP) Annual Progress Report for Kleinkopje Colliery, dated 2015 (attached hereto as Annexure F) as well as the Emalahleni Local Municipality Integrated Development Plan (IDP) 2016/17 (IDP, 2016/17).

1 Demographic profile

1.1 Population size

According to Stats SA (2011 Census) 395 466 people were recorded in 2011 which is 30.2% of Nkangala's population and 9.8% of Mpumalanga Province. Emalahleni is ranked number 3 in the whole province in terms of population, which grew by 43.1% between 2001 & 2011 while annualised population growth rate was measured at 3.6%.

Table 58: Population size (source: IDP, 2016/17)

Demographic indicators	Stats SA Census 1996	Stats SA Census 2001	Stats SA Census 2011	Share of Nkangala's figure	Share of Mpumalanga's figure	Ranking highest (1) – lowest (18)
Population number	236 040	276 413	395 466	30.2%	9.8%	3
Annual growth rate		1.58	3.58			
Area size (km2)			2 677.67	16.0%	3.5%	13
Population per km2			**148**			

2 Composition

2.1 Gender distribution

Table 59: Gender distribution (source: IDP, 2016/17)

Gender	1996	2001	2011
Males	51.73%	50.91%	52.79%
Females	48.27%	49.09%	47.21%

The above table indicates an increase of males and decrease of females between 2001 and 2011. This is largely due to the nature of industries around the municipality area which tend to be more male oriented.

2.2 Population groups

Table 60: Population age groups (source: IDP, 2016/17)

Population group	1996	2001	2011
% Population (0 – 14 years)	29	28	25
% Population (15 - 64 years)	67	69	71
% Population (65+ years)	4	3	4
% Population (14 - 35 years)	43	42	43
% Persons with disability	5		5

The above table reveal the economical active populations (15-64 years) as represent the highest percentage of 71%.

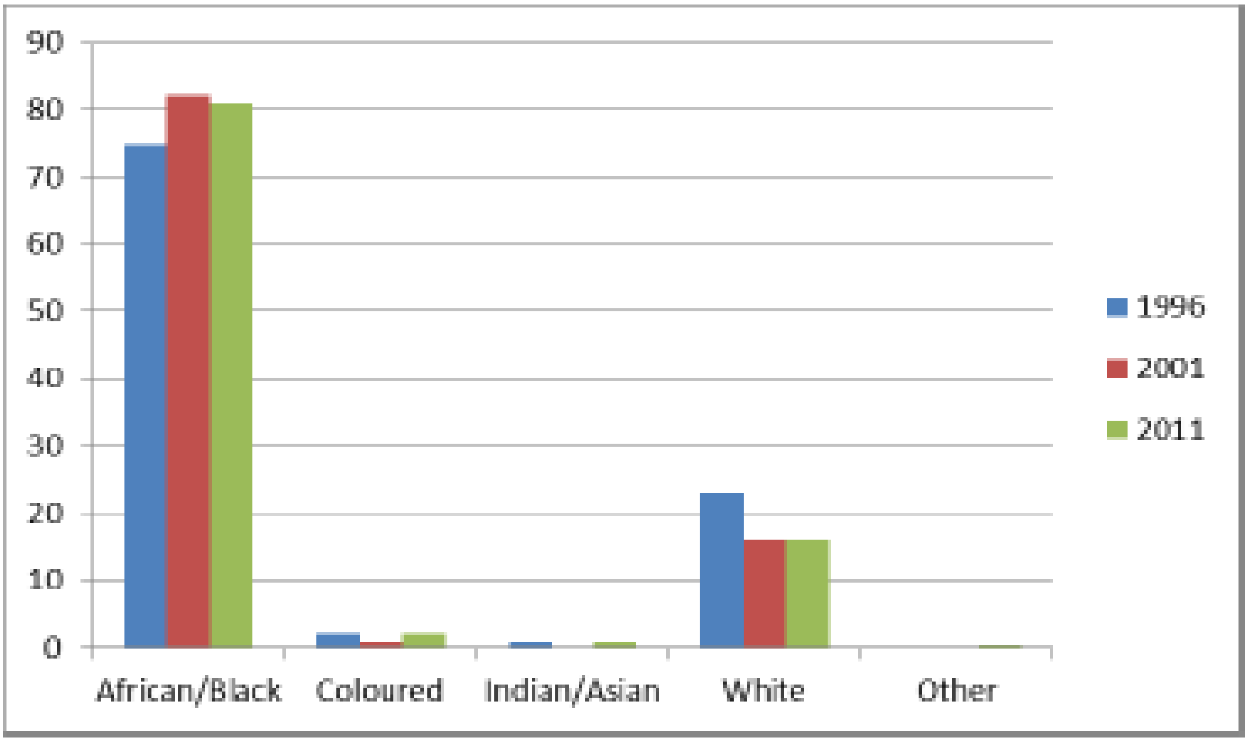

Figure 78: Racial groups (IDP, 2016/17)

Emalahleni is composed of all racial groups with 321,668 Black African, Coloured 6 717, Indian or Asian 3562, White and Other 1, 626. The table above shows that in 2001 and 2011 there was slight decrease of Africans and a slight increase of Coloureds, with the white population group remaining the same. African/Blacks are 81, 3%, 0, 9% Asians, 1, 7% Coloured, 15, 7% Whites and 0, 4% Others.

