Integrated Water and Wastewater Management Plan (IWWMP) for the Dorstfontein East Mine Extension of Pit 1 and Water Transportation Pipeline from Dorstfontein West to Dorstfontein East, eMalahleni Local Municipality, Mpumalanga

Report Prepared for

Exxaro Central Coal

POWERING POSSIBILITY

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Report Prepared by

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Executive Summary

Background

Dorstfontein Coal Mines (Pty) Ltd (DCM) is owned by Exxaro Coal Central (ECC) (74%) and Mmakau Mining (26%), its Black Economic Empowerment Partner. The mine is an outsourced operation with opencast and underground mining as well as coal processing conducted by contractors and with ECC retaining general management and marketing control.

DCM East has approval to mine the No. 4 Seam via underground mining operations on the western portion of the mining rights area and both underground and opencast operations on the east. DCM has an arrangement with the Richards Bay Coal Terminal (RBCT) to supply the terminal with 2 million tonnes of export coal per annum (mtpa). The coal supply requirement initiated the extension of the DCM East activities and infrastructure in order to provide for the full entitlement. DCM comprises of the following:

- The existing DCM No. 2 coal seam (DCM West Mine)'; and
- The DCM No. 4 coal seam (DCM East Mine).

The DCM East Project includes the opencast and underground mining of coal reserves and the operation of a processing plant for different grades of coal. DCM East makes use of a transport railway system to deliver coal to the RBCT.

ECC plans to expand the current opencast mining operations of Pit 1. This will occur in a North Western direction for approximately 85 ha and will include the construction of a water pipeline from the West to the East of the Dorstfontein Mine for approximately 11 km. This pipeline will transport processed water to be recycled.

SRK Consulting SA (Pty) Ltd (SRK) has been appointed by ECC as an independent consultant to conduct the required Environmental Impact Assessment (EIA) and Water Use Licence Application (WULA) process for the proposed extension project and associated water pipeline. SRK is also undertaking the public involvement component of the EIA/EMPr to meet the requirements of the National Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA) and the National Water Act, 1998 (Act No 36 of 1998) (NWA).

Location of the Project

The DCM East Operations Pit 1 extension area is situated in Mpumalanga Province, 45 kilometres to the North, northwest of Bethal and 12 kilometres northeast of the town of Ga-Nala (Kriel).

The proposed project is located on the farm portions provided in Table ES-1 provides a description of the proposed activities on each farm portion.

Table ES-1: List of Affected Farms and Farm Portions Illustrating the Relevant Activities

Farm and 21 Digit Survey General Code	Portions	Owner	Proposed Activities
Dorstfontein 71 IS T0IS00000000007100003	2	Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 1, 2, and 3
Dorstfontein 71 IS T0IS00000000007100002	3	Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 2 and 3
Dorstfontein 71 IS T0IS00000000007100008	8	Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 1, 2, and 3
Welstand 55 IS	4		

Farm and 21 Digit Survey General Code	Portions	Owner	Proposed Activities
T0IS00000000005500004		Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 2 and 3
Welstand 55 IS T0IS00000000005500005	5	Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 1, 2, and 3
Welstand 55 IS T0IS00000000005500011	11	Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 1 and 2
Welstand 55 IS T0IS00000000005500013	13	Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 1, 2, and 3
Welstand 55 IS	Remainder	Dorstfontein Coal Mines (Pty) Ltd **	Pit extension and portion of Alternative 1 pipeline

Water Uses in terms of the NWA

The extension of Pit 1 and the construction of the associated pipeline will trigger water uses as classified in Section 21 of the NWA. The water uses triggered by the project are provided in Table ES-2.

Table ES - 2: Water Uses triggered by the project

NWA Section 21	Description of the water use
21 (c) and (i)	Impeding, diverting and altering the flow of water in a watercourse. The development of a maintenance road along the pipeline route, which includes a 10m servitude of approximately 12.5km. This will include surface and ground water management, erosion and soil controls and stormwater management. All three pipeline route options traverse various perennial, non-perennial, channelled valley bottom wetlands and floodplain wetlands. All activities taking place within 500 m of a wetland or watercourse will be licensed under Section 21 (c).
21 (e)	Engaging in a controlled activity identified as such in Section 37 (1) or declared under Section 38 (1). As a result of the proposed mining activities, dust suppression activities will be undertaken using process water.
21 (g)	Disposing of waste in a manner which may detrimentally impact on a water resource. Because of the proposed mining activities, dust suppression activities will be undertaken using process water.
21(j)	Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people: The dewatering process associated with the continuation of mining activities in the Pit 1 extension.

Legal Assessment

National Water Act, 1998 (Act 36 of 1998)

- ***Existing Lawful water uses:*** There are no Existing Lawful Uses at the DCM Eat operations.
- ***Integrated Water Use Licence:*** DCM East was issued with an Integrated Water Use License (IWUL) No. 04/B11B/ACGIJ/957 by the Department of Water and Sanitation (DWS) on 17 December 2014. The IWUL was issued to the mine in line with the requirements of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) and associated Regulations for the following water uses:

- Section 21(a) – Taking of water from a water resource;
- Section 21(c) – Impeding or diverting the flow of water in a water course;
- Section 21(i) – Altering the bed, banks, course or characteristics in a watercourse;
- Section 21(g) – Disposing of waste in a manner which may detrimentally impact on a water resource; ; and
- Section 21(j) – Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity of for the safety of people.

- ***Exemptions:*** *DCM East operations has applied for a number of exemptions as follows:*
  - 2008 Exemption Application: In the 2008 WULA submitted to DWS, exemption from Government Notice No. 704 (GN 704), Regulation 4 (Restriction on locality) was requested for mining within 100 meter of a watercourse at Opencast Pit 2.
  - 2009 Exemption Application: In the 2009 exemption application for the conveyor and rail loop as follow:
    - *GN704 (4):* Exemption from regulation 4a and 4b
    - *GN 704 (4a): Exemption from Regulation 4a for the construction of* The within a horizontal distance of 100m of a wetland

The National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA)

An application for an Environmental Authorisation for the extension of Pit 1 and the construction of the associated pipeline was accepted by the DMR on 18 July 2017, and the Scoping Report was accepted on 2 August 2017. The Draft EIA/EMPr was submitted to the DMR on 25 October 2017 for comment.

Minerals and Petroleum Resources Act, 2008 (Act XX of 2008)

The DCM East also has an existing Environmental Management Programme (EMPr) for its two opencast mining pits (pit 1 and Pit 2) (Reference Number: MP 30/5/1/2/2/51MR) under the Minerals and Petroleum Resources Development Act, 2008 (Act no 22 of 2008) (MPRDA).

Activity Description

It is anticipated that the mine extension and pipe construction will include the following infrastructure and activities:

- Selective vegetation clearance for the extension of Pit 1 and the footprint of the pipeline;
- Stripping and stockpiling topsoil and sub-soil and the establishment of a topsoil stockpile area and berms;
- Mining of the Pit 1 extension area (Including blasting);
- Erection of the pipeline;
- The development of a maintenance road along the pipeline route;
- Loading, hauling and transportation of Run of Mine (ROM), product and materials;
- The dredging, excavation and moving of soil, sand and rock from the non-perennial streams for the erection of the pipeline;
- Erection of pipe racks and culvert at the stream crossings;
- Operation of storm water control systems; and

- The establishment of construction camps by contractors and the operation of earth moving vehicles and equipment.

The mining methodology will entail both open cast mining and underground mining.

The proposed pipeline will be approximately 11 km in length with an internal diameter of 250 mm. This will equate to a peak throughput exceeding 120 litres / second. The pipeline will be constructed from the Dorstfontein West to the Dorstfontein East Mine and will assist Exxaro to optimise their water management between the two mines.

Baseline Environment

- Climate: The project is located in the Highveld climatic region of South Africa, which is a summer rainfall area. The local climate can be described as semi-arid high-veld conditions, with warm summers and moderate dry winters.
- Water Management Area (WMA): The Dorstfontein Mine falls within the upper reaches of the Olifants Water Management area, within quaternary catchments B11B and B11D.
- Surface Water: The area is strongly influenced by the Olifants River to the north of the mining area. The streams in the western area of the project flow west and north west into the Steenkoolspruit, which flows north into the Olifants River. The main stream on the eastern area of the project flows north into the Olifants River.
- Surface Water Quality: The project area falls within segment 1-8, which is the upper reaches of the Olifants River from its source to the confluence with the Steenkoolspruit. According to the intermediate reserve determination study conducted by DWS in 2001, the upper reaches of the Olifants River are relatively undisturbed with dryland agriculture being the main land-use and some coal mining at the bottom end of the reach. The Present Ecological State (PES) of the Upper reaches of Olifants River segment 1-8 is moderately modified which is a Class C.
- Resource Class and River Health: The Olifants River is currently a Class C River in terms of the Present Ecological Status, (PES). According to GN R619, there are no resource quality objectives that have been set for Resource Units 1 and 4 where the project is located. It must also be noted that the resource class objectives are not applicable to the DCM East operations as there is no discharge from the site to the receiving water resources.
- Surface Water Users: Water use in the catchment comprises of the uses related to the Reserve, as well as the following uses:
    - Agriculture;
    - Industry (primarily related to the underground coal mining);
    - Domestic (primarily related to water abstracted from Witbank dam for supply to urban areas); and
    - Recreation on Witbank dam.
- Sensitive Areas: Three types of wetlands will be affected by the proposed water pipeline. No wetlands will be affected by the pit extension area.
- Groundwater Quality: Groundwater samples collected from six hydro-census boreholes show that no measured variables exceeded the SANS standards. At sampling point DTNM18 the nitrate concentration of 8.03 mg/l was slightly elevated, exceeding 50% of the SANS standard of 11 mg/l.
- Aquifers: Three principal aquifers were identified: the weathered aquifer; the fractured Karoo aquifer; and the fractured pre-Karoo aquifer.

Alternatives considered

Mining

The proposed mining alternatives are provided in Table ES-3.

Table ES-3: Summary of Proposed Alternatives

Option 1	Option 2 Opencast Phase	Option 2 Underground Phase
Mining Method		
• Opencast method of mining will continue as normal from the existing Pit 1 until the planned pit is depleted; • Pit 1 Extension will follow with a slight change in the mining direction; and • Roll over method suggested. The roll over method involves the removal of a long strip of overburden. This method is favoured where coal is located close to the surface.	• Pit 1 Extension will follow existing pits depletion; and • Mining of Pit 1 Extension by means of opencast methods on the right hand side of the North Eastern side of the Pit 1 Extension and to mine the left hand side North West of the Pit 1 Extension.	• Underground construction phase in Option 2 will commence at the end of 2021; • First production is planned for April 2022 ramping up to full production by June 2022; • The second phase will be introduced in March 2023 as pit room is opened up by the first section; and • Will be mining the No. 4 seam only.
Equipment Used		
• Combination of excavators, front-end-loaders as well as in-pit coal drilling machines, haul trucks and track bulldozers.	• Opencast mining for the area to the east through the use of earth moving mining equipment to conduct the opencast mining on the right hand side of the igneous intrusion (sheet of newer rock that has “intruded” between older layers of rock); and • Here, the addition of a combination of excavators, front-end-loaders as well as in-pit coal drilling machines, haul trucks and track bulldozers (as in Option 1).	• Conventional mechanized underground mining using continuous miners.
Estimated Production		
• Production rates may be adjusted during the life of the Pit 1 Extension; • Opencast will be mined at a run of mine production of ± 180 Kilotons per month	• Production at a reduced rate of estimated 40 Kilotons per month (480 Kilotons per annum); and • Reduction due to limited pit length.	• 1 191 630 tons in 2022, reducing to 688 908 tonnes in 2023.

Option 1	Option 2 Opencast Phase	Option 2 Underground Phase
mining both the No. 4 and No. 2 seam; and • Production is planned to ramp up from 500 Kilotons to 1.3 Megatons per annum over a 10 year period.		
Life of Mine		
• Estimated LOM: 10 years.	• Estimated LOM: 7 years.	• Estimated LOM: 2 years.

Process Water Supply Pipeline

Three alternative pipeline routes were identified for the proposed DCM East Extension Project. All three routes, to some extent, use existing roads and infrastructure corridors. This is particularly true of Route 1, which makes use of existing farm and mine roads and crosses the R544. As such, Route 1 is the preferred route, as it does not dissect as many of the surrounding cultivated farms, which is the case for both Routes 2 and 3.

Specialist Studies

The following specialist studies were conducted as part of the application:

- Wetland and Aquatic Ecology to define EIS and PES of the wetlands;
- Surface Water Hydrology; and
- Groundwater.

Findings from the studies are summarised below.

Surface Water

Hydrology

According to the Hydrology and Surface Water Impact Assessment Study conducted by SRK Consulting, the 0.85 km^2 open cast pit extension will reduce runoff generated within the immediate catchment. The catchment in which the pit extension is located is 17.4 km^2. In addition, the Digital Elevation Model (DEM) was projected from quaternary catchment B11B, which is 435 km^2.

The pipeline falls across two quaternary catchments B11B and B11D and will not have any effect on the MAR. As a result, B11D will not be affected by a change in MAR. The MAR for the unnamed tributary is shown in Table 4-3.

Table ES-4: Natural mean annual runoff (MAR) (from WR2012) at conveyor

Catchment	Area (km^2)	B11D MAR contributing rainfall (mm)	MAR from Pit Catchment (mill m^3)	Dirty water area (km^2)	MAR from dirty water (m^3)	Loss of MAR (%)
Pipeline	34	54	1.84	0	0	0

The effects of mining activity on the catchment MAR in which the pit extension is located, will be a reduction in MAR. The results for the localised investigation are shown in Table 4-4. The captured dirty water will result in a reduction of MAR of 45 900 m^3.

Table ES-5: Natural MAR (from WR2012) and loss of MAR due to dirty water containment

Catchment	Area (km^2)	B11B MAR contributing rainfall (mm)	MAR from Pit Catchment (mill m^3)	Dirty water area (km^2)	MAR from dirty water (m^3)	Loss of MAR (%)
Pit Extension	17.4	54	0.94	0.85	45 900	4.9

In the greater context, the pit extension is located within quaternary catchment, B11B. The catchment area and the associated MAR is presented in Table 4-5. The reduction in MAR included in Table 4-5 was estimated using the runoff depth given in WR2012 (Midgley, Pitman and Middleton, 1994).

Table ES-6: Quaternary natural MAR (from WR2012) and loss of MAR due to dirty water containment

Catchment	B11B Area (km^2)	B11B MAR contributing rainfall (mm)	MAR from B11B (mill m^3)	Dirty water area (km^2)	MAR from dirty water (m^3)	Loss of MAR B11B (%)
B11B	435	54	23.65	0.85	45,900	0.2

Surface Water Quality

DCME has a number of water quality sampling points located on the Olifants River and affected tributaries. The Olifants River flows to the north of the mining area with sampling points MP3, MP4, MP5 and MP6 located on the Olifants River. MP6 is upstream of MP5 and all mining activities.

Sampling points MP1 and MP2 are located on the western tributary of the Olifants River and samples DCM6 and DCM7 are located on the eastern tributary of the Olifants River. The results from the water quality monitoring are as follows:

- The results of the water quality sampling of the Olifants River shows that the water quality remained good and complied with SANS limits in the first quarter 2015, with only occasionally elevated aluminium at MP3, MP5 and MP6.
- Sampling point MP1 was dry throughout the first quarter of 2015 and MP2 could only be sampled in January 2015 as it was also mostly dry. When sampled MP2 still slightly exceeded the SANS limit indicating a possible impact related to mining, but due to the low water content might be a result of evaporation.
- Sample points DCM6 (upstream) and DCM7 (downstream) monitor the impact of DCM East Mine on the small eastern tributary flowing to the east of the mine. It was not possible to sample DCM7 in February and March 2015 as it was dry. Both sample sites continued to have good water quality in the first quarter 2015 in term of compliance to SANS limits.
- Slightly higher sulphate concentrations were observed at MP4 than the rest of the sampling points. The sulphate concentration at MP5 and MP6 were relatively the same as downstream at MP3.
- The calculated volumes and quality of the potential decant indicates a high impact on the water quality of the Olifants River and the tributaries on the site.

Groundwater

Aquifer characterisation

The three aquifer (the weathered aquifer; the fractured Karoo aquifer; and the fractured pre-Karoo aquifer) that occur in the area were classified as minor aquifers (low yielding), but of high importance.

Hydrocensus

A hydro-census was conducted within a 5 km radius of the Dorstfontein West and East workings. A total of 26 boreholes were visited. Information pertaining to water use of the 26 boreholes is presented below:

- 21 boreholes were used for domestic, stock watering purposes and irrigation;
- 3 boreholes were dormant/not in use;
- 2 boreholes, owned by Exxaro and BHP Billiton respectively, are used for monitoring purposes; the borehole owned by Exxaro is still part of the current monitoring network.