3 Economic indicators

The municipality is expected to record a GDP growth of 3.3% per annum over the period 2011-2016. The historic growth rate is 2.8% per annum for the period 1996-2011. Emalahleni contributed 17.9% to the provincial economy in 2011. GVA in 2011 was R40.5 billion at current prices and R19.9 billion at constant 2005 prices, which is third largest economy in the province.

4 Labour indicators

Unemployment rate in Emalahleni decreased since 2001. The below table show the unemployment rate of 27.3% (strict definition) in 2011 – 52 114 unemployed as a percentage of the Economically active population of 190 662 – decreasing trend.

Table 61: Labour indicators (source: IDP, 2016/17)

Labour indicators	Census 2001	Census 2011	Share of Nkangala's figure	Ranking: Best (1) – worst (18)
Working group	190 882	238 768		
Economically active population / labour force	124 371	190 662		
Number of employed	76 668	138 548	39.0%	
Number of unemployed	47 703	52 114	34.2%	
Unemployment rate (%)	38.4%	27.3%		8

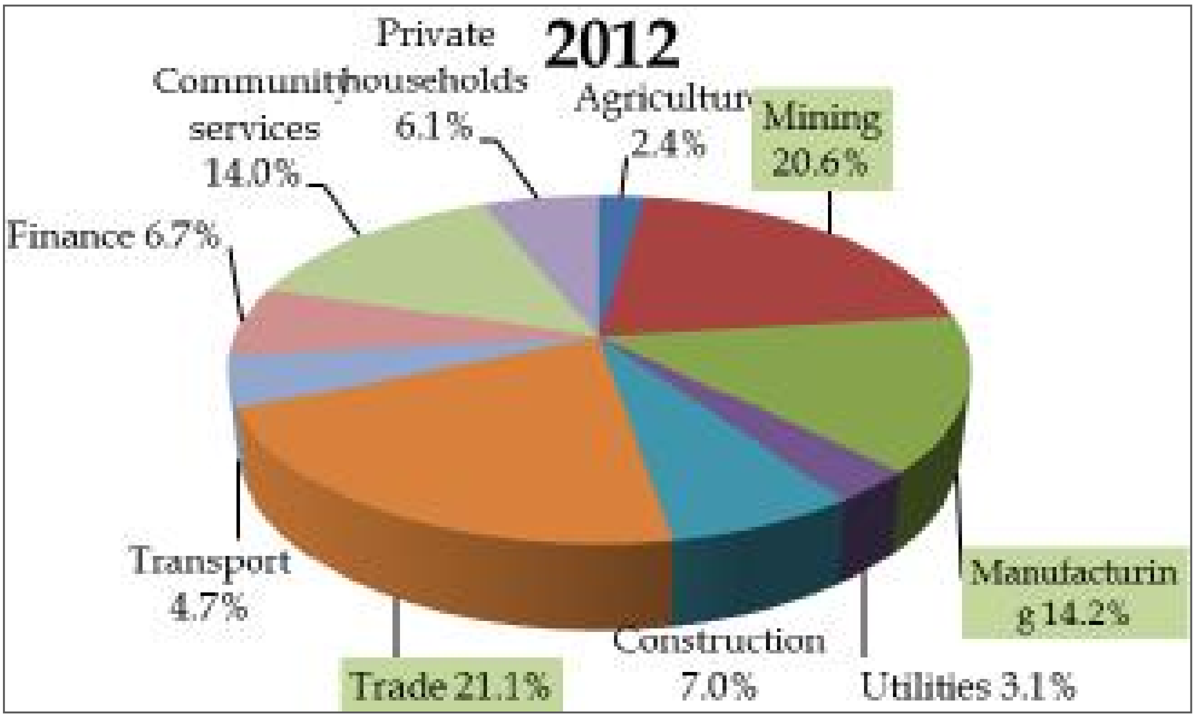

Figure 79: Industries (IDP, 2016/17)

The leading industry in terms of employment is trade with 21.1%, followed by mining 20.6% and manufacturing 14.2%. Since 2001 there has been an increasing role/share of mining, construction, community services & finance as employer and a decrease in the role/share of trade, manufacturing, transport, agriculture, private households and utility.

5 Education indicators

Table 62: Education indicators (source: IDP, 2016/17)

Labour indicators	Census 2001	Census 2011	Better (+) or worse (-) than Nkangala	Better (+) or worse (-) than Province	Ranking: Best (1) – worst (18)
Number of people 20+ with no schooling	24 908	14 993			11
Population 20+ with no schooling (%)	14.5%	5.8%	(+)(11.5%)	(+)(14.1%)	1
Population 20+ with matric and higher (%)	31.9%	45.3%	(+)(39.7%)	(+)(38.7%)	3
Functional literacy rate (%)	73.9%	86.0%	(+)(79.0%)	(+)(76.9%)	1

6 Househole profile and services

Table 63 below indicates an increase in the number of households in Emalahleni since 1996 and 2011. The ownership on houses is decreasing since 1996. The decrease in % of ownership implies that the Emalahleni people prefer buying houses in other areas. In terms of 2011 statistics there are 38 519 owned and fully paid houses, 15 798 owned but not yet paid off, 22 874 occupied rent-free and rented is 39 463.

Table 63: Household trends (source: IDP, 2016/17)

	1996	2001	2011
Number of households	56 349	82 298	119 874
Annual growth rate of households (%)		3.79	3.76
Average household size	4.01	3.22	3.25
% Ownership (houses)	75	55	45

Table 64: Basic Service Infrastructure Indicators (source: IDP, 2016/17)

Basic Service Infrastructure indicators	Census 2001	Census 2011	Better (+) or worse (-) than Nkangala	Better (+) or worse (-) than Province	Ranking: Best (1) – worst (18)
% of households in informal dwellings	26.0%	19.3%	(-) (13.8%)	(-) (10.9%)	14

Basic Service Infrastructure indicators	Census 2001	Census 2011	Better (+) or worse (-) than Nkangala	Better (+) or worse (-) than Province	Ranking: Best (1) – worst (18)
% households with no toilets	8.0%	3.1%	(+) (3.8%)	(+) (7.2%)	3
% households with connection to piped (tap) water: on site and off site	93.8%	94.8%	(+) (92.7%)	(+) (87.4%)	8
% households with electricity for lighting	70.3%	73.4%	(-) (85.7%)	(-) (86.4%)	17
% households with weekly municipal refuse removal	64.2%	67.2%	(+) (48.3%)	(+) (42.4%)	7

7.4.2 Description of the current land uses

7.4.2.1 Land use

Early topo-cadastral maps indicate that the pre-mining (1960s) land use was agricultural. There is evidence of previous grazing on a number of blocks, as shown by the presence of *Stoebe vulgaris*, which is an indicator of excessive grazing pressure. Invasive wattle and eucalyptus trees were present in the area, and large stands of wattle have been removed as part of the colliery land management strategy. The Kleinkopje processing plant and associated infrastructure was commissioned in 1979, and consists of a tip, stockpiles, processing plant and overland conveyors. Mining infrastructure consists of open pits, offices, a sewage plant, workshops, water reticulation pipelines, overhead powerlines and service roads. The land associated with the proposed location of the Pit 2A Extension is occupied by the existing operational 2A Dam (PCD) and the associated wetland system (refer to Annexure E3). The site identified for the proposed location of the new PCD falls on previously disturbed land.

Refer also to the Master Layout Plan (Figure 15) for a visual representation of the current mining infrastructure on-site.

According to the local Mpumalanga Biodiversity Sector Plan (MBSP), the following is applicable to the proposed development area (SAS, 2016):

- The proposed Haul Route is located within an area classified as Critical Biodiversity Area (CBA) Optimal, ONAs, moderately modified land, and heavily modified land;
- The proposed PCD is dominated by heavily modified land. This is largely attributed to coal mining and cultivated pastures as the dominant land uses in the vicinity of the lease area;
- The application area is dominated by heavily and moderately modified lands as well as Other Natural Areas (ONAs); and
- The application area also comprises of a small portion of CBA Optimal on the northern corner, as depicted in Figures 80 and 81.