Groundwater Quality

Groundwater samples were collected from six hydro-census boreholes. Sample analyses results were compared to the South African National Standard (SANS) 241:2011 Class 1 water quality standards for drinking water. No measured parameters exceeded the SANS standards. The results showed that the groundwater quality measured in third party boreholes is of good quality when compared to drinking water standards. There is no indication that mining activities are impacting on the groundwater quality in these boreholes (GCS (Pty) Ltd, 2016).

Decant

At Dorstfontein East the potential decant points are located at the lowest topographical sections of the opencast mines. The calculations show the time-to-decant ranges between 25 and 154 years depending on porosity (15 to 25%) and recharge rate (6.5 % according to rehabilitation info and 16% as a maximum from other studies). Decant volume calculations show discharge rates of between approximately 91 and 585 m^3/d. Decant from Pit 1 will flow towards the western tributary of the Olifants River and the calculated volumes and quality of the potential decant indicates a high impact on the water quality of the Olifants River and the tributaries on the site. To reduce the impact on surface water quality a water treatment plant may be needed to increase the water quality emanating from the opencast areas.

The rate of water level recovery in the underground voids should be monitored.

Wetlands/Aquatic Ecology Assessment

During the field assessment, one freshwater resource, comprising three hydro geomorphic types (HGM), was identified along the proposed pipeline routes. The resource was characterised as an inland system (i.e. a system having no existing connection to the ocean but which is inundated or saturated with water, either permanently or periodically), located within the Highveld Aquatic Ecoregion. The applicable WetVeg group is the Mesic Highveld Grassland Group 4. The characterisation of this resource is summarised in Table 4-6.

Table ES-7: Characterisation of the resources identified along the linear development.

Freshwater Resource	Level 3: Landscape unit	Level 4: HGM Type
Dorstfontein Wetland		Channelled valley bottom: A valley bottom wetland with a river channel running through it.

Freshwater Resource	Level 3: Landscape unit	Level 4: HGM Type
	Valley: The typically gently sloping, lowest surface of a valley.	Unchannelled valley bottom: A valley-bottom wetland without a river channel running through it.
	Slope: an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley.	Hillslope Seep: a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

No wetlands were observed within the pit extension area, with this area being characterised almost wholly of agricultural land. However, a wetland system was observed approximately 120 m to the east of the proposed pit extension area. As such it must be noted that the extension pit may impact on this system.

Risk Assessment

A quantitative risk assessment was conducted for the pre-construction, construction and operation phases of the project.

Pre-Construction Phase

During the pre-construction phase, the following main activities will take place:

- Site clearing and grubbing of the footprint areas associated Pit 1 extension and pipeline route;
- Site surveillance for any Red Data Listed (RDL) species;
- Surveillance and marking of graves and cultural artefacts;
- Conduct a Phase 2 Heritage assessment and grave relocation;
- Removal of vegetation (shrubs and trees) to be relocated, monitored and maintained;
- Stripping and stockpiling of soils on a topsoil stockpile area;
- Preparation of the contractor's yard. All equipment and vehicles to be used during the pre-construction and construction phases will be stored at this facility;
- Possible grave relocation and application for destruction permits from South African Heritage Resources Agency (SAHRA).

The following water and waste management impacts are envisaged during the pre-construction phase.

Groundwater Impacts

The Pit 1 extension and pipeline construction may possibly result in the following impacts on the geo-hydrology of the area during the pre-construction phase are as follows:

- Machinery and equipment used for the construction of the contractor's camps and local earthworks pose a risk of local spillages of oils which may leach to groundwater. Clearing of clay soils and vegetation could involve the use of machinery. The clearing of the vegetation and stripping of clay top soil could potentially result in slightly higher infiltration rate to the unsaturated zone. The removal of vegetation could furthermore lower the evapotranspiration rates, thereby allowing a greater volume of potentially

contaminated water to percolate to the underlying aquifer in the event of an accidental spill from the machinery;

- Monitoring boreholes on the border of the Pit 1 extension area may be a conduit of flow to the groundwater unless sealed;
- Site clearing and grubbing is unlikely to materially affect the groundwater within the project area. However, care should be taken during the utilisation and storage of hydrocarbons and chemicals, which may impact on groundwater as a result of spillages and uncontrolled release.

Surface Water Impacts

The potential impacts on surface water during the pre-construction phase of the proposed project are as follows:

- Direct Impact as a result of an increase in erosion from cleared areas, topsoil stockpiles or any other area where there are exposed soils can occur during storm events;
- Indirect impact due to Increased erosion can result in an increase in turbidity, suspended solids and sedimentation of nearby water resources (unnamed tributary);
- Accidental hazardous substances spillage during site establishment.

Some level of sedimentation is expected to occur in the unnamed tributary pre-development as runoff is naturally anticipated to pick up environmental debris as it crosses natural areas. Increased turbidity is reversible and surface water should return to pre-impact turbidity levels once sediment levels entering the watercourse are reduced. Settled sediments should naturally move downstream during periods of high flow flowing storm events.

Wetland and Aquatic Environmental Impacts

The Pit 1 extension and water pipeline construction may result on the following envisaged impacts during the pre-construction phase:

- Placement of infrastructure in sensitive wetland habitat areas resulting in the loss of ecological structure;
- Potential poor planning, resulting in the placement of the linear development within wetland habitat, leading to altered habitat;
- Increased anthropogenic activity within the wetland feature leading to an increased impact on the biological structure of the wetland features and the associated effects that this will have on service provision;
- Bush clearing and erosion may cause localised impacts on water quality which may affect the aquatic habitats and ecology within the area;
- Failure to initiate a rehabilitation plan and alien control plan during the pre-construction phase may lead to further impacts during the construction and operation phase.

Where significance ratings differ between alternatives, these are indicated in the assessment tables. The impact assessment for the pre-construction phase is presented in Table 5-12.

Table ES - 8: Table Risk Assessment Results for the Pre-Construction Phase

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION	MITIGATION MEASURES	IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)
Groundwater Impacts				
Direct	Local spillages of hydrocarbons and chemicals which may leach to groundwater.	**ML Maintain Current Management**	• All spillages will need to be cleaned up as soon as practically possible; • Proper management of stormwater drainage infrastructure should be ensured; • Vehicles and machinery will be maintained in good order to minimise leakages; • Employees will report spillages as soon as they are discovered and the spillages will be cleaned up immediately.	**L No Management Required**
Indirect	Monitoring borehole on the border of the Pit 1 extension area may be a conduit of flow to the groundwater unless sealed.	**MH Maintain Current Management**	• Grouting and capping of boreholes located within the footprint of construction camps be required prior to construction activities.	**L No Management Required**
Surface Water Impacts				
Direct	Increase in erosion from cleared areas	**MH Maintain Current Management**	• Construct in the dry season and install silt bunds; • Erosion control measures will be implemented as soon as erosion has become evident. Water velocity will be reduced as far as feasible.	**L No Management Required**
Indirect	Increase in turbidity, suspended solids and sedimentation of nearby water resources	**MH Maintain Current Management**	• Limit disturbed footprint and install retardation structures	**L No Management Required**
Direct	Accidental hazardous substances spillage during site establishment	**MH Maintain Current Management**	• Operate using best practises by storing hazardous substances in an adequately sized bunded area, with appropriate safety equipment; • Place spill kits on site which are operated by trained staff members for the adhoc remediation of minor chemical and hydrocarbon spillages.	**L No Management Required**
Wetland and Aquatic Environmental l Impacts				
Direct	Placement of infrastructure in sensitive wetland habitat areas resulting in the loss of ecological structure.	**MH Maintain Current Management**	• Access roads for support vehicles, and vehicles used in the construction of the crossings, should not encroach into the freshwater features	**L No Management Required**

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION	MITIGATION MEASURES	IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)
Direct	Potential poor planning, resulting in the placement of the linear development within wetland habitat, leading to altered habitat.	**MH Maintain Current Management**	• Wetland areas other than the immediate areas of crossing are to be demarcated as no-go areas for vehicles and construction personnel; • Vegetation removal should be kept at a minimum to avoid loss of freshwater features' assimilation and attenuation abilities	**L No Management Required**
Direct	Increased anthropogenic activity within the wetland feature leading to an increased impact on the biological structure of the wetland features and the associated effects that this will have on service provision.	**MH Maintain Current Management**	• Rehabilitation should be conducted in a manner that ensures that the wetland features' conditions are reinstated to as natural a state as possible	**L No Management Required**
Direct	Bush clearing and erosion may cause localised impacts on water quality which may affect the aquatic habitats and ecology within the area	**ML Maintain Current Management**	• All construction must be done in such a manner so as to ensure species migration will take place by ensuring a suitable structure height to allow species to move under or over the pipelines and roads.	**L No Management Required**
Direct	Failure to initiate a rehabilitation plan and alien control plan during the pre-construction phase may lead to further impacts during the construction and operation phase	**MH Maintain Current Management**	• Any storage facilities and all other non-essential activities should be located away from the identified wetlands in order to avoid water and soil contamination.	**L No Management Required**

Construction Phase

During the construction phase, the following main activities will take place:

- Construction and ground preparation for the planned Pit 1 extension and water pipeline;
- Construction and maintenance of stormwater control measures;
- Stockpiling of topsoil for the pipeline construction as well as for the Pit 1 extension;
- Trench excavations for the pipeline;
- Laying of the pipeline;
- Backfilling of trenches associated with the pipeline;
- Preparation of mining activities associated with the Pit 1 Extension;
- Vegetation clearing of the construction footprint;
- Demarcating no-go areas;

The following impacts are envisaged during the construction phase.

Groundwater Impacts

The Pit 1 extension and pipeline construction may possible result in the following impacts on the geo-hydrology of the area during the construction phase are as follows:

- Accidental spillages or leaks of hydrocarbons from construction machinery may occur during construction of the planned infrastructure. The hydrocarbons may infiltrate to the underlying groundwater system reducing the groundwater quality;
- Monitoring borehole on the border of the Pit 1 extension area may be a conduit of flow to the groundwater unless sealed;
- Site clearing and grubbing is unlikely to materially affect the groundwater within the project area. However, care should be taken during the utilisation and storage of hydrocarbons and chemicals, which may impact on groundwater as a result of spillages and uncontrolled release.

The assessment of the groundwater impacts during the construction phase, has illustrated that there is no preferable alternative to the mining methodology or pipeline route alternative. Minimal groundwater impacts are envisaged as a result of the construction phase.

Surface Water Impacts

The potential impacts on surface water during the construction phase of the proposed project are as follows:

- Impeding flow while under construction of the pipeline over the non-perennial streams. During the construction of the stream crossings surface water will need to be diverted in order assist in construction of the pipeline in a dry environment;
- Accidental spillages of hazardous substances from construction vehicles used during construction of the crossings, as well as from hazardous storage areas;
- Contamination of runoff by poor materials/waste handling practices;
- Debris from poor handling of materials and/or waste blocking watercourses;
- Contaminated dirty water runoff to surrounding areas resulting in the impact on local surface water quality;
- Increase in turbidity of the local water streams as a result of runoff of cleared areas;

- Increase of surface runoff and potentially contaminated water that needs to be maintained in the areas where site clearing occurred;
- Construction of possible river diversion may temporarily disturb the water course affecting the hydrology of the water courses;
- Increase of erosion potential during construction activities associated with the river crossings and Pit 1 extension;
- Removal of MAR from the catchment, as this runoff will now be considered dirty water and will need to be contained within the mining area.

Some level of sedimentation is expected to occur in the unnamed tributary pre-development as runoff is naturally anticipated to pick up environmental debris as it crosses natural areas. Increased turbidity is reversible and surface water should return to pre-impact turbidity levels once sediment levels entering the watercourse are reduced. Settled sediments should naturally move downstream during periods of high flow flowing storm events.

The assessment of the surface water impacts during the construction phase has illustrated that there is no preferable alternative to the mining methodology or pipeline route alternative. Surface water impacts experienced will be experienced across all alternatives.

Wetland and Aquatic Environmental Impacts

The Pit 1 extension and water pipeline construction may result on the following envisaged impacts during the pre-construction phase:

- Loss of habitat and wetland ecological structure as a result of site clearance activities and uncontrolled wetland degradation;
- Impact on the wetlands systems as a result of changes to the sociocultural service provisions though site clearance. Waste management and wetland disturbance;
- Potential poor planning, resulting in the placement of the linear development within wetland habitat, leading to altered habitat;
- Impact on the hydrological functioning of the wetland systems;
- Soil compaction and levelling as a result of construction activities and vehicle movement leading to loss of wetland and riparian habitat;
- Increased runoff due to topsoil removal and vegetation clearance leading to possible erosion and sedimentation of wetland and riparian resources.

The wetland assessment has concluded that the most preferable option for the pipeline is the proposed alternative. Alternative 2 and Alternative 3 cross sensitive ecological services

Where significance ratings differ between alternatives, these are indicated in the assessment tables. The impact assessment for the construction phase is provided in Table 5-13.

Table ES - 9: Table Risk Assessment Results for the Construction Phase

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION	MITIGATION MEASURES	IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)
Groundwater Impacts				
Direct	Impact on groundwater quality because of hydrocarbon spillages from machinery.	**ML Maintain Current Management**	• All spillages will need to be cleaned up as soon as practically possible; • Proper management of stormwater drainage infrastructure should be ensured; • Maintain construction vehicles and encourage contractors to report, react and manage all spills and leaks so that action can be taken to immediately minimise contamination to the groundwater; • Groundwater monitoring of boreholes should continue as per the WUL and approved monitoring programme. • Spill kits will be made available in areas of likely spillage; • All hydrocarbon storage containers will be stored within a bunded areas which are water tight and able to contain 110% of the stored volume; and • All equipment utilising hydrocarbons will be stored on a hard standing surface.	**L No Management Required**
Direct	Storage of hydrocarbons and chemicals, which may impact on groundwater as a result of spillages and uncontrolled release	**ML Maintain Current Management**	• Grouting and capping of boreholes located within the footprint of construction camps be required prior to construction activities.	**L No Management Required**
Indirect	Monitoring borehole on the border of the Pit 1 extension area may be a conduit of flow to the groundwater unless sealed	**MH Maintain Current Management**		**L No Management Required**
Surface Water Impacts				
Direct	Impact on surface water flow as a result of impeding flow while under construction of the pipeline over the non-perennial streams	**MH Maintain Current Management**	• Construction must take place within the dry season as far as possible; • Gabions and mattresses will be used to protect the river banks; and • All litter and debris will be continuously removed during construction.	**L No Management Required**
Direct	Impact on surface water quality as a result of accidental spillages of hazardous substances from construction vehicles used during construction of the crossings, as well as from hazardous storage areas	**MH Maintain Current Management**	• Access to the construction site will be controlled; • Refuelling areas will be bunded and nozzles protected from spillage during refuelling; • Vehicular access to the stream will be restricted; • All spillages will need to be cleaned up as soon as practically possible; • Proper management of stormwater drainage infrastructure should be ensured; • Hazardous substances stored on site will be stored within a designated bunded areas fitted with a sump and value. Collection of water within the bunded areas will be deemed hazardous and disposed of as such;	**L No Management Required**

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION	MITIGATION MEASURES	IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)
			• Bunded areas will be water tight and inspected for leaks on a frequent basis; • Leaks to the bunded areas will be rectified as soon as possible; • Drip trays will be utilised for the collection of leaks from vehicles and machinery parked for long period of time; • Should a spill occur, this will be handled at the source of the leak and prevented from transpiring to nearby watercourse; • Ensure that routine maintenance on all vehicles is undertaken as per maintenance schedule and records are kept; and • Sewage spillages will be seen as hazardous waste and will be handled as such.	
Direct	Debris from poor handling of materials and/or waste blocking watercourses, resulting in flow impediment and pollution.	**L No Management Required**	• Operate using best practises in separating waste streams and disposing of the waste correctly.	**L No Management Required**
Direct	Contaminated dirty water runoff to surrounding areas resulting in the impact on local surface water quality	**H Improve Current Management**	• Construct diversion drains around the site timeously prior to operation; and • Ensure adherence to GNR 704 of the NWA;	**MH Maintain Current Management**
Direct	Increase in turbidity of the local water streams as a result of runoff of cleared areas	**MH Maintain Current Management**	• Where necessary, and as defined when the final detailed project design is confirmed, construct sediment collection paddocks downstream of the working activities to minimise uncontrolled runoff from the site; • Minimise the areas that are to be stripped of vegetation; • Adequate storm water management should be considered in the detailed design of the proposed infrastructure in order to minimize undue erosion; • Erosion can also be limited by ensuring that mine vehicles and human movement is limited to project specific dedicated access ways; • Stormwater culverts and clean water diversions will be designed and constructed to accommodate the 1:50 year storm event around the mining areas; • Stormwater runoff will be directed towards natural watercourses; • Construction will be undertaken during the dry season, where possible, to minimise the potential for stormwater runoff; • Routine surface water quality monitoring up and down stream of construction activities and position of infrastructure and activities associated with the Project will be undertaken on a monthly basis.	**L No Management Required**
Direct	Increase of surface runoff and potentially contaminated water that needs to be maintained in the areas where site clearing occurred.	**MH Maintain Current Management**	• Adequate protection measures at river crossings will be included in the pipeline designs.	**L No Management Required**