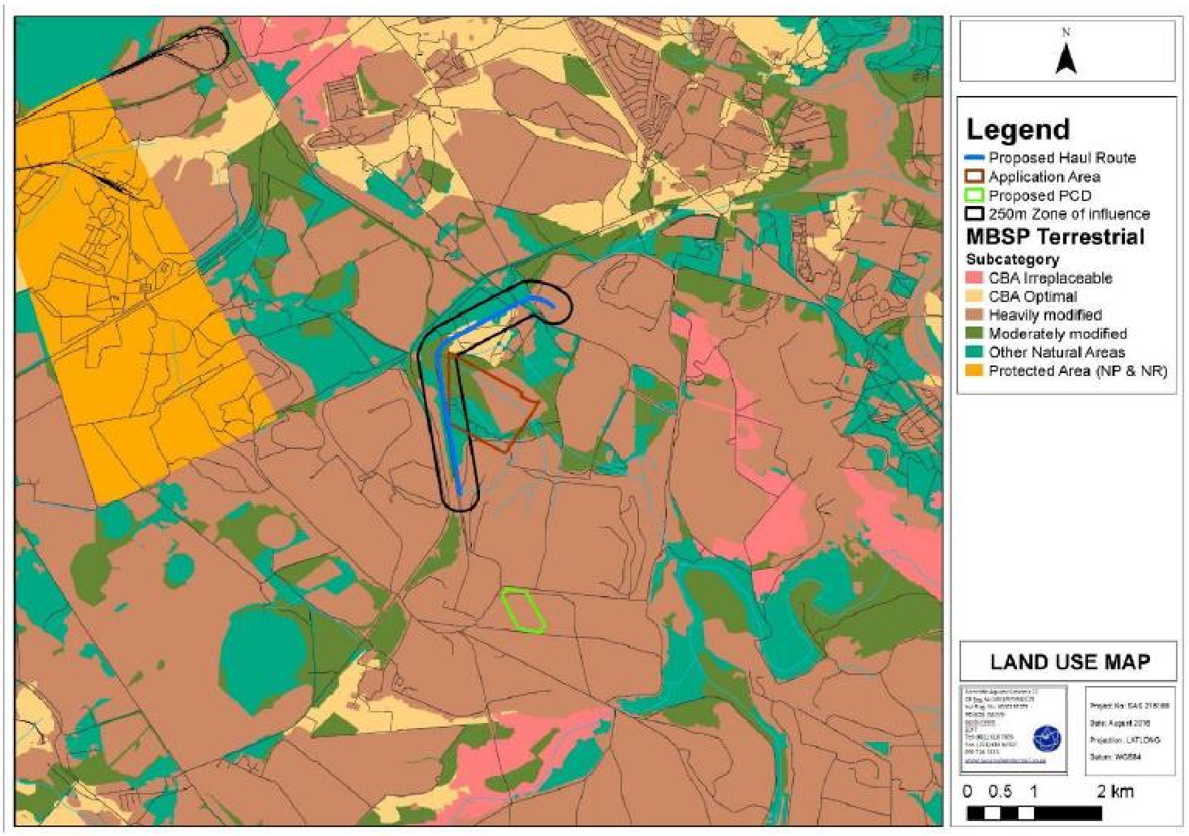

Figure 80: Land use activities in the vicinity of the proposed PCD, Haul Route and application area as inferred from the MBSP database (SAS, 2016)

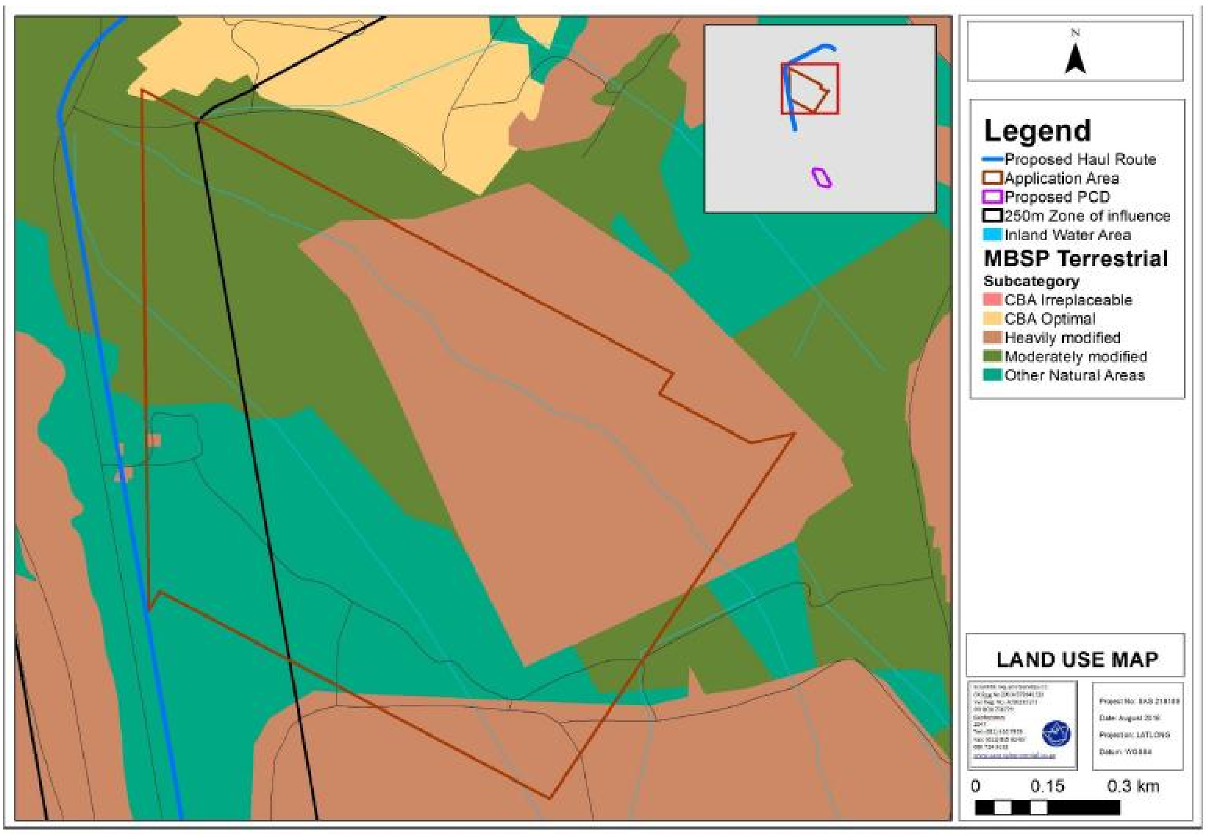

Figure 81: Land use activities in the vicinity of the Application Area as per MBSP database (SAS, 2016)

7.4.2.2 Land capability

In South Africa, agricultural land capability is generally restricted by climatic conditions, particularly water availability. However, even within similar climatic zones, different soil types typically have different land use capabilities attributed to their inherent characteristics. High potential agricultural land is defined as having the soil and terrain quality, growing season and adequate available moisture supply needed to produce sustained economically high crop yields when treated and managed according to best possible farming practices (Scotney et al., 1987). For the purpose of the Soil, land use and land capability assessment (Annexure E9), land capability was inferred from physical soil properties and prevailing climatic conditions. Climate capability (measured on a scale of 1 to 8) was therefore considered in the agricultural potential classification. The surveyed area is considered to fall within Climate Capability Class 4, with a good yield potential for a selected range of adapted crops under cautious planting date selection.

The identified soils were classified into six land capability classes as presented in Figures 82 and 83 below. The identified land capability limitations for the identified soils are discussed in comprehensive dashboard summary tables presented in Tables 6 to 11 of Annexure E9.

Figure 82: Land capability classification of the identified soils within the on the northern section of the proposed development areas (SAS, 2016)

Figure 83: Land capability classification of the identified soils within the proposed PCD area (SAS, 2016)

7.4.3 Description of specific environmental features and infrastructure on the site

Refer to Sections 7.4.1 and 7.4.2 above and Section 7.4.4 and Figure 84 below.

7.4.4 Environmental and current land use map

Figure 84 below presents the specific environmental features in relation to the proposed Pit 2A Extension area. Figure 15 is a Master Layout Plan showing the current mining activities on-site.

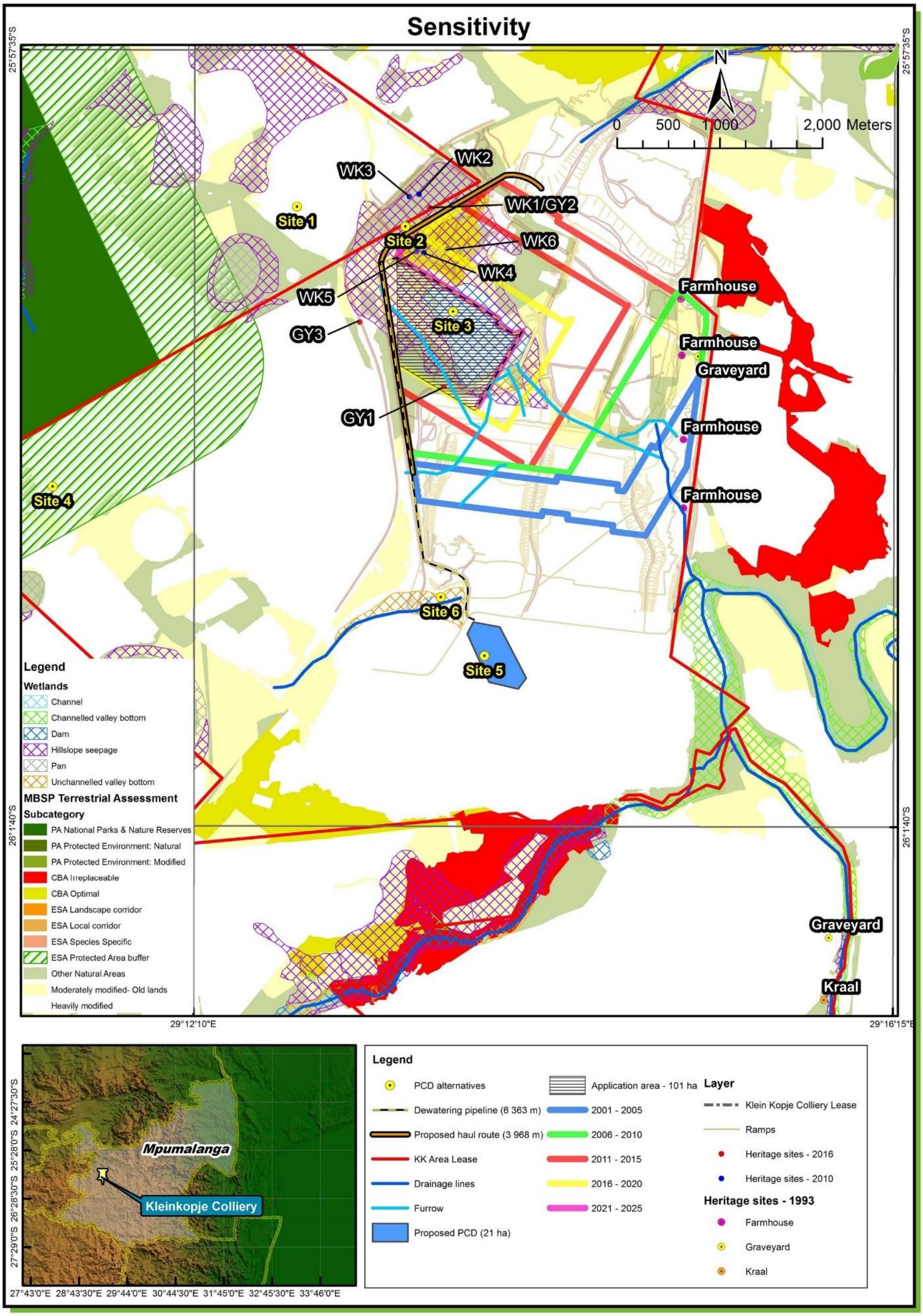

Figure 84: Environmental features (Sensitivity map) in relation to proposed site layout plan