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION	MITIGATION MEASURES	IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)
Direct	Construction of possible river diversion may temporarily disturb the water course affecting the hydrology of the water courses	**MH Maintain Current Management**	• The point where the diversion re-enters the natural system must enter the system at the same elevation as the receiving aquatic environment as well as consist of an energy dissipation structures thereby preventing erosion and incision of the natural watercourse; and • The point where the diversion re-enters the natural watercourse must enter the system where possible at an acute angle to prevent the creation of turbulent flow, erosion and incision.	**L No Management Required**
Direct	Increase of erosion potential during construction activities associated with the river crossings and Pit 1 extension	**ML Maintain Current Management**	• Adequate storm water management should be considered in the detailed design of the proposed infrastructure in order to minimize undue erosion; • Ensure erosion protection measures are adequately implemented and monitored; and • Erosion can also be limited by ensuring that mine vehicles and human movement is limited to project specific dedicated access ways.	**L No Management Required**
Indirect	Removal of MAR from the catchment, as this runoff will now be considered dirty water and will need to be contained within the mining area.	**L No Management Required**	• The stormwater will be diverted into the natural environment which further mitigates the impact; • Stormwater dams need to be assessed to ensure that the capacity of water pumped during construction will be adequately catered for; • Recycle waste water as far as feasible.	**L No Management Required**
Indirect	Contamination of runoff by poor materials/waste handling practices, impacting on surface water quality.	**MH Maintain Current Management**	• Waste will be disposed of in accordance to the waste management procedure; • Housekeeping will be kept up to standard. Housekeeping should be done after every shift.	**L No Management Required**
Wetland and Aquatic Impacts				
Direct	Loss of habitat and wetland ecological structure as a result of site clearance activities and uncontrolled wetland degradation	**MH Maintain Current Management**	• The wetland features must be rehabilitated immediately after the construction phase; • During the construction phase of the development, all wetland areas other than the immediate areas of crossing are to be demarcated as no-go areas for vehicles and construction personnel; • Access roads for support vehicles, and vehicles used in the construction of the crossings, should not encroach into the freshwater features; • Activities that lead to elevated levels of sedimentation in the freshwater features should be minimised. Increased runoff due to vegetation clearance and/or soil compaction must be managed. Where necessary, access roads should have erosion berms installed in order to reduce the speed of any surface runoff, which could initiate erosion; • Implement alien vegetation control program within the wetland features; • Ensure that all activities impacting on the wetland features are managed according to the relevant DWS Licensing regulations (where applicable)	**L No Management Required**
	Alternative 2	**MH Maintain Current Management**		**L No Management Required**
	Alternative 3	**MH Maintain Current Management**		**ML Maintain Current Management**

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION	MITIGATION MEASURES	IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)
Direct	Impact on the wetlands systems as a result of changes to the sociocultural service provisions	**MH Maintain Current Management**	• In a case where it is impossible to avoid development within the watercourse, it is advisable to minimise the extent and duration of the activities (i.e. during construction and rehabilitation and the use of less invasive methods such as directional drilling techniques) within the watercourse in order to reduce impacts on the biodiversity and Eco services provision; • Any storage facilities and all other non-essential activities should be located away from the identified wetlands in order to avoid water and soil contamination, which would affect the structure and function of these resources; • During construction use techniques which support the hydrology and sediment control functions of the freshwater features; • Limit excavations to a limited extent to ensure that drainage patterns within the features returns to normal as soon as possible after construction.	**L No Management Required**
	Alternative 2	**MH Maintain Current Management**		**L No Management Required**
	Alternative 3	**MH Maintain Current Management**		**L No Management Required**
Direct	Impact on the hydrological functioning and sediment balance of the wetland systems	**ML Maintain Current Management**	• Avoid encroachment of activities into the watercourse where feasible; • Rehabilitation should be conducted in a manner that ensures that the wetland features' conditions are reinstated to as natural a state as possible; • As much vegetation growth as possible should be promoted within the wetland features in order to protect soils. In this regard, special mention is made of the need to prevent the loss of large areas of the freshwater features' vegetation and the use of indigenous vegetation species' where hydro seeding and rehabilitation planting (where applicable) are to be implemented; • Any construction-related waste must not be placed in the vicinity of the wetland features; • Stockpiled soil must be removed and the area must be levelled to avoid sedimentation of the wetland features from runoff.	**L No Management Required**
	Alternative 2	**MH Maintain Current Management**		**L No Management Required**
	Alternative 3	**MH Maintain Current Management**		**L No Management Required**
Indirect	Increased runoff due to topsoil removal and vegetation clearance leading to possible erosion and sedimentation of wetland and riparian resources	**MH Maintain Current Management**	• Restrict construction to the drier winter months if possible, to avoid increased water inputs and sedimentation within the wetland; • Adequate storm water management must be incorporated into the design of the proposed development throughout all phases in order to prevent erosion of topsoil and the loss of floral and faunal habitat. In this regard, special mention is made of: • Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed; • Runoff from paved surfaces should be slowed down by the strategic placement of berms; and • All topsoil and waste stockpiles must have berms and catchment paddocks at their toe to contain runoff of the facilities.	**ML Maintain Current Management**

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION	MITIGATION MEASURES	IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)
Indirect	Soil compaction and levelling as a result of construction activities and vehicle movement leading to loss of wetland and riparian habitat	**MH Maintain Current Management**	• No construction of infrastructure may take place within riparian and wetland areas and associated buffer zones unless authorisation is granted by the DWS; • As far as possible all mining activity and infrastructure should be excluded from the wetland and riparian areas and associated 100 m buffer zone; • If this is not possible, pipelines should be designed to cross drainage lines at right angles and be placed outside of the active channels; • All areas of increased ecological sensitivity should be designated as No-Go areas and be off limits to all unauthorised construction vehicles and personnel; • All development footprint areas and areas affected by the proposed mining development should remain as small as possible and any disturbance of sensitive habitat must be actively avoided; • Construction vehicles must remain on demarcated roads and should not encroach into the wetland areas or their associated buffer zones; • It must be ensured that contractor laydown areas are located outside of wetland and riparian areas and associated 100 m buffer zones and excluded from clearing activities in order to minimise vegetation loss and resultant erosion and sedimentation.	**ML Maintain Current Management**

Operational Phase

During the operational phase, the following main activities will take place:

- Mining of Pit 1 extension area;
- Water and stormwater management;
- Maintenance of existing and new infrastructure;
- Pumping of water from Dorstfontein East to Dorstfontein West;
- Maintenance of topsoil stockpiles;
- Machinery movement during mining activities;
- Blasting as part of the mining methodology.

The following impacts are envisaged during the operational phase.

Groundwater Impacts

The Pit 1 extension and pipeline construction may possible result in the following impacts on the geo-hydrology of the area during the construction phase are as follows:

- Opencast and underground mining impacting on water quality as a result of groundwater inflows into the workings which needs to be pumped out for mine safety and the resultant dewatering (water level decrease) of the groundwater system in the immediate vicinity of the working;
- Analyses showed that Acid Mine Drainage (AMD) formation is expected and poor quality leachate can occur based on the leach potential of the material, leading to impacted water quality;
- The co-disposal facility receives coal containing materials from the underground workings being exposed to water and oxygen, resulting in Acid Rock Drainage (ARD). Contamination of the groundwater system may occur through seepage from the co-disposal facility.
- Stockpiling of coal will expose coal to water and oxygen, resulting in ARD from stockpiles. Contamination of the groundwater system may occur from these sites;
- Handling of waste and transport of materials cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and cause contamination of the groundwater system.

The assessment of the groundwater impacts during the construction phase, has illustrated that there is no preferable alternative to the mining methodology or pipeline route alternative. Minimal groundwater impacts are envisaged as a result of the construction phase.

Surface Water Impacts

The potential impacts on surface water during the construction phase of the proposed project are as follows:

- Impact on water quality and erosion as a result of the pipeline breaking and spillage to non-perennial streams;
- Pump failure will result in dirty water accumulation in the pit, leading to uncontrolled dirty water management and associated pollution;
- Impact on water quality and availability as a result in ineffective dirty water separation, and dirty water entering into the wetland;
- High rate of ground water ingress causing flooding of the pit;

- The rainfall water within the designated dirty water area of the pit 1 extension area that forms part of the MAR to the local water courses will be removed from the catchment. This will result in a lower intensity potential on the local surface water resource;
- Increase in volume of contaminated water that needs to be managed within the footprint;
- Erosion of stream banks as a result of crossings and diversions leading to siltation of the streams;
- Impacts on surface water resources quality as a result of incorrect waste management practises and pollution.

Some level of sedimentation is expected to occur in the unnamed tributary pre-development as runoff is naturally anticipated to pick up environmental debris as it crosses natural areas. Increased turbidity is reversible and surface water should return to pre-impact turbidity levels once sediment levels entering the watercourse are reduced. Settled sediments should naturally move downstream during periods of high flow flowing storm events.

The assessment of the surface water impacts during the construction phase, has illustrated that there is no preferable alternative to the mining methodology or pipeline route alternative. Surface water impacts experienced will be experienced across all alternatives.

Wetland and Aquatic Environmental Impacts

The Pit 1 extension and water pipeline operation may result on the following envisaged impacts during the operation phase: Most of the impacts are directly related to the maintenance of the pipeline:

- Loss of habitat and wetland ecological structure as a result of continual wetland disturbance and uncontrolled wetland degradation;
- Impact on the wetlands systems as a result of changes to the sociocultural service provisions through uncontrolled vegetation clearance, waste management and wetland disturbance;
- Potential poor planning, resulting in the placement of the linear development within wetland habitat, leading to altered habitat;
- Impact on the hydrological functioning of the wetland systems as a result of reduce wetland footprints and uncontrolled disturbance during maintenance activities;
- Impacts on the hydrological functioning of the wetland as a result of the pit 1 extension.

The wetland assessment has concluded that the most preferable option for the pipeline is the proposed alternative. Alternative 2 and Alternative 3 cross sensitive ecological services, resulting in a significant impact on the sociocultural service provision and hydrological functioning.

Where significance ratings differ between alternatives, these are indicated in the assessment tables. The impact assessment for the construction phase can be found in Table 5-130.

Table ES - 10: Table Risk Assessment Results For the Operation Phase

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION Significance Rating	MITIGATION MEASURES	IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION) Significance Rating
Groundwater Impacts				
Direct	Impact on groundwater quality as a result of hydrocarbon spillages from machinery.	**ML Maintain Current Management**	• All spillages will need to be cleaned up as soon as practically possible; • Proper management of stormwater drainage infrastructure should be ensured; • Maintain construction vehicles and encourage contractors to report, react and manage all spills and leaks so that action can be taken to immediately minimise contamination to the groundwater; • Groundwater monitoring of boreholes should continue as per the WUL and approved monitoring programme. • Spill kits will be made available in areas of likely spillage; • All hydrocarbon storage containers will be stored within a bunded areas which are water tight and able to contain 110% of the stored volume; • All equipment utilising hydrocarbons will be stored on a hard standing surface.	**L No Management Required**
Direct	Storage of hydrocarbons and chemicals, which may impact on groundwater as a result of spillages and uncontrolled release.	**ML Maintain Current Management**		**L No Management Required**
Indirect	Monitoring borehole on the border of the Pit 1 extension area may be a conduit of flow to the groundwater unless sealed.	**MH Maintain Current Management**	• Grouting and capping of boreholes located within the footprint of construction camps be required prior to construction activities; • Treat the water emanating for the opencasts to increase the decant water quality	**L No Management Required**
Surface Water Impacts				
Direct	Impact on water quality and erosion as a result of the pipeline breaking and spillage to non-perennial streams.	**L No Management Required**	• Operation of the pipeline should be conducted using best practises; • Frequent monitoring of the pipeline should be done to ensure leakages are identified and repaired timeously.	**L No Management Required**
Direct	Pump failure will result in dirty water accumulation in the pit, leading to uncontrolled dirty water management and associated pollution.	**L No Management Required**	• Undertake regular structural inspections of pumps and pipes of exiting pit; • Ensure groundwater investigation is done to understand groundwater levels; and • Stormwater culverts and clean water diversions will be designed and constructed to accommodate the 1:50 year storm event.	**L No Management Required**
Direct	Impact on water quality and availability as a result in ineffective dirty water separation, and dirty water entering into the wetland.	**L No Management Required**	• Monitor the effective usage and functioning of the upstream bunds constructed upstream of the affected site; • Monitor and maintain good vegetation cover, to reduce runoff;	**L No Management Required**

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION Significance Rating	MITIGATION MEASURES	IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION) Significance Rating
Direct	High rate of ground water ingress causing flooding of the pit	**H Improve Current Management**	• Develop and implement controls to clean up oil/diesel leaks and spillages of any designated hazardous waste.	**MH Maintain Current Management**
Direct	The rainfall water within the designated dirty water area of the pit 1 extension area that forms part of the MAR to the local water courses will be removed from the catchment. This will result in a lower intensity potential on the local surface water resource	**MH Maintain Current Management**	• The clean stormwater will be diverted which further mitigates the impact.	**L No Management Required**
Direct	Increase in volume of contaminated water that needs to be managed within the footprint	**MH Maintain Current Management**	• Monitor the effective usage and functioning of the upstream bunds constructed upstream of the affected site; • Monitor and maintain good vegetation cover, to reduce runoff; • Develop and implement controls to pick up oil/diesel leaks and spillages of any designated hazardous waste.	**L No Management Required**
Indirect	Erosion of stream banks as a result of crossings and diversions leading to siltation of the streams	**MH Maintain Current Management**	• River crossings and diversions will be inspected monthly; • Erosion control measures will be implemented should it be evident that erosion has occurred; • Establish vegetation around disturbed areas to prevent any erosion; • Stormwater runoff will be handled on surface and directed towards natural watercourses.	**L No Management Required**
Indirect	Impacts on surface water resources quality as a result of incorrect waste management practises and pollution.	**ML Maintain Current Management**	• A waste management plan will be compiled and approved for implementation of site. This management plant should focus on the waste hierarchy of the NEM:WA; • No waste may be disposed of to land without the necessary legal permits; • Waste will be removed from site by an accredited waste removal company and legally disposed of. Disposal certificates will be kept on site for audit purposes; • Sufficient waste receptacles will be placed around the site allowing the separation of waste as source.	**L No Management Required**
Wetland and Aquatic Impacts				

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION Significance Rating	MITIGATION MEASURES	IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION) Significance Rating
Direct	Loss of habitat and wetland ecological structure as a result of continual wetland disturbance and uncontrolled wetland degradation.	**MH Maintain Current Management**	• Operational vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities; • It must be ensured that contractor laydown areas are located outside of wetland and riparian areas and associated 100 m buffer zones and excluded from clearing activities in order to minimise vegetation loss and resultant erosion and sedimentation where not approved by DWS; • Compacted areas are to be ripped, re-profiled and revegetation as soon as areas becomes available; • Any areas where active erosion within the wetland features are observed must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible; • Cutting/ clearing of the herbaceous layer within the wetland areas along the linear development should be avoided so as to retain soil stability provided by the grass root structures.	**L No Management Required**
	Alternative 2	**MH Maintain Current Management**		**L No Management Required**
	Alternative 3	**MH Maintain Current Management**		**ML Maintain Current Management**
Direct	Impact on the wetlands systems as a result of changes to the sociocultural service provisions through uncontrolled vegetation clearance, waste management and wetland disturbance	**MH Maintain Current Management**	• As much vegetation growth as possible should be promoted within the wetland features in order to protect soils. In this regard, special mention is made of the need to prevent the loss of large areas of the freshwater features' vegetation and the use of indigenous vegetation species' where hydro seeding and rehabilitation planting (where applicable) are to be implemented; • No dumping of waste should take place within wetland and riparian areas or their buffer zones. If any spills occur, they should be immediately cleaned up; • It must be ensured that mining related waste or spillage and effluent do not affect the sensitive habitat boundaries, wetland resources and associated buffer zones. All waste and rubble must be removed from site and disposed of according to relevant SABS standards; • Implement an alien vegetation control program within the wetland features and ensure establishment of indigenous species within areas previously dominated by alien vegetation; • Maintain the REC for each of the wetland features, as stated within the wetland report during the life of the development.	**L No Management Required**
	Alternative 2	**MH Maintain Current Management**		**L No Management Required**
	Alternative 3	**MH Maintain Current Management**		**L No Management Required**
Direct	Potential poor planning, resulting in the placement of the linear development within wetland habitat, leading to altered habitat	**ML Maintain Current Management**	• Rehabilitation should be conducted in a manner that ensures that the wetland features' conditions are reinstated to as natural a state as possible.	**L No Management Required**

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION Significance Rating	MITIGATION MEASURES	IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION) Significance Rating
Indirect	Impact on the hydrological functioning of the wetland systems as a result of reduce wetland footprints and uncontrolled disturbance during maintenance activities	**MH Maintain Current Management**	• Flow continuity and connectivity of the freshwater features must be reinstated post- construction activities; • Regular monitoring of water quality must be implemented in order to ensure the impacts of runoff and decant of water into wetland resources is prevented or minimised; • Adequate storm water management must be incorporated into the design of the proposed development throughout all phases in order to prevent erosion of topsoil and the loss of floral and faunal habitat. In this regard, special mention is made of: ○ Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed; ○ Runoff from paved surfaces should be slowed down by the strategic placement of berms; ○ All topsoil and waste stockpiles must have berms and catchment paddocks at their toe to contain runoff of the facilities.	**L No Management Required**
Indirect	Impacts on the hydrological functioning of the wetland as a result of the pit 1 extension	**MH Maintain Current Management**	• Dirty water must be recycled back into the mining system; • All wetland areas adjacent to the operational footprint will demarcated as no-go areas.	**ML Maintain Current Management**

Action Plan

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	**Timeframe**	**Executing Party**	**Monitoring Party**	
Prevent groundwater contamination.	All spillages will need to be cleaned up as soon as practically possible.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Proper management of stormwater drainage infrastructure should be ensured.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Maintain construction vehicles and encourage contractors to report, react and manage all spills and leaks so that action can be taken to immediately minimise contamination to the groundwater.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Employees will report spillages as soon as they are discovered and the spillages will be cleaned up immediately.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Grouting and capping of boreholes located within the footprint of construction activities be required prior to construction activities	Prior to construction	Contractor	ECO / SHE Representative	Pre-Construction
	Groundwater monitoring of boreholes should continue as per the WUL and approved monitoring programme	Monthly	Contractor	ECO / SHE Representative	All Phases
	Spill kits will be made available in areas of likely spillage.	Monthly	Contractor	ECO / SHE Representative	All Phases
	All hydrocarbon storage containers will be stored within a bunded areas which are water tight and able to contain 110% of the stored volume.	Monthly	Contractor	ECO / SHE Representative	All Phases
	All equipment utilising hydrocarbons will be stored on a hard standing surface.	Monthly	Contractor	ECO / SHE Representative	All Phases
Rehabilitate mining areas.	All mined areas should be flooded as soon as possible to bar oxygen from reacting with remaining pyrite.	As soon as possible following operation.	Contractor	ECO / SHE Representative	Decommissioning
	The final backfilled opencast topography should be engineered such that runoff is directed away from the opencast areas.	Following operation	Exxaro	SHE Representative	Decommissioning
	The final layer (just below the topsoil cover) should be as clayey as possible and compacted if feasible, to reduce recharge to the opencasts.	Following operation	Exxaro	SHE Representative	Decommissioning
	Surface water monitoring of the streams will be essential.	Following operation	Exxaro	SHE Representative	Decommissioning
	Quarterly groundwater sampling should be done to establish a database of plume movement trends, to aid eventual mine closure.	Following operation	Exxaro	SHE Representative	Decommissioning

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	**Timeframe**	**Executing Party**	**Monitoring Party**	
	The drilling of boreholes into mining areas is recommended so that recovery of water in mining areas can be monitored.	Following operation	Exxaro	SHE Representative	Decommissioning
Minimise AMD potential.	Limiting the amount of water entering the voids left by the mined out areas can be achieved by replacing spoils in such a manner as to be free-draining and preventing the collection and pooling of water on rehabilitated mined land and thus reducing the volumes of water infiltrating into the old box cut.	Following operation	Exxaro	SHE Representative	Decommissioning
	An impermeable or partially permeable layer should be recreated at variable depth within the rehabilitated landscape.	Following operation	Exxaro	SHE Representative	Decommissioning
	Treating of decanting mine water to acceptable water quality levels can be achieved by the installation of a treatment plant. Exxaro must continue with the investigations to the most effective way to possibly treat water on site if needed at the end of LoM.	Following operation	Exxaro	SHE Representative	Decommissioning
Prevent erosion and sedimentation.	Construct in the dry season and install silt bunds.	Monthly	Contractor	ECO	Pre-Construction and Construction
	Erosion control measures will be implemented as soon as erosion has become evident. Water velocity will be reduced as far as feasible.	Monthly	Contractor	ECO	Pre-Construction and Construction
	All litter and debris will be continuously removed during construction.	Monthly	Contractor	ECO	Pre-Construction and Construction
	Erosion can be limited by ensuring that mine vehicles and human movement is limited to project specific dedicated access ways.	Monthly	Contractor	ECO	All Phases
	To prevent the erosion of top soils, management measures may include berms, soil traps, hessian curtains and stormwater diversion away from areas susceptible to erosion. It must be ensured that topsoil stockpiles are located outside of any wetland and riparian areas and areas susceptible to erosion. Stockpiles should be placed away from areas known to contain hazardous substances such as fuel and if any soils are contaminated, it should be stripped and disposed of at a registered hazardous waste dumping site.	Monthly	Contractor	ECO	All Phases
Prevent surface water contamination and reduction in water quality.	Operate using best practises by storing hazardous substances in an adequately sized bunded area, with appropriate safety equipment.	Monthly	Contractor	ECO	Construction
	Place spill kits on site which are operated by trained staff members for the *adhoc* remediation of minor chemical and hydrocarbon spillages.	Monthly	Contractor	ECO / SHE Representative	Construction and Decommissioning
	Access to the construction site will be controlled.	Daily	Contractor	ECO / SHE Representative	All Phases

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	**Timeframe**	**Executing Party**	**Monitoring Party**	
	Refuelling areas will be bunded and nozzles protected from spillage during refuelling.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Vehicular access to the stream will be restricted.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Proper management of stormwater drainage infrastructure should be ensured.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Hazardous substances stored on site will be stored within a designated bunded areas fitted with a sump and value. Collection of water within the bunded areas will be deemed hazardous and disposed of as such..	Monthly	Contractor	ECO / SHE Representative	All Phases
	Bunded areas will be water tight and inspected for leaks on a frequent basis. Leaks to the bunded areas will be rectified as soon as possible.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Drip trays will be utilised for the collection of leaks from vehicles and machinery parked for long period of time.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Should a spill occur, this will be handled at the source of the leak and prevented from transpiring to nearby watercourse.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Ensure that routine maintenance on all vehicles is undertaken as per maintenance schedule and records are kept.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Sewage spillages will be seen as hazardous waste and will be handled as such.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Frequent monitoring of the pipeline should be done to ensure leakages are identified and repaired timeously.	Monthly	Exxaro	SHE Representative	Operation
	Runoff from compacted and built-up surfaces should be slowed down by the strategic placement of berms.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
Ensure adequate clean and dirty water separation.	Construct diversion drains around the site timeously prior to operation.	Prior to Construction	Contractor	ECO / SHE Representative	Construction and Operation
	Ensure adherence to GNR 704 of the NWA.	Prior to Construction	Exxaro	ECO / SHE Representative	Construction and Operation
Minimise Turbidity of local streams.	Construct sediment collection paddocks downstream of the working activities to minimise uncontrolled runoff from the site.	Prior to Construction	Exxaro	ECO / SHE Representative	Construction, Operation, and Decommissioning
	Minimise the areas that are to be stripped of vegetation.	Monthly	Exxaro	ECO / SHE Representative	Construction, Operation, and Decommissioning

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	**Timeframe**	**Executing Party**	**Monitoring Party**	
	Adequate storm water management should be considered in the detailed design of the proposed infrastructure in order to minimize undue erosion.	Prior to Construction	Exxaro	ECO / SHE Representative	Construction and Operation
	Stormwater runoff will be directed towards natural watercourses.	Weekly	Exxaro	ECO / SHE Representative	Construction and Operation
	The point where the diversion re-enters the natural system must enter the system at the same elevation as the receiving aquatic environment as well as consist of an energy dissipation structures thereby preventing erosion and incision of the natural watercourse.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
	The point where the diversion re-enters the natural watercourse must enter the system where possible at an acute angle to prevent the creation of turbulent flow, erosion and incision.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
Prevent surface water contamination through ineffective waste management and housekeeping.	Waste will be disposed of in accordance to the waste management procedure.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	Housekeeping will be kept up to standard. Housekeeping should be done after every shift.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	A waste management plan will be compiled and approved for implementation of site. This management plant should focus on the waste hierarchy of the NEM:WA.	Prior to Operation	ECO / SHE Representative	ECO / SHE Representative	Pre-Construction, Construction, and Operation
	No waste may be disposed of to land without the necessary legal permits.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Waste will be removed from site by an accredited waste removal company and legally disposed of. Disposal certificates will be kept on site for audit purposes.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Sufficient waste receptacles will be placed around the site allowing the separation of waste at source.	Monthly	Contractor	ECO / SHE Representative	All Phases
Minimise proliferation of Alien Vegetation.	Implement an alien plant management and eradication program.	Quarterly	Exxaro	ECO / SHE Representative	Construction and Operation
	Removal of alien vegetation should commence during the construction phase and continue during the operational and decommissioning phases.	Quarterly	Exxaro	ECO / SHE Representative	Construction and Operation
	Care should be taken with the choice of herbicide to ensure that no additional impact or loss of indigenous plant species occur due to the use of the herbicides.	Quarterly	Contractor	ECO / SHE Representative	Construction and Operation
	No vehicles should be allowed to drive through riparian areas during the eradication of alien and weed species.	Quarterly	Contractor	ECO / SHE Representative	Construction and Operation
	Removal of alien and weed species must take place in accordance with existing legislation process and procedures.	Quarterly	Exxaro	ECO / SHE Representative	Construction and Operation

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	**Timeframe**	**Executing Party**	**Monitoring Party**	
Minimise impact on faunal and floral habitats as a result of waste management.	No dumping of waste should take place. If any spills occur, they should be immediately cleaned up.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	It must be ensured that mining related waste or spillage and effluent do not affect the sensitive habitat boundaries and associated buffer zones or any other surrounding natural habitat.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	No construction-related waste material is to enter wetland or other natural habitats.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
Conserve the ecological and biological structure of wetland habitats.	Access roads for support vehicles, and vehicles used in the construction of the crossings, should not encroach into the freshwater features	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
	Rehabilitation should be conducted in a manner that ensures that the wetland features' conditions are reinstated to as natural a state as possible.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
	The wetland features must be rehabilitated immediately after the construction phase.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
	During the construction phase of the development, all wetland areas other than the immediate areas of crossing are to be demarcated as no-go areas for vehicles and construction personnel.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
Minimise Wetland Destruction.	Wetland areas other than the immediate areas of crossing are to be demarcated as no-go areas for vehicles and construction personnel.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
	Vegetation removal should be kept at a minimum to avoid loss of freshwater features' assimilation and attenuation abilities.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
Minimise Change and effectiveness of Wetland Service Provision.	In a case where it is impossible to avoid development within the watercourse, it is advisable to minimise the extent and duration of the activities (i.e. during construction and rehabilitation and the use of less invasive methods such as directional drilling techniques) within the watercourse in order to reduce impacts on the biodiversity and Eco services provision.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	Any storage facilities and all other non-essential activities should be located away from the identified wetlands in order to avoid water and soil contamination, which would affect the structure and function of these resources.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	An annual alien vegetation management plan should be implemented throughout the operational phase of the project.	Annually.	Exxaro	SHE Representative	Operation and Decommissioning

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	**Timeframe**	**Executing Party**	**Monitoring Party**	
Protect the wetlands hydrological functioning	Rehabilitation should be conducted in a manner that ensures that the wetland features' conditions are reinstated to as natural a state as possible.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	As much vegetation growth as possible should be promoted within the wetland features in order to protect soils. In this regard, special mention is made of the need to prevent the loss of large areas of the freshwater features' vegetation and the use of indigenous vegetation species' where hydro seeding and rehabilitation planting (where applicable) are to be implemented.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	Flow continuity and connectivity of the freshwater features must be reinstated post- construction activities.	Monthly	Contractor	SHE Representative	Operation
	Regular monitoring of water quality must be implemented in order to ensure the impacts of runoff and decant of water into wetland resources is prevented or minimised.	Monthly	Contractor	SHE Representative	Operation
Minimise the impact on wetland and riparian habitats.	No construction of infrastructure may take place within riparian and wetland areas and associated buffer zones unless authorisation is granted by the DWS.	Monthly	Contractor	ECO	Construction
	As far as possible all mining activity and infrastructure should be excluded from the wetland and riparian areas and associated 100 m buffer zone.	Monthly	Contractor	ECO	Construction
	If this is not possible, pipelines should be designed to cross drainage lines at right angles and be placed outside of the active channels.	Monthly	Contractor	ECO	Construction
	All areas of increased ecological sensitivity should be designated as No-Go areas and be off limits to all unauthorised construction vehicles and personnel.	Monthly	Contractor	ECO	Construction
	All development footprint areas and areas affected by the proposed mining development should remain as small as possible and any disturbance of sensitive habitat must be actively avoided.	Monthly	Contractor	ECO	Construction
	Construction vehicles must remain on demarcated roads and should not encroach into the wetland areas or their associated buffer zones.	Monthly	Contractor	ECO	Construction
	It must be ensured that contractor laydown areas are located outside of wetland and riparian areas and associated 100 m buffer zones and excluded from clearing activities in order to minimise vegetation loss and resultant erosion and sedimentation.	Monthly	Contractor	ECO	Construction
Minimise soil erosion.	Protect the existing topsoil stockpile area from impacts of erosion, compaction and contamination. If necessary, vegetate and/or cover with appropriate and suitable indigenous grass species.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	Maintain vegetation cover on rehabilitated land and topsoil stockpiles.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	**Timeframe**	**Executing Party**	**Monitoring Party**	
	Construct soil erosion protection measures should erosion be identified.	Monthly	Contractor	ECO/ SHE Representative	Construction and Operation
Reduce soil sterilisation	All vehicles should be serviced on a regular basis at the specific demarcated areas.	Monthly	Contractor	ECO/ SHE Representative	Construction and Operation
	Any spillage from vehicles should be cleaned up as soon as possible.	Monthly	Contractor	ECO/ SHE Representative	Construction and Operation
	Rehabilitate areas where the planned tasks have been completed.	Monthly	Contractor	ECO/ SHE Representative	Construction and Operation
	Topsoil stockpiles should be protected from contamination of waste, waste water and hazardous materials.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	Waste piles should be placed on impervious layer to prevent direct soil contact.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	Excavate and dispose of any contaminated soil at the appropriate landfill as per waste classification.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
Prevent soil contamination and ensure rehabilitation.	Existing established roads should be used wherever possible.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	Access roads should be designed with a camber to avoid ponding and to encourage drainage to side drains. where necessary, culverts should be installed to permit free drainage of existing water courses.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	The side drains of the roads can be protected with sediment traps and/or gabions to reduce the erosive velocity of water during storm events and where necessary geo-membrane lining can be used.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	Losses of fuel and lubricants from the oil sumps and steering racks of vehicles and equipment should be contained using a drip tray with plastic sheeting filled with absorbent material.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	Using biodegradable drilling fluids, using lined sumps for collection of drilling fluids, recovering drilling muds and treating them off-site, and securely storing dried waste mud by burying it in a purpose-built containment area.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
Minimise loss of soil resources.	Instructions must be included in contracts that will restrict construction work and construction workers to the clearly defined limits of the construction site	Monthly	Contractor	ECO	Construction
	Locate all topsoil stockpiles in areas where they will not have to be relocated prior to replacement for final rehabilitation	Monthly	Contractor	ECO	Construction
	Map all stockpile locations	Monthly	Exxaro	ECO/ SHE Representative	Construction and Operation

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	**Timeframe**	**Executing Party**	**Monitoring Party**	
	Topsoil should never be used as a filling material for roads	Monthly	Exxaro	ECO/ SHE Representative	Construction and Operation
	Height of stockpiles be restricted between of 4 – 5 metres maximum. For extra stability and erosion protection, the stockpiles may be benched	Monthly	Exxaro	ECO/ SHE Representative	Construction and Operation
	Reducing slope gradients as far as possible along road cuts and disturbed areas to gradients at or below the angle of repose of those disturbed surfaces.	Monthly	Exxaro	ECO/ SHE Representative	Construction and Operation
	Use drainage control measures and culverts to manage the natural flow of surface runoff.	Monthly	Contractor	ECO	Construction
	Soils should be loosely packed during stockpiling	Monthly	Contractor	ECO	Construction
	Use recycled grey water from washing facilities to spray un-vegetated areas to combat dust	Monthly	Exxaro	ECO/ SHE Representative	Construction and Operation
Minimise mining waste.	Mining will be conducted strictly according to the mine plan submitted to the DMR.	Monthly	Exxaro	SHE Representative	Construction and Operation
	Optimally exploit this resource in terms of tonnage of rock mined and cost as provided for in the mine plan.	Monthly	Exxaro	SHE Representative	Construction and Operation
Minimise cumulative impacts	Through the implementation of all the above mentioned mitigation measures, the overall significance of the activity's impact can be lowered to LOW.	Monthly	Exxaro	ECO/ SHE Representative	Construction, Operation, and Decommissioning

Public Participation Process

The Interested and Affected Parties (landowners and land occupiers) were notified of the project and application via notification letters as well as newspaper advertisements that were published in the Witbank News on 5 May 2017.