7.5 Impacts and risks identified

A detailed risk assessment has been undertaken, as contained in Annexure I. The following table contains all the potential impacts identified for the activities described in the initial site layout.

Table 65: Impacts and risks identified

Environmental component	Activity	Impact description	Duration	Pre-mitigation[49]			Reversible (Yes/No)	Irreplaceable loss (Yes/No)	Avoided/ Managed/ Mitigated
				Probability	Magnitude	Significance			
Geology	Mining of the ore reserve	A permanent impact on the localised geology of the areas associated with the proposed extension area will result from the mining and removal of coal.	Permanent	**5**	**3**	**H**	No	Yes	Managed
Topography	• Removal and stockpiling of topsoil and overburden. • Mining of the ore reserve and subsequent (concurrent) rehabilitation of the open pit extension area(s)	The existing and continued mining activities at Pit 2A has altered the topography. The construction and progressive development of the open pit (as part of the Pit 2A Extension activities) and the establishment of various associated stockpiles will continue to temporarily alter the topography until such time as rehabilitation activities have been undertaken.	Medium to Long-term	5	2	M	Yes	No	Managed; Mitigated
	• Construction and use of haul roads within and around the open pit extension area(s) • Continuation of the disposal of mine residue within the existing footprint of the current Klippan Co-disposal site, located at Kleinkopje Colliery. • Construction and operation of a new pollution control dam	The continuation of disposal of residue within the existing footprint of the Klippan Co-Disposal Facility will continue to influence the nature of the topography that is typical of the surrounding area[50]	Permanent	5	2	M	No	Yes	Managed
		The construction of the haul road and pollution control dam will lead to an alteration of the topography and subsequently the alteration of drainage patterns on-site.	Long-term	5	2	M	Yes	No	Mitigated; Managed
Soil	• Clearance of vegetation • Construction and use of haul roads within and around the open pit extension area(s) and associated storm water management measures • Construction and operation of a new pollution control dam • Removal and stockpiling of topsoil and overburden. • Mining of the ore reserve and subsequent (concurrent) rehabilitation of the open pit extension area(s)	Susceptibility to erosion will be largely increased once the vegetation is cleared and the soils become exposed to wind and storm water.	Long-term	5	3	H	Yes	No	Avoided; Mitigated

[49] High; H = High; M = Medium; L = Low

[50] Not a listed activity applied for as part of this EIAR / EMPr. The mentioned existing facility was included in the approved EMPR dated 2012 which EMPR is deemed to be approved in terms of the National Environmental Management: Waste Act (NEMWA), 2008. Therefore, this activity is not applied for as a waste management activity. However the continued impact on the topography as a result of the Pit 2A Extension activities has been included in this Risk Assessment Report.

Environmental component	Activity	Impact description	Duration	Pre-mitigation[49]			Reversible (Yes/No)	Irreplaceable loss (Yes/No)	Avoided/ Managed/ Mitigated
				Probability	Magnitude	Significance			
	• Dewatering activity: Pumping of water collecting in the open pit extension area (i.e. pipeline)								
Soil	• Clearance of vegetation • Construction and use of haul roads within and around the open pit extension area(s) and associated storm water management measures • Construction and operation of a new pollution control dam • Removal and stockpiling of topsoil and overburden. • Mining of the ore reserve and subsequent (concurrent) rehabilitation of the open pit extension area(s) • Dewatering activity: Pumping of water collecting in the open pit extension area (i.e. pipeline)	Heavy equipment traffic is anticipated to cause significant soil compaction during construction activities. The severity of this impact is anticipated to be particularly highest in the vicinity of the proposed hauling road and during stripping within the application area.	Long-term (beyond life of mine if left unrehabilitated)	4	3	H	Yes	No	Avoided; Managed
Soil	• Clearance of vegetation • Construction and use of haul roads within and around the open pit extension area(s) and associated storm water management measures • Construction and operation of a new pollution control dam • Removal and stockpiling of topsoil and overburden. • Mining of the ore reserve and subsequent (concurrent) rehabilitation of the open pit extension area(s) • Dewatering activity: Pumping of water collecting in the open pit extension area (i.e. pipeline) • Potential in-pit emergency maintenance on equipment or machinery. • Use and maintenance of chemical / portable toilets at open pit extension area(s).	The soil contamination impact is largely dependent on the nature, volume and/or concentration of the contaminant of concern, and all of the identified soils are considered to be equally predisposed to contamination, as contamination sources are unpredictable and typically occur as incidental spills or leaks, and or decant of contaminated mine water in such mining projects.	Long-term	3	4	H	Yes	No	Avoided; Mitigated
		The incorrect handling and disposal of general waste, scrap metal and industrial waste (e.g. waste tyres) will have a long-term impact on the local area. Impact will not only effect soil but could also impact on the habitat of fauna and impact of fauna, surface water and groundwater. In addition, the visual character of the area will be impacted on. The incorrect handling and disposal of hazardous waste can also have a permanent negative impact on the local area. Soil, water sources and fauna habitats can be adversely affected and human health can be impacted on.	Long-term (beyond life of mine if no mitigation measures applied)	4	3	H	Yes	No	Avoided; Managed; Mitigated
Land Use and Land Capability	• Clearance of vegetation • Construction and use of haul roads within and around the open pit extension area(s) and	The main impact from a land capability perspective at Kleinkopje Colliery is land degradation and loss of land capability from the proposed mining pit extension area. The	Long-term	4	3	H	Yes	No	Managed