Section 27 Motivation

Section 27	Motivation
a) Existing Lawful Water Use	There are no existing lawful water uses applicable to the DCM East mining operation. All water uses have been authorised in terms of the IWUL issued
b) The need to redress the Results of Past Racial and Gender Discrimination	ECC is part of the multinational French-based energy company, which holds a 50.1% interest in the local operation. The remaining shares are held by BEE partner TOSACO (25%) and Remgro (24,9%). While DCM's Mineral Rights are held by ECC, DCM is owned by ECC (74%) and Mmakau Mining (26%), its Black Economic Empowerment Partner. ECC and Mmakau have entered into a Joint Venture (JV) to mine the deposit thereby promoting the newly established mining charter's Broad Based Black Economic Empowerment (BBBEE) requirements. ECC also implements an aggressive procurement policy to enhance BBBEE companies. Since 1992 alone, ECC invested more than R70 million in 63 black-owned businesses of which 27 were new projects costing R55 million. ECC's black-owned businesses provide employment to at least 2 200 people who in turn support some 6 500 dependants.
c) Efficient and Beneficial Use of Water in the Public Interest	ECC contributes to the efficient and beneficial use of water by adhering to the regulatory provisions as contained in the IWUL and the provisions of the NWA. Water use activities may not commence without an approved water use authorisation. Furthermore, ECC is committed to responsible management of its approved water uses and strives to adhere to the principles of water conservation and demand management will benefit the community in terms of employment. Monitoring of water resources has been implemented to detect any impacts during the early stages and to mitigate these as soon as practically possible. ECC has a zero discharge policy and operates a closed water system, i.e. all contaminated effluent is isolated to not impact on the clean catchment area. Dirty water is channelled to a PCD where it is re-used as process water.
d) The Socio-Economic Impact of the water use if authorised	If the water use is authorised, LoM of DCM East will be extended, resulting in the continuation and extension of employment of workers currently working on the Dorstfontein East operations. This is because the livelihoods and employment status of those workers will be maintained, resulting in job security and sustainable livelihood outcomes for both workers and their dependants. This is of particular importance to those employed form the local area because of the low socio-economic base and vulnerability to poverty and unemployment.

Section 27	Motivation
e) The Socio-Economic Impact of the water use if not authorised	Failure to authorise the water use will mean that LoM will not be extended and the socio-economic benefits that would otherwise be derived from the extension will not be realized.
f) Any Catchment Management Strategy Applicable to the Relevant Water Resource	The Olifants River Basin Catchment Management Agency (CMA) is in the process of being established. It will take over direct water resource management responsibilities in the basin currently being performed by DWS. The CMA co-ordinates water-related activities in the basin and provides an effective mechanism for stakeholder participation in water management.
g) The Likely Effect of the Water Use to be authorised on the Water Resource and on Other Water Users	Please refer to the risk assessment Section 5.5 for the impacts of ground and surface water resources as a result of the mining activities. All the identified impacts can be mitigated to medium and low significance.
h) The Class and the Resource Quality Objectives of the Water Resource	An Intermediate Reserve Determination was done for the whole Olifants River Water Management Area (WMA) in July 2001. The full report was attached as an annexure to the original IWWMP submitted to the DWS. The In stream Flow Requirements to cater for the basic human needs and the ecological environment were first determined for certain reference points (IFR sites) in the Olifants River WMA. The water quantity reserve for the IFR sites was used to determine the water quality reserve for the basic human needs and the ecological environment. The water quality reserve is termed the resource quality objectives. DCM falls within the River Reach Segments 1-8 of the Upper Olifants River. The Olifants River is currently a Class C River in terms of the Present Ecological Status, (PES).
i) Investments Already made and to be made by the Water User in Respect to the Water Use in Question	The estimated environmental cost forecast is R 1.254m. The total budget for technical skills and services required to operate the mine are estimated to be R 43.2 m.
j) The Strategic Importance of the Water Uses to be Authorised	In strict economic terms, the overall mining industry is paramount to South Africa's current and future prosperity. The primary value chain alone accounts for 500 000 jobs directly and indirectly creates another 500 000 jobs giving a total contribution of 1 000 000 jobs created for the economy. It produces almost a fifth of GDP and pays a similar percentage of corporate tax. It accounts for half of all traffic moved by Transnet and 94% of the power generated in this country. The value of mining companies listed on the JSE is R1.9 trillion, which represents 43% of the total market capitalisation of the exchange and therefore helps create wealth for millions of South African pension fund holders and investors, while at the same time attracting significant foreign capital flows that help unlock our mineral potential. And, perhaps most critically, more than half of our export earnings are derived from mining and mineral products. With specific reference to coal mining, just over two thirds (by mass) of domestic coal consumption is utilised for electricity

Section 27	Motivation
	generation by Eskom, the national power utility. Coal- to-liquid-fuel plants, operated by Sasol, account for another fifth of coal consumption. Small merchants, who supply mainly residential users and small businesses, account for about 2%, metallurgical industries about 3% and cement, chemical and other industries consume the remaining 5% (DMR, 2009). Coal therefore plays a vital role in South Africa's energy-economy: it accounts for 70% of primary energy consumption, 93% of electricity generation and 30% of petroleum liquid fuels
k) The Quality of Water in the Water Resource which may be required for the Reserve and for meeting International Agreements	The Olifants WMA falls within the Limpopo River Basin, which is shared by South Africa, Botswana, Zimbabwe and Mozambique. The Olifants River flows directly from South Africa into Mozambique, where it joins the Limpopo River. Developments in South Africa can therefore directly impact upon Mozambique. Of particular importance in this respect is Massingire Dam in Mozambique, located immediately downstream of the border with South Africa, and with the total catchment area of the dam falling within South Africa. Issues related to the management of the Limpopo River below the Olifants confluence, can have a bearing on all the basin States of the Limpopo. Joint utilisation of the water resources of the Olifants River is facilitated through the bilateral Joint Water Commission between South Africa and Mozambique. International cooperation with respect to the use and management of the watercourses in the Limpopo River Basin is overseen by the Limpopo Permanent Technical Committee with membership by South Africa, Botswana, Zimbabwe and Mozambique. A joint hydrometric study of the Limpopo River Basin by the basin countries has recently been completed, and a full basin study has been agreed upon in principle. It is foreseen that a "Limpopo River Basin Commission" may be established in the foreseeable future.
l) The Probable Duration of any undertaking or which a Water use is to be Authorised	All the water uses being applied for will be permanent and are as follows, throughout the LoM of Pit 1. Current estimates indicate a LOM of 10 years for the Pit 1 NW Extension.

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Disclaimer

This title and wording for this page will vary by region, based on local legal advice.

The information provided in this Integrated Water and Waste Management Plan (IWWMP) is based on information supplied to SRK Consulting (South Africa) (Pty) Ltd (SRK) by Exxaro Coal Central (ECC). This report has been compiled to comply with the specific requirements of the National Water Act (No. 36 of 1998).

SRK has exercised all due care in reviewing the supplied information provided by ECC and the independent specialists and has included the requirements of commenting authorities. The appropriateness and practicality of the management measures has been considered in terms of comments received and discussed with ECC as necessary. ECC is fully responsible for the implementation of the IWWMP.

The IWWMP has been provided to ECC for review, prior to submission, to determine whether the management measures are implementable and accurate. SRK cannot be held responsible for failure of ECC to comply with the IWWMP for any reason whatsoever. The IWWMP by nature is a dynamic document and provides for continual updating of the management measures, with approval from the DWS.

SRK does not accept responsibility for any errors or omissions in the information supplied by ECC and do not accept any consequential liability arising from commercial decisions, design changes or actions resulting from such decisions and/or changes. Management measures presented in this report relate to the project description and plans as they existed at the time of SRK's investigations, and those reasonably foreseeable. These management measures do not necessarily apply to conditions and aspects that may arise after the date of this report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

List of Abbreviations

ABET:	Adult Basic Education & Training
AIDS:	Acquired Immuno-Deficiency Syndrome
AMD:	Acid Mine Drainage
ARD:	Acid Rock Drainage
BBBEE:	Broad Based Black Economic Empowerment
CMA:	Catchment Management Agencies
CMA:	Catchment Management Agency
dB:	Decibels
DCM:	Dorstfontein Coal Mines (Pty) Ltd
DEA:	Department of Environment Affairs
DEM:	Digital Elevation Model
DME:	Department of Minerals and Energy
DMR:	Department of Mineral Resources
DMR:	Department: Mineral Resources
DWAF:	then Department of Water And Forestry (now Department of Water and Sanitation)
DWS:	Department of Water and Sanitation
ECC:	Exxaro Coal Central
EE:	Employment Equity
EIA:	Environmental Impact Assessment
EIS:	Ecological Importance and Sensitivity
ELU:	Existing Lawful Water Use
EMPr:	Environmental Management Programme
EMS:	Environmental Management System
ERA:	Environmental Risk Assessment
GCS:	Groundwater Consulting Services (Pty) Ltd
GDP:	Gross Domestic Product
GMS:	Groundwater Modelling System
GN:	Government Notice
HDSA:	Historically Disadvantaged South Africans

HGM:	Hydro Geomorphic types
HN:	Hydrological Node
I&APs:	Interested and Affected Parties
ISO:	International Organisation for Standardisation
ISP:	Internal Strategic Perspective
IUA:	Integrated Units of Analysis
IWRM:	Integrated Water Resource Management
IWUL:	Integrated Water Use License
IWWMP:	Integrated Water and Waste Management Pan
JMDP:	Joint Management Development Programme
KNP:	Kruger National Park
LED:	Local Economic Development
MAE:	Mean Average Evaporation
MAP:	Mean Annual Precipitation
MAR:	Mean Annual Runoff
MDALA:	Mpumalanga Department of Agriculture and Land Administration
MPRDA:	Minerals and Petroleum Resources Development Act, 2008 (Act no 22 of 2008)
MQA:	Mining Qualifications Authority
Mtpa:	Million Tonnes per Annum
Nafcoc:	National African Federated Chamber of Commerce
NAFU:	National African Farmers' Union
NEM: WA:	National Environmental Management: Waste Act, 2008 (Act 56 of 2008)
NEMA:	National Environmental Management Act, 1998 (Act No 107 of 1998)
NW:	North West
NWA:	National Water Act, 1998 (Act 36 of 1998)
NWRS2:	National Water Resource Strategy 2
OC:	Open Cast
OHSAS:	Occupational Health and Safety Assessment Series
PCD:	Pollution Control Dam
PES:	Present Ecological State

PID:	Proportional Integral Derivative
PPP:	Public Participation Process
RBCT:	Richards Bay Coal Terminal
REC:	Recommended Ecological Status
ROM:	Run-of-mine
RSM:	Retail Service Management
RU:	Resource Unit
SABTA:	South African Black Taxi Association
SAHRA:	South African Heritage Resources Agency
SALDTA:	South African Long Distance Taxi Association
SANS:	South African National Standards
SAWS:	South African Weather Services
SLP:	Social and Labour Plan
StatsSA:	Statistics South Africa
SWMP:	Storm Water Management Plan
TDS:	Total Dissolved Solids
TNC:	Transvaal Navigation Colliery
UG:	Underground
WMA:	Water Management Area
WULA:	Water Use Licence Application

1 Introduction

1.1 Activity background

Dorstfontein Coal Mines (Pty) Ltd (DCM) is owned by Exxaro Coal Central (ECC) (74%) and Mmakau Mining (26%), its Black Economic Empowerment Partner. The mine is an outsourced operation with opencast and underground mining as well as coal processing conducted by contractors and with ECC retaining general management and marketing control.

DCM East has approval to mine the No. 4 Seam via underground mining operations on the western portion of the mining rights area and both underground and opencast operations on the east. DCM has an arrangement with the Richards Bay Coal Terminal (RBCT) to supply the terminal with 2 million tonnes of export coal per annum (mtpa). The coal supply requirement initiated the extension of the DCM East activities and infrastructure in order to provide for the full entitlement. DCM comprises of the following:

- The existing DCM No. 2 coal seam (DCM West Mine)'; and
- The DCM No. 4 coal seam (DCM East Mine).

The DCM East Project includes the opencast and underground mining of coal reserves and the operation of a processing plant for different grades of coal. DCM East makes use of a transport railway system to deliver coal to the RBCT.

DCM East was issued with an Integrated Water Use License (IWUL) **No. 04/B11B/ACGIJ/957** by the Department of Water and Sanitation (DWS) on 17 December 2014. The IWUL was issued to the mine in line with the requirements of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) and associated Regulations for the following water uses:

- Section 21(a) – Taking of water from a water resource;
- Section 21(c) – Impeding or diverting the flow of water in a water course;
- Section 21(i) – Altering the bed, banks, course or characteristics in a watercourse;
- Section 21(g) – Disposing of waste in a manner which may detrimentally impact on a water resource; and
- Section 21(j) – Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity of for the safety of people.

A copy of the IWUL is attached as Appendix A.

The DCM East also has an existing Environmental Management Programme (EMPr) for its two opencast mining pits (pit 1 and Pit 2) (Reference Number: MP 30/5/1/2/2/51MR) under the Minerals and Petroleum Resources Development Act, 2008 (Act No 22 of 2008) (MPRDA).

ECC plans to expand the current opencast mining operations of Pit 1. This will occur in a North Western direction for approximately 85 ha and will include the construction of a water pipeline from the West to the East of the Dorstfontein Mine for approximately 10 km. This pipeline will transport processed water to be recycled.

SRK Consulting SA (Pty) Ltd (SRK) has been appointed by ECC as an independent consultant to conduct the Environmental Impact Assessment (EIA) and Water Use Licence Application (WULA) process. SRK will also undertake the public involvement component of the EIA/EMPr to meet the requirements of the National Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA) and NWA.

1.2 Regional setting and location of activity

The DCM East Operations Pit 1 NW Extension area is situated in Mpumalanga Province, 45 kilometres to the North, northwest of Bethal and 12 kilometres northeast of the town of Ga-Nala (Kriel). It falls within the eMalahleni Local Municipality which is part of the Nkangala District Municipality (Figure 1-1 and Figure 1-2.)

1.3 Property description

The proposed project is located on the farm portions as illustrated in Figure 1-2. Table 1-1 provides a description of the proposed activities on each farm portion.

Table 1-1: List of Affected Farms and Farm Portions Illustrating the Relevant Activities

Farm and 21 Digit Survey General Code	Portions	Owner	Proposed Activities
Dorstfontein 71 IS T0IS00000000007100003	2	Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 1, 2, and 3
Dorstfontein 71 IS T0IS00000000007100002	3	Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 2 and 3
Dorstfontein 71 IS T0IS00000000007100008	8	Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 1, 2, and 3
Welstand 55 IS T0IS00000000005500004	4	Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 2 and 3
Welstand 55 IS T0IS00000000005500005	5	Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 1, 2, and 3
Welstand 55 IS T0IS00000000005500011	11	Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 1 and 2
Welstand 55 IS T0IS00000000005500013	13	Dorstfontein Coal Mines (Pty) Ltd	Portion of pipeline Alternative 1, 2, and 3
Welstand 55 IS	Remainder	Dorstfontein Coal Mines (Pty) Ltd **	Pit extension and portion of Alternative 1 pipeline

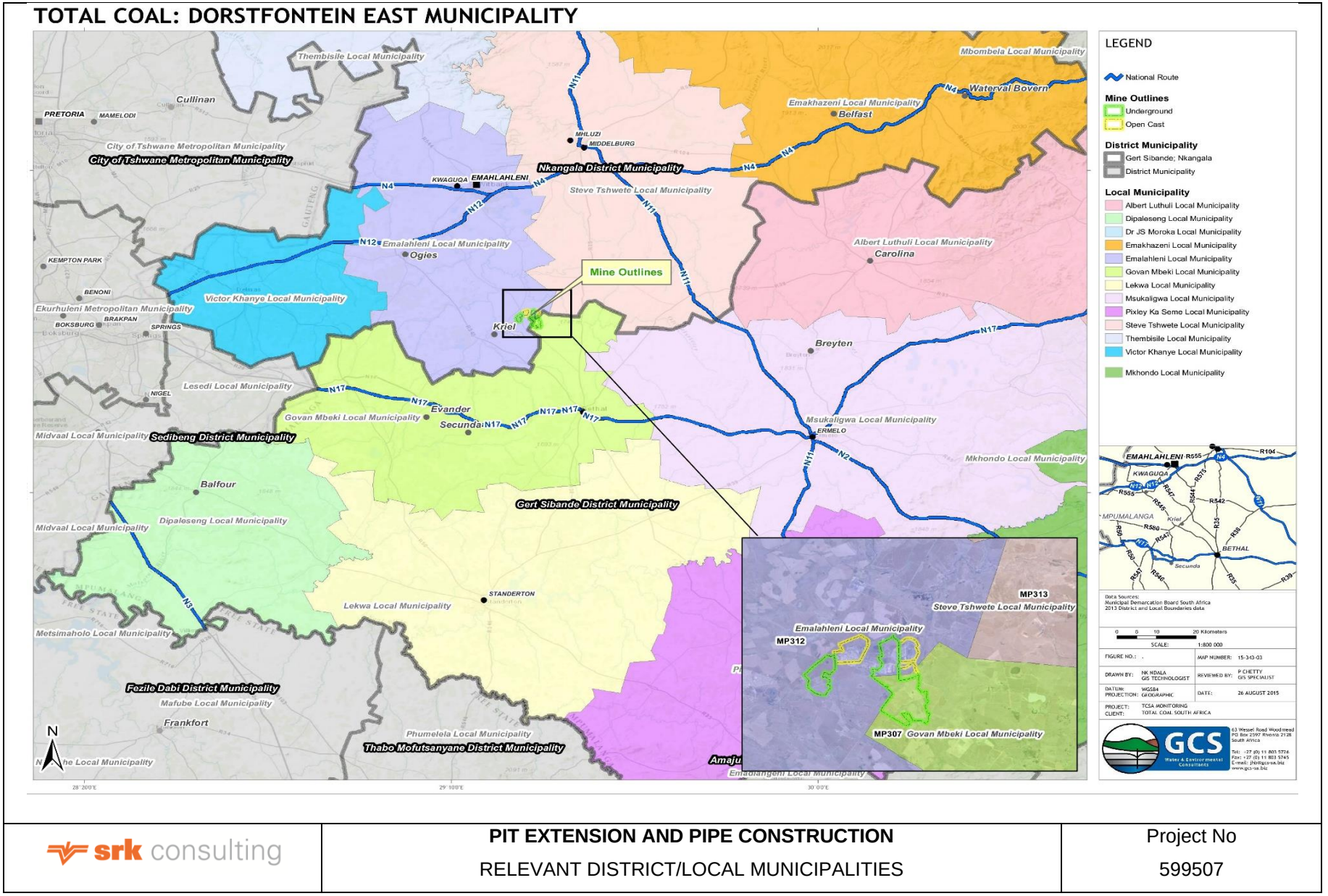
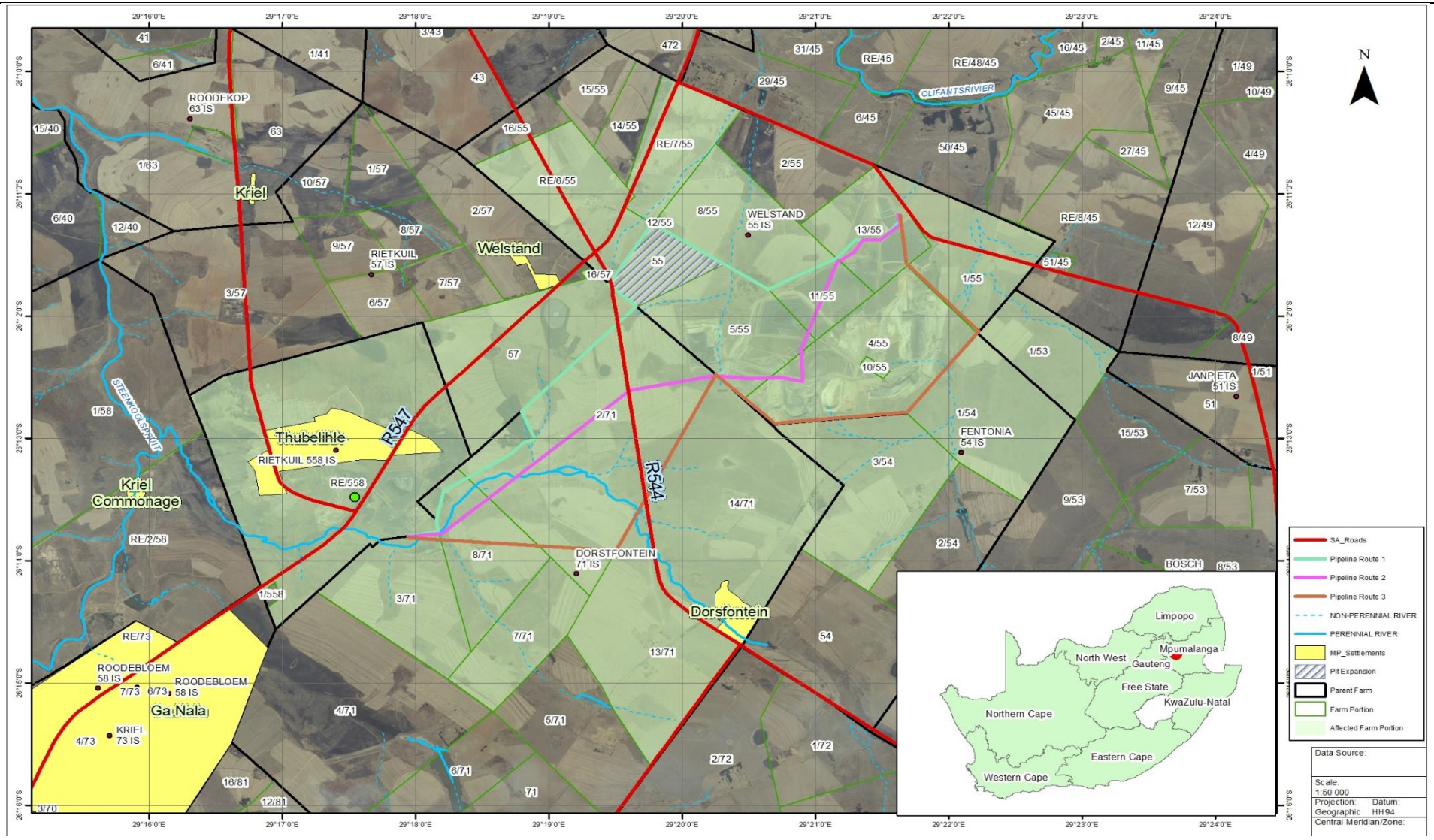


Figure 1-1: Relevant District and Local Municipalities Relevant to the Proposed Project (GCS, 2015)



srk consulting	**PIT EXTENSION AND PIPE CONSTRUCTION** Layout Plan of Affected Farm Portions	Project No 499507

Figure 1-2: Layout Plan and Affected Farm Portions

1.4 Land Ownership

DCM is a joint venture between ECC and Mmakau Mining (Pty) Ltd. DCM holds 2 066 Ha of coal rights and 1 230 Ha of surface rights, which make up the DCM East Operations. The proposed extension of Pit 1, is located on the farm Welstand 55 IS Portion 5 on which Exxaro holds the mineral and surface rights. DCM owns surface rights of Portions 2, 3 and 8 of Dorstfontein 71 IS and 4, 5, 11 and 13 of Welstand 55 IS of the affected farms

1.5 Contact Details

The contact details of the mine and the environmental consultant compiling this IWWMP update can be seen in Table 1.1.

Table 1-2: Contact Details

Contact details of the Environmental Applicant and Mine Manager Service Provider:	
Exxaro Coal (Pty) Ltd Roger Dyson Road Pretoria West, 0183 Tel: (011) 441 6857 Fax: (012) 323 3400	
Contact details of the Mine Manager Responsible Person:	
Business Unit Manager – Daniel Jacobus Chrisstoffel Stapelberg Private Bag X 5007 Ganala 2271 Tel: (011) 441 6857 Fax: (012) 323 3400	
For the purpose of the application process the following people may be contacted at Exxaro:	
Lorenzo van den Heever Environment Specialist, Sustainability Tel: (011) 441 7911 Lorenzo.vandenHeever@exxaro.com	William Seabi Sustainability Manager, ECC Tel: (011) 441 6857 William.Seabi@exxaro.com
Environmental Assessment Practitioner	
SRK Consulting (Pty) Ltd Ndomupei Masawi (Senior Environmental Scientist) and Manda Hinsch (Partner) Physical Address: Block A, Menlyn Woods, 291 Sprite Avenue, Faerie Glen, 0081 Postal Address: PO Box 35290, Menlo Park, 0102 Telephone: (012) 361 9912 Facsimile: (012) 361 9821 E mail: nmasawi@srk.co.za and mhinsch@srk.co.za	

1.6 Purpose of Integrated Water and Waste Management Plan (IWWMP)

The purpose of the Integrated Water and Waste Management Plan (IWWMP) is to provide technical information in support of the Water Use Licence Application by ECC for the proposed extension of pit 1 and construction of the proposed water pipeline. This report aims to achieve the following objectives:

- Provide an implementable management guide to DCM East on the management of water use and waste management related aspects. It is a system that can be audited and continuously improved to ensure that the impacts on the water resource are reduced; and
- Provide direction and guidance to DCM East on water and waste management aspects of the project during the operational phase.

The IWWMP also strives to show the DWS that the selected management measures included into the IWWMPs action plan adhere to the SMART concept which refers to:

- S – Sustainable;
- M – Measureable;
- A – Achievable;
- R – Resources Allocated; and
- T – Timeframe Specific.

2 Contextualisation of activity

This section provides background on the Dorstfontein East operations in support of the application for the Pit 1 extension and construction of the water pipeline.

2.1 Mine Process

From the anticipated tonnage from the reserve to be beneficiated at a Run of Mine (ROM) feed rate of 3.6 million tonnes, per annum the existing plant will be to treat all the tonnes produced. The current daily feed rate is 15 350 tonnes per day, which is beneficiated in 5.5 days per week at 700 tonnes per module.

Coal is delivered via 773/777 dump trucks into a crushing plant (rotary crushers.) and the coal sized to 50 mm via primary, secondary and tertiary crushers and stockpiled (at the ROM stockpile) from which it is fed to the washing plant.

A standard 700 tonnes per hour plant with screens, cyclones and spirals separate the coal from the waste product. A description of the process flow can be found in Figure 2-1.

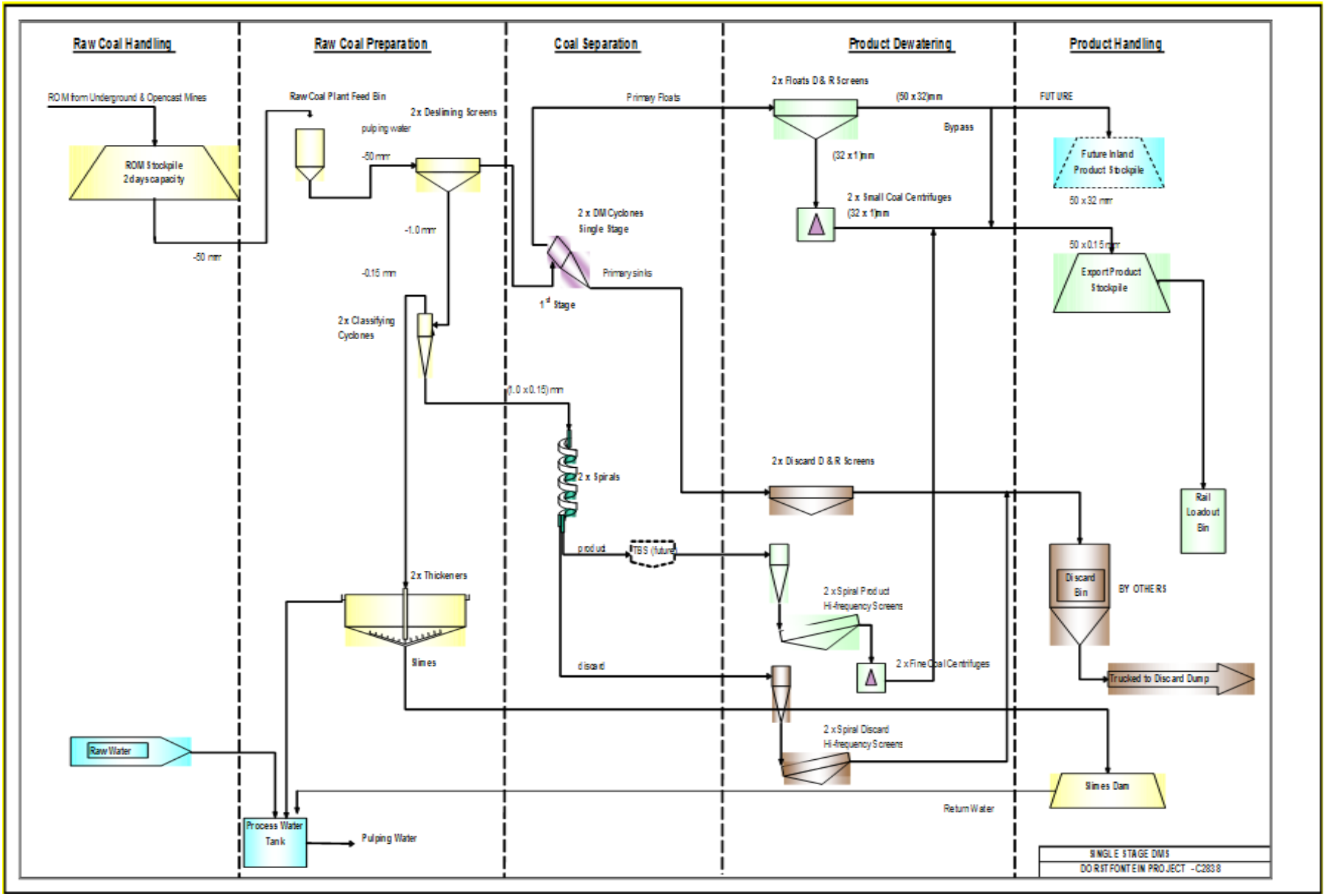
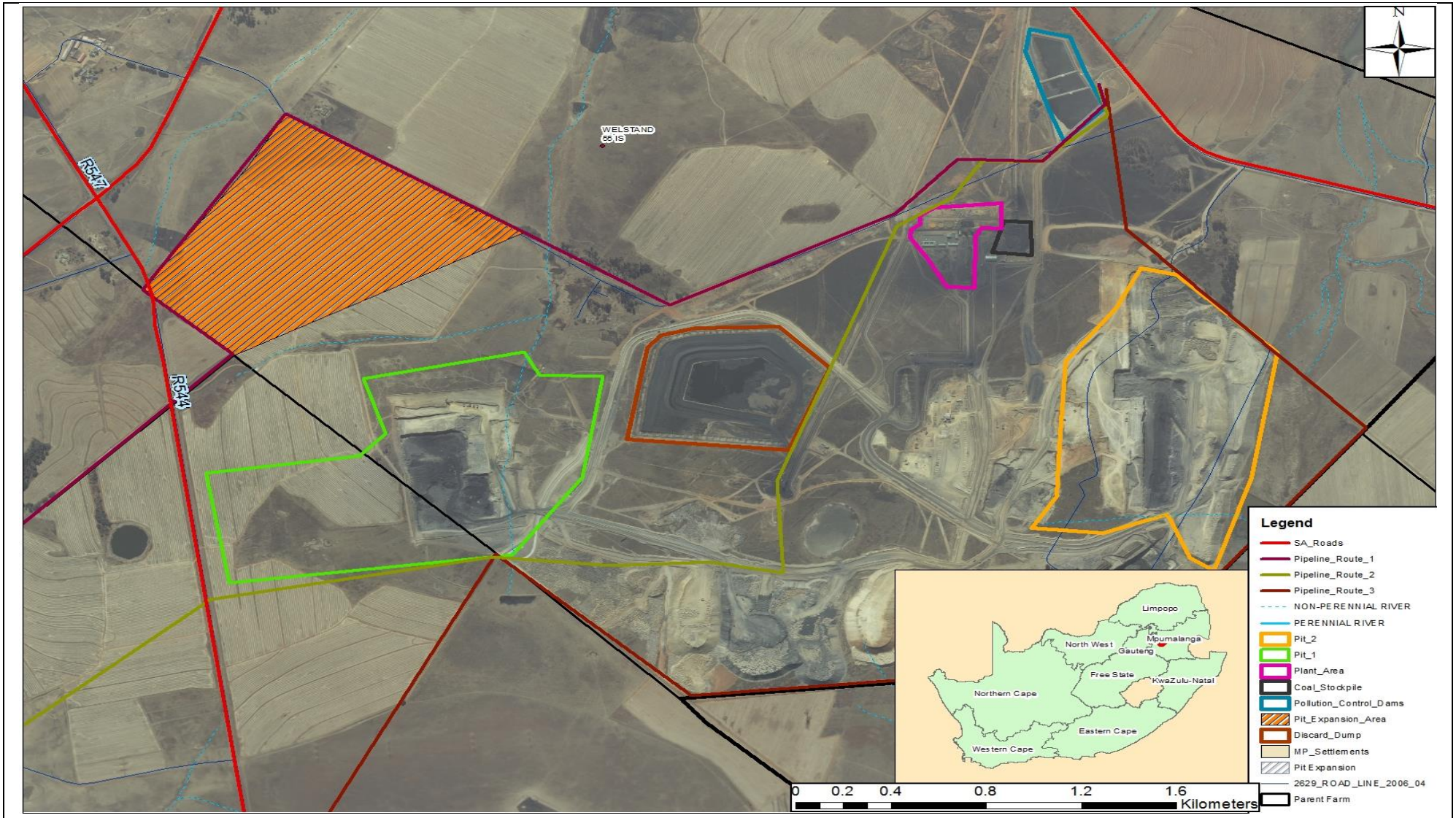


Figure 2-1: Dorstfontein East Process Flow Diagram (Exxaro Coal Central (Pty) Ltd A, 2017)



srk consulting	**PIT EXTENSION AND PIPE CONSTRUCTION** Illustration of existing and proposed infrastructure	Project No 499507

Figure 2-2: Illustration of Existing and Proposed Infrastructure

2.2 Process Plant Description

2.2.1 Front-End Material Handling

Raw coal with a top size of – 50 mm discharges to a ~7400 tone surge stockpile. Material is withdrawn from the stockpile via three feeders (two fixed and one variable speed) and is conveyed to a plant feed bin. The plant feed bin distributes the coal vial two independent vibrating feeders and conveyors to the two modules. A weightometer and variable speed feeders maintain a constant feed rate via a Proportional Integral Derivative (PID) loop for each plant feed (Exxaro Coal Central (Pty) Ltd B, 2017).