Environmental component	Activity	Impact description	Duration	Pre-mitigation[49]			Reversible (Yes/No)	Irreplaceable loss (Yes/No)	Avoided/ Managed/ Mitigated
				Probability	Magnitude	Significance			
	associated storm water management measures • Construction and operation of a new pollution control dam • Removal and stockpiling of topsoil and overburden. • Mining of the ore reserve and subsequent (concurrent) rehabilitation of the open pit extension area(s) • Dewatering activity: Pumping of water collecting in the open pit extension area (i.e. pipeline)	soils that will be impacted by the proposed mining activities include the following: • Clovelly/Hutton; • Longlands/Fernwood; • Westleigh; • Katspruit; and • Dresden soil forms.							
Flora	• Clearance of vegetation • Construction and use of haul roads within and around the open pit extension area(s) and associated storm water management measures • Construction and operation of a new pollution control dam • Removal and stockpiling of topsoil and overburden. • Mining of the ore reserve and subsequent (concurrent) rehabilitation of the open pit extension area(s) • Dewatering activity: Pumping of water collecting in the open pit extension area (i.e. pipeline)	The Kleinkopje Colliery mining area has been heavily impacted by existing mining activities on site, extensive agricultural activities (especially the cultivation of maize) as well as impacts associated with infrastructure (e.g. roads and railways) and urbanisation. All of these activities have resulted in the extensive transformation of the natural habitats within the area (Wetland Consulting Services, 2016). The project area is situated within an area vegetated by the Moist Sandy Highveld Grassland vegetation type according to Low & Rebelo (1998) with the most recent vegetation classification, classifying it as Eastern Highveld Grassland (Mucina & Rutherford 2006). The vegetation type is considered to be Endangered nationally with none conserved and 55% altered, primarily by cultivation. The conservation status of this vegetation type is very poor, with large parts that are either currently cultivated or have been previously ploughed, and the remaining untransformed vegetation that occurs as patchy remnants that are often heavily grazed. The Kleinkopje Colliery mine lease area is situated in an endangered ecosystem. This means that the ecosystem has undergone degradation of ecological structure, function or composition as a result of human intervention, although it is not critically endangered (Digby Wells, 2014). A number of impacts on the study area were observed on site by the wetland specialist (Wetland Consulting Services, 2016) (Annexure E3):	Long-term to permanent (if not mitigated appropriately)	3	3	M	Yes	No	Mitigated; Managed

Environmental component	Activity	Impact description	Duration	Pre-mitigation[49]			Reversible (Yes/No)	Irreplaceable loss (Yes/No)	Avoided/ Managed/ Mitigated
				Probability	Magnitude	Significance			
		• Mining activities in and downstream from the direct catchment of the area, • Abandoned agricultural activities, including old cultivated fields, within and surrounding the hillslope seepage wetland area (i.e. Pit 2A Extension study area); • Contaminated seepage with elevated salinities from the adjacent discard dump; • Overflow and discharge of dirty water from reservoirs and pump stations located adjacent to and within the study area; • Numerous trenches cross the study area, diverting and intercepting flows; • A number of old excavations occur within the study area; • Stands of alien vegetation, including stands of *Populus x canescens* and *Eucalyptus trees* within the study area; • Numerous roads and tracks cross the study areas; and • Impoundment of flow in dams and upstream of road crossings. As per the Biodversity Action Plan (BAP) for Kleinkopje Colliery (Digby Wells, 2014), the areas associated with the proposed location of the Pit 2A Extension and related activities fall within an area with low biodiversity value (Annexure E1). Only one species *Gladiolus macneilii*, which is included in the BAP even though it does not occur on the National Herbarium of Pretoria (PRE) Computerised Information system (PRECIS) list for the area, is endangered, and may require special measures to protect any populations that are positively identified. The remainder of the threatened species are in the vulnerable and near threatened categories indicating that conservation efforts aimed at the level of habitat conservation are adequate in the surface rights area (Digby Wells, 2014). However, the BAP also indicates that the wetland systems within Kleinkopje Colliery's mine boundary area (and thus also the hillslope seepage wetland associated with the proposed Pit 2A Extension area and associated haul road and							