2.2.2 Dense Medium Plant

A conventional dense medium cyclone plant is used for single stage washing. As the two modules are identical, the process explained below is for one module. The raw coal is deslimed at 1 mm prior to being introduced into the plant, with the 50 x 1mm fraction reporting to the dense medium plant and the 1 mm to a spiral plant.

The desliming screen discharge combines with circulating medium from the head box and is pumped to the DM cyclone for separation. The cyclone underflows gravitate over static panels as well as vibrating drain and rinse (D/R) screens for medium recovery.

Correct medium returns to the circulating medium tank whilst dilute medium is pumped to the magnetic separator. Over dense medium recovered by the magnetic separator returns to the circulating medium tank and magnetic separator effluent reports to the effluent distribution box. Water from the distribution box gravitates to the desliming screen, while the overflow reports to the sink D/R screen as well as the float screen as primary rinse water.

The plant also has a densification circuit consisting of a cyclone and an actuated splitter, which splits the overflow in different ratios between the tanks to vary the densification intensity.

The design yield range significantly influences the size of the equipment in each option. In all cases the design minimum yield dictates the cyclone size and consequently circulating medium quantity which in turn dictates the tank, and cyclone feed pump and floats screen size (to provide sufficient medium drainage)

2.2.3 Spiral Plant

The desliming screen underflow is pumped to the classifying cyclones in the spiral circuit. The -150 micron cyclone overflow gravitates to the plant thickener. The -1 mm +0.15 mm cyclone underflow is diluted to approximately 30% solids and reports to the spirals. Spiral product is dewatered via a combination of dewatering cyclones and a fine coal centrifuge. A high frequency dewatering screen is provided as a standby to the centrifuge. Spiral rejects are dewatered via cyclone and a dewatering screen.

2.2.4 Slimes Circuit

The spiral circuit classifying cyclone overflow and spiral reject cyclone overflow gravitate to the plant thickener. Thickener underflow reports to a slimes tank and is then pumped to the tailings dam, whilst the thickener overflow is recycled as process water via the process water surge tank. One slimes tank is provided to pump the thickener underflow of both modules' thickeners to the slimes dam.

An automated flocculent make up and dosing plant is provided to supply flocculent to both thickeners.

2.2.5 Product

Discard arising from the modules is conveyed to a discard bin for out loading and trucking to the discard dump.

The product from both cyclones will be screened on the discharge end of the floats screen. The screen undersize will pass via a centrifuge onto the export product collecting conveyor to join the oversize.

The export product conveyor will also collect the spiral product. Both wash plant modules share the export product conveyor, and hence the entire plant produces a single combined product stream.

The combined export product is transferred onto a ~24000 t intermediate product stockpile; from which it gets transferred to the export product stockpile (24 000 t capacity load-out) feeding with a sacrificial conveyor onto the overland conveyors (overland conveyors are in a different contract). Mass meters are provided to measure the quantity of export product going onto the export product stockpile. A hammer sampler will also be installed on the intermediate product stockpile feed conveyor.

Coal is conveyed from the export stockpile to the rapid load-out system (vendor package) that load the trains. The floats screen oversize (50 x 32 mm) chute is designed to allow for separate collection (future) of the oversize as an inland product, which could be discharged onto a conveyor and be stockpiled separately from the export product.

2.2.6 Magnetite Make-Up System

Magnetite medium will be provided from a dedicated make up system comprised of make-up sump with 2 x spillage pumps and magnetic separator for producing over dense and recycling of water to the monitor guns. Off-loading is by bulk truck for discharging into the magnetite make-up sump.

2.2.7 Flocculent System

Flocculent will be provided from an automated powder flocculants make up and dosing system.

2.2.8 Dust Suppression

Dust suppression will be allowed for at the plant feed stockpile withdrawal points. Dust suppression will not be necessary on plant product and discard (once the material has been through the wet process).

2.2.9 Air

The compressed air supply system consists of two compressors (45 kW), with one being a standby. A single compressor will provide air for both agitation and instrumentation via two separate air receivers (process air receiver and instrument air receiver).

2.3 Description of activity

DCM is planning to expand the opencast mining of Pit 1 at their Dorstfontein East mine in a North Western direction of approximately 85 Ha, ensuring a constant RoM of 3 mtpa. In addition to this, DCM would like to construct a pipeline from the Dorstfontein West Mine to the Dorstfontein East Mine of approximately 11 km for the transportation of process water, which will be recycled. The exploitation of the Pit 1 extension area will run concurrently with the DCM operations.

It is anticipated that the Mine extension and pipe construction will include the following infrastructure and activities:

- Selective vegetation clearance would be required for the extension of the Pit 1 extension and the footprint of the pipeline;
- Stripping and stockpiling topsoil and sub-soil and the establishment of a topsoil stockpile area and berms;
- Mining of the Pit 1 extension area (Including blasting);

- Erection of the pipeline;
- The development of a maintenance road along the pipeline route;
- Loading, hauling and transportation of ROM, product and materials;
- The dredging, excavation and moving of soil, sand and rock from the non-perennial streams for the erection of the pipeline;
- Erection of pipe racks and culvert at the stream crossings;
- Operation of storm water control systems; and
- The establishment of construction camps by contractors and the operation of earth moving vehicles and equipment.

An illustration of the proposed layout can be found in Figure 1-2 and

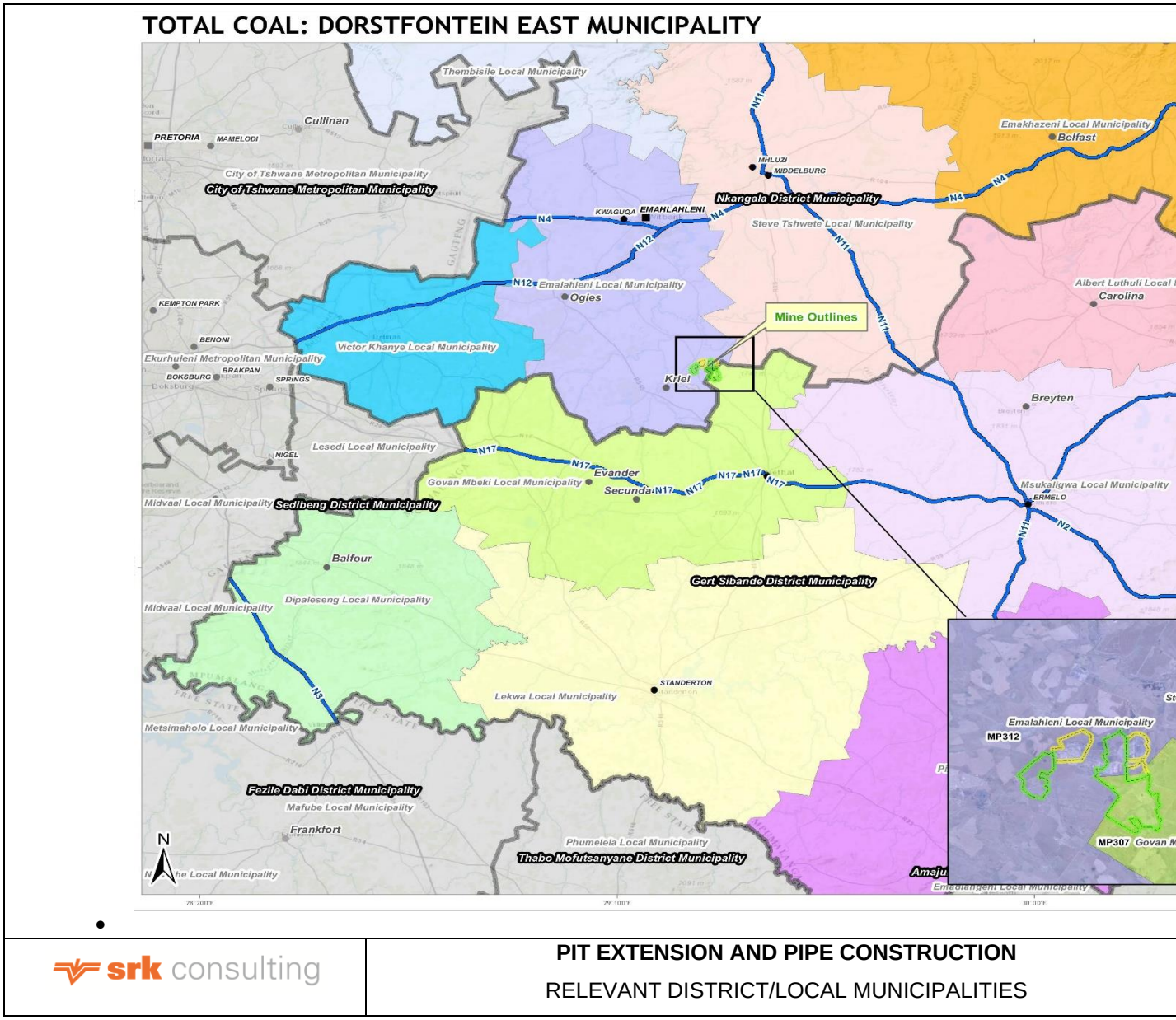


Figure 1-1: Relevant District and Local Municipalities Relevant to the Proposed Project

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2.3.1 Resource Particulars

The Witbank coal seams (No. 1 – No. 5 seam) are present within the proposed mining area. The mining activities at DCM focus mainly on the No. 2 and No, 4 seam for economic exploitation. The No. 4 seam averages 2.83 metres in seam thickness and ranges in depth from approximately 25 to 45 metres below surface. The No. 2 seam averages approximately 19 – 102 metres from surface.

2.3.2 Employment

Dorstfontein Complex mine provides employment opportunities to approximately 836 workers on a contract basis. The mine is operated by a few large contracting companies and only employs a full-time staff compliment at the mine of 85 employees, excluding vacancies. To facilitate the upliftment of the previously disadvantaged labour force, a programme is in place for the upgrading of literacy levels. Dorstfontein Complex Mine also partakes in the graduate intake programme, which provides relevant job-related training and placement opportunities for individuals who successfully complete the programme. Current interventions are implemented, in line with the company's Employment Equity and Skills Development Plans (Exxaro Coal Central (Pty) Ltd A, 2017).

The Social and Labour Plan (SLP) for Dorstfontein Complex is based on the following strategic approach:

- Promotion of employment and advancing the social and economic welfare of all South Africans;
- Contribution to the transformation of the mining industry; and
- Promotion of sustainable economic development and poverty eradication.

2.3.3 Stripping of Soil

The original opencast pits were planned and developed in 50-meter-wide strips, throughout the extent of the various pits in the advance direction. The opencast pits are also developed in various benches to ensure adequate slope stability and flexibility in exposed coal reserves. The mining pits with regard to Option 1 of Pit 1 Extension are designed and planned in strips of 50 m wide. With the inception of roll over mining techniques all waste from mining strips will be back filled into previous voids. Option 2 accounts for shorter strips but increased underground production activity (Exxaro Coal Central (Pty) Ltd B, 2017).

2.3.4 Stockpiling

Coal reserves are transported via truck and shovelled out to a main tipping arrangement from where the ROM coal is crushed and screened and delivered to a stockpile from where it is fed to the processing plant. Material is withdrawn from the stockpile via three feeders (two fixed and one variable speed) and is conveyed to a plant feed bin. Raw coal with a top size of – 50 mm discharges to a ~7400 ton surge stockpile.

The combined export product is transferred onto a ~24000-ton intermediate product stockpile, from which it is transferred to the export product stockpile (24 000-ton capacity load-out) feeding with a sacrificial conveyor onto the overland conveyors. Mass meters will be provided to measure the quantity of export product going onto the export product stockpile. A hammer sampler will also be installed on the intermediate product stockpile feed conveyor. Coal is conveyed from the export stockpile to the rapid load-out system (vendor package) that load the trains. The floats screen oversize (50 x 32 mm) chute is designed to allow for separate collection (future) of the oversize as an inland product, which could be discharged onto a conveyor and be stockpiled separately from the export product (Exxaro Coal Central (Pty) Ltd B, 2017).

2.3.5 Topsoil and Subsoil

Topsoil will be removed during the dredging and excavation activities undertaken in order to erect the pipeline. Soil, sand and rock will also be moved from the non-perennial streams. The topsoil stockpile will be utilized for rehabilitation purposes of surface areas for decommissioned infrastructure. Mitigation activities will include a plan to decrease soil erosion and conserve the status of the soil as well as effectively manage the waste produced.

The underground layers of minerals have been identified as economically viable for the purposes of the Dorstfontein East Mine. These account for No. 2 Seam, No.4 Seam and to a lesser extent, the No.3 Seam, which occurs in some isolated areas in Pit 2. The in-situ Reserve tonnage is known to be 27 million tonnes of 2 Seam and 57.6 million tonnes of 4 Seam select or some 83 million tonnes of complete 4 Seam. The No. 4 Seam Upper is considered to be of inferior quality. The No.4 Seam is therefore considered to consist of some 57.6 million tons (original estimates) of in-situ coal, which varies, in depth from sub outcrop to 43 meters. The mining height of the seam varies from 2.5 meters to 4.9 meters with an average mining height of 2.83 meters, which affords the seam to high speed, high production mining with continuous miners. In addition to the above-mentioned Reserves, the Pit 1 North West Extension is estimated to have a known mineable tonnes in situ Resource of 3.5 million tonnes of the No. 2 Seam and 2.5 million tonnes of the No.4 Seam select or some 2.8 million tons of No.4 Seam complete.

2.3.6 Blasting and Vibration

Blasting of overburden and the coal will be conducted by a dedicated drilling and blasting crew. An appointed Blast Engineer designs each blast for optimal fragmentation and minimum environmental impact. Surrounding property owners will be informed of the blasting procedures and schedules in advance in and around the mining area. Blasting boards at access routes to construction areas will be updated 24 hours prior to the blast, displaying details regarding the time and date of the blast. An exclusion zone on 500 m will be in place for the life on the mine. Employees and external contractors will be informed of the blasting procedures and the associated safety measures during induction. Vehicles and machinery will be removed prior to the blasting and parked at designated sites. Personnel with red flags will block all access roads.

Vibrations will occur due to the blasting. As a result, controls will be set in place to monitor the noise and vibrations, surface and ground water. Electrical Crack monitors will be installed if requested by the surrounding property owners. They will employ a single sensor that measures both weather-induced micrometre changes in crack width and those produced by the habitation and ground motion-induced vibrations. The air over pressure level and vibration, (audible and the inaudible – concussion - noise), to be monitored and controlled during the blasting operation. The standards implemented by the USA Bureau of Mine Standards, RU 8507, are used as a guideline to monitor and control blasting operations in South Africa:

Monitoring of the vibrations will be done continuously during the opencast operations, and when required as the mining face underground approaches dwellings overhead. Vibration sensing equipment will be used, which should be placed near residential dwellings (near communal land border and at the nearest commercial farmer’s homestead) to record blast over pressure and vibration. No specific blasting designs are proposed since available equipment may vary, however, the blasting constraints will be considered as the limiting criteria. Proposed criteria would be a maximum peak particle velocity of 12.5 mm/s at frequencies of 4 to 15 Hz, higher frequencies as per the USBM RU 8507 graph. Air blast recordings at the residential houses should not exceed 128 dB, with no more than a maximum of 4 occurrences in excess of 128 dB per calendar month, but no more than 134 dB. of a transgression, the mining concern to proactively communicate corrective action to the Department of Mineral Resources (DMR).

2.3.7 Proposed Process Water Pipeline

The proposed pipeline will be approximately 11 km in length with an internal diameter of 250 mm. This will equate to a peak throughput exceeding 120 litres / second. The pipeline will be constructed from the Dorstfontein West to the Dorstfontein East Mine. The pipeline will be used for the transportation of process water, abstracted from the Pit, to Dorstfontein East to be recycled in their operations. This pipeline will assist ECC to optimise their water management between the two mines.