Environmental component	Activity	Impact description	Duration	Pre-mitigation[49]			Reversible (Yes/No)	Irreplaceable loss (Yes/No)	Avoided/ Managed/ Mitigated
				Probability	Magnitude	Significance			
		dewatering pipeline) provides unique habitat for various flora species, especially potential Red Data *Nerine gracillis, Callilepis leptophyll, Crinum bulbispermum, Crinum macowanii* , and *Aspidoglossum validum.* The possibility thus exist that potentially occurring conservation important species may be impacted upon, if not mitigated appropriately.							
Flora	• Clearance of vegetation • Construction and use of haul roads within and around the open pit extension area(s) and associated storm water management measures • Construction and operation of a new pollution control dam • Removal and stockpiling of topsoil and overburden. • Mining of the ore reserve and subsequent (concurrent) rehabilitation of the open pit extension area(s) • Dewatering activity: Pumping of water collecting in the open pit extension area (i.e. pipeline)	During the clearance, construction and operational phase activities and following the completion of decommissioning, the recently replaced and disturbed soils will be susceptible to invasion by alien vegetation, e.g. *Acacia mearnsii* (black wattle). This was observed happening on other rehabilitated sites within the Kleinkopje mining rights area and can be assumed to become a problem on the rehabilitated 2A pit as well. These alien species could spread to the adjacent wetland areas and result in decreased flows, increased erosion and decreased biodiversity in these systems (Wetland Consulting Services, 2016).	Long-term (permanent if not mitigated and managed)	5	3	H	Yes	No	Mitigated; Managed
Fauna	• Clearance of vegetation • Construction and use of haul roads within and around the open pit extension area(s) and associated storm water management measures • Construction and operation of a new pollution control dam • Removal and stockpiling of topsoil and overburden. • Mining of the ore reserve and subsequent (concurrent) rehabilitation of the open pit extension area(s) • Dewatering activity: Pumping of water collecting in the open pit extension area (i.e. pipeline)	Loss and degradation of untransformed faunal habitat as a direct result of clearing of vegetation and habitat to allow for mining and farming activities as well as related infrastructure establishment. This in turn may affect the biodiversity regionally, as present ecological systems may be altered and replaced by another less sensitive system. Refer however also to discussions under Section 5.5 above (Flora) regarding the biodiversity value of the mining area and project area specifically. Habitat fragmentation may occur as a result of the degradation and seclusion of possible natural corridors and habitat types. This results in the disruption of ecological connectivity and migration routes of larger animals as well as territorial infringement.	Long-term	3	3	M	Yes	No	Avoided; Managed

Environmental component	Activity	Impact description	Duration	Pre-mitigation[49]			Reversible (Yes/No)	Irreplaceable loss (Yes/No)	Avoided/ Managed/ Mitigated
				Probability	Magnitude	Significance			
		Surface and groundwater related impacts may result in an impact on fauna including loss of species, loss of habitat and overall loss of ecological integrity. Furthermore, noise and lighting disturb animal migration, occupation patterns and natural foraging activities.							
		This impact includes the potential loss of natural animal individuals through increase of traffic through natural areas resulting in potential collisions with animals on roads. Direct mortality is highly likely of ground-living animals as a result of blasting operations and operation of heavy mining machinery. Animals may also become trapped or drown in the pollution control dam.	Short-term (per incident). Incidents may occur for the duration of the life of mine	3	2	M	Yes	No	Avoided
Surface water	Construction and use of haul roads	The surface area of the new proposed haul road will be compacted to ensure that the road will be able to carry heavy vehicle activity. As a result, increased volumes of surface runoff will be generated during storm events that might lead to erosion of the road itself.	Long-term (Operational Phase)	3	1	L	Yes	No	Managed; Mitigated
	Operation of channels, trenches and return water dams	Silt accumulation within the conveyance channels is a continual problem at coal mining operations and thereby, as a result, reducing channel capacities, blocking silt traps and compromising the capacities containment facilities such as the plant return water dams. <u>Surface water quantity:</u> Process water spillages within the plant area will result in a reduced amount of water recycled within the process resulting in additional water that has to be sourced for usage. Ponding of surface water runoff at the plant also have a negative effect on plant operations.	Long-term (Operational Phase)	5	3	H	Yes	No	Avoided; Mitigated
	Operation of Ramp 7 trench	The current Ramp 7 trench and Ramp 7 sump should be used as an additional measure to contain any possible spillages or overflows from the current plant return water dams or the proposed pollution control dam. Ineffective maintenance of the trench and the sump might cause overflow towards the Olifants River located approximately 700 meters downstream. <u>Surface water quality:</u> Contaminated process water will alter the ecological function and water quality within the Olifants River.	Long-term (Operational Phase)	4	3	H	Yes	No	Avoided