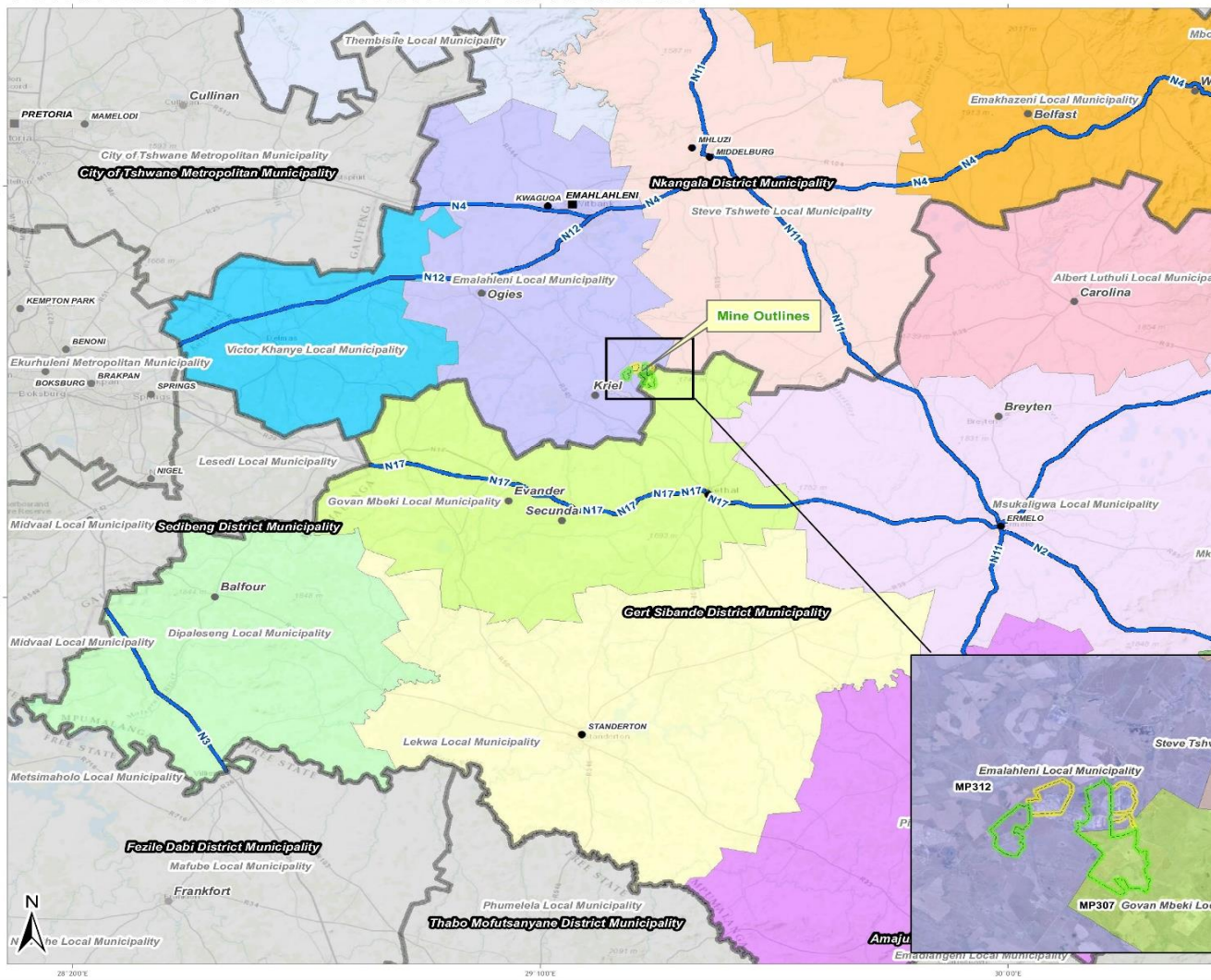
2.3.8 Supporting Infrastructure

The proposed extension of the DCM Pit 1 will make use of existing road, rail, water and electricity infrastructure. The DCM has its own rapid loading terminal connected to RBCT rail line.

2.3.9 Exploration

Approximately 590 boreholes have been drilled over the DCM mining right area. A further 57 boreholes were drilled between 2012 and 2015 of which 16 were placed in the Pit 1 extension area on portion 55 the farm Welstand 55 IS.

Figure 1-2 and



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PIT EXTENSION AND PIPE CONSTRUCTION

RELEVANT DISTRICT/LOCAL MUNICIPALITIES

Figure 1-1: Relevant District and Local Municipalities Relevant to the Proposed Project

illustrate the farm portions which are affected by the project and the existing and proposed mining infrastructure respectively.

2.3.10 Construction Methodology

It is anticipated that the construction and extension will include, but not limited to, the following key components:

- Selective vegetation clearance would be required for the extension of the Pit 1 extension and the footprint of the pipeline.
- Stripping and stockpiling topsoil and sub-soil and the establishment of a topsoil stockpile area and berms.
- Mining of the Pit 1 extension area (Including blasting)
- Erection of the pipeline.
- The development of a maintenance road along the pipeline route.
- Backfilling of discard into the opencast pit
- Loading, hauling and transportation of Run of Mine (ROM), product and materials.
- The dredging, excavation and moving of soil, sand and rock from the non perennial streams for the erection of the pipeline.
- Erection of pipe racks and culvert at the stream crossings.
- Operation of storm water control systems.
- The establishment of Construction Camps by contractors and the operation of earth moving vehicles and equipment.

2.4 Extent of activity

The pit extension will occur in a North Western direction for approximately 85 ha and the proposed water pipeline will run from the West to the East of the Dorstfontein Mine for approximately 10 km.

2.5 Key activity related processes and products

The key activity related processes are described in Section 2.1, 2.2 and 2.3.

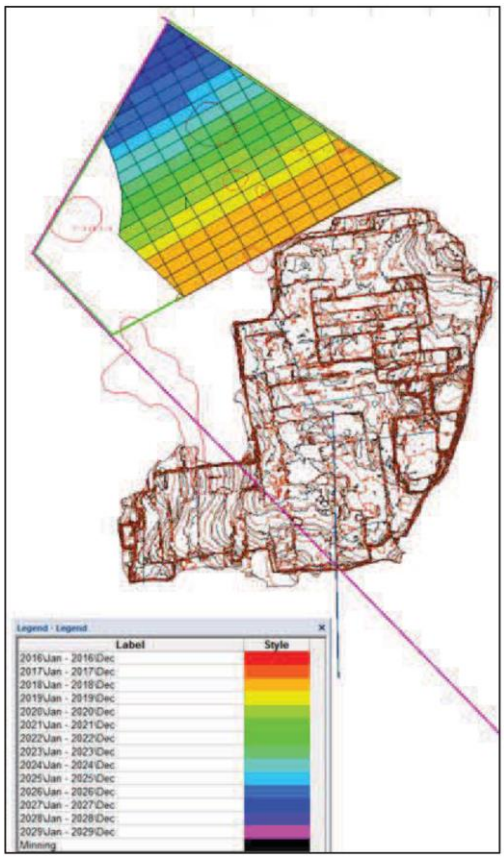
2.6 Activity life description

It is anticipated that the approval of all legal and permitting submissions such as the Environmental Management Program (EMPr) and the amended Integrated Water Use License (IWUL) will be finalised by Q4 2017.

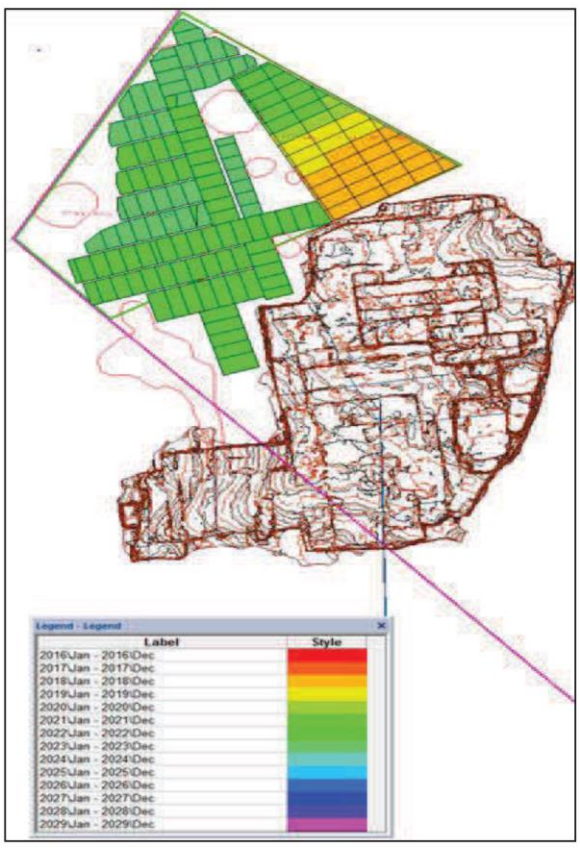
The original pit 1 of DCM East operations will be mined out toward the end of Q1 2017 and the extension of pit 1 is planned to commence in Q2 of 2018. The mine has an approved business plan and as soon as all regulatory requirements permits and permissions signed off mining of Pit 1 NW Extension will commence.

Open Cast (OC) mining will be conducted until all the coal for the OC Reserves have been depleted. The Underground (UG) mining will commence (construction phase) when the OC has mined past the area planned for the UG portals to be established. The OC mining operation will downscale as the production from the UG is increased and the OC pit strip lengths become shorter as the pit progresses (Figure 2-2).

Current estimates indicate a LOM of 10 years for the Pit 1 NW Extension.



Plan Showing the proposed Option 1 (OC) Mining Layout



Plan Showing the proposed Option 2 (OC and UG) Mining Layout

Figure 2-3: Plan showing the proposed mining layout

2.7 Activity infrastructure description

Please refer to Section 2.1 to 2.6.

2.8 Key water uses and waste streams

2.8.1 Key Water Uses

The key water uses being applied for are provided in Table 2-1.

Table 2-1: Anticipated Water Uses

NWA Section 21	Description of the water use
21 (c) and (i)	Impeding, diverting and altering the flow of water in a watercourse. The development of a maintenance road along the pipeline route, which includes a 10m servitude of approximately 12.5km. This will include surface and ground water management, erosion and soil controls and stormwater management. All three pipeline route options traverse various perennial, non-perennial, channelled valley bottom wetlands and floodplain wetlands. All activities taking place within 500 m of a wetland or watercourse will be licensed under Section 21 (c).

NWA Section 21	Description of the water use
21 (e)	Engaging in a controlled activity identified as such in Section 37 (1) or declared under Section 38 (1). As a result of the proposed mining activities, dust suppression activities will be undertaken using process water.
21 (g)	Disposing of waste in a manner which may detrimentally impact on a water resource. Because of the proposed mining activities, dust suppression activities will be undertaken using process water.
21(j)	Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people: The dewatering process associated with the continuation of mining activities in the Pit 1 extension.

2.8.2 Key Waste Streams

The following waste streams have been identified at the DCM East mining operation:

- Domestic Waste;
- Hazardous Waste; and
- Wastewater.

Please refer to Section 5 of this report for more information pertaining to the management of waste generated by the mining operation.

2.9 Organisational structure of activity / company

Please refer to Figure 2-4 for the Organisational Structure of the DCM East mining operations.

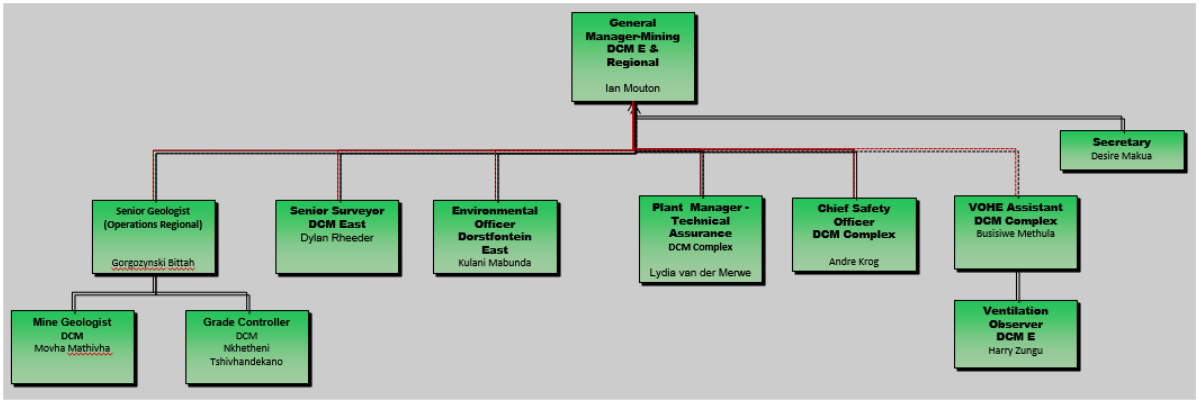


Figure 2-4: Organisation Structure of DCM East

2.10 Business corporate policies related to the environment

2.10.1 Health and Safety Policy

From the outset, safety has been management's top priority with mandatory training and induction programmes designed to sustain an environment in which every employee is expected to enjoy the

right to work safely. The frequency of safety campaigns has been increased and safety awareness has improved considerably.

ECC is committed to managing the hazardous risks associated with underground bord and pillar coal mining, surface opencast mining as well as the transportation and processing of coal.

ECC recognises that subsidence, explosions, fire, moving machinery, noise and dust pose significant health and safety risks and seek to mitigate these through effective and proactive controls. In doing so ECC seek to prevent accidents, injuries, occupational illnesses or releases of materials that could be detrimental to the health and safety of employees and contractors as defined in the Mine Health and Safety Act, 1996 (Act No. 29 of 1996). ECC also ensures that persons who are not employees but who may be directly affected by the activities at the mine are protected.

In accordance with the above, ECC:

- Accept the responsibility to inform and consult with those who may be exposed to identified hazards;
- Develop appropriate operating standards and procedures as part of an effective hazard identification and risk management programme. Where hazards are unavoidable they will be monitored, their effect on the health and safety understood and appropriate action taken to manage the situation in order to minimise the risk;
- Are committed to comply with applicable health and safety legislation as well as other requirements to which the company subscribes. Communication with relevant stakeholders to ensure ongoing compliance is ensured;
- Will ensure safety and health considerations will take precedence over expedient operational practices. Achievements in safeguarding the workplace against hazards resulting from our operations will be in accordance with sustainable business principles and valued alongside company financial performance;
- Will ensure that employees, contractors and suppliers who pose a significant health and safety risk are familiar with, understand and implement this policy. All employees and contractors are trained and expected to work and act safely at all times. They accept responsibility for preventing accident, incidents and illnesses and for reporting practices that could endanger themselves or others;
- Will remain committed to seeking continual improvement in health and safety performance and the associated management system in order to attain the highest possible degree of physical, mental and social welfare of the ECC employees;
- Will monitor and audit the health and safety performance of the operation in accordance with legal requirements Occupational Health and Safety Assessment Series (OHSAS) 18001 specifications and corporate expectations such as the twelve Colden Rules.

The health of ECC employees is of prime importance and continues to receive attention at all levels of the organisation. The mine has a medical staff on site to help in case of an emergency. Regular check-ups and tests are carried out on the Group’s workforce and appropriate action is taken where

needed. Acquired Immuno-Deficiency Syndrome (AIDS) awareness campaigns are carried out on a regular basis and the Company ensures that the nutritional needs of employees are taken care of.

2.10.2 Environmental Policy

ECC recognises that coal mining and associated operations can have detrimental environmental impacts, such as potential environmental pollution of water reserves, air and the consumption of energy and other natural resources. ECC is therefore committed to the implementation of an Environmental Management System (EMS) that will minimise pollution and resource consumption and comply with the international standard International Standard Organisation (ISO) 14001. The mine is IS0 14001 certified.

ECC will adhere to the objectives of their environmental policy through:

- Compliance: Compliance to identified and relevant environmental legislation for the various activities taking place on site;
- Pollution prevention: Measures taken to prevent or minimise environmental pollution caused by impacts of the operations, processes and products;
- Competence: ECC will ensure that the various personnel performing tasks for and on behalf of ECC are competent and understand the impact their activities on the environment, and their role in the prevention of pollution and the maintenance of the EMS;
- Communication: The environmental policy of ECC will be communicated to the relevant parties working for and on behalf of ECC. It will also be made available to the public; and
- Review: The environmental policy will be reviewed to ensure its suitability, adequacy and that t remains valid at all times.

3 Regulatory water and waste management framework

Water management is primarily controlled by the NWA, the NEMA and the NEM: WA. Section 19 of the NWA focuses on the regulatory control of pollution. In terms of Section 21 of the NWA there are eleven water uses that may require authorisation. In developing this IWWMP the core strategies of the National Water Resource Strategy 2 (NWRS2), developed in terms of the NWA to provide a framework for the protection, use, development, conservation, management and control of water resources for the whole country (Department Water Affairs, 2013) were considered. The core strategies include:

- Implementation of equity policy;
- Putting water at the centre of integrated development planning and decision-making;
- Ensuring water for equitable growth and development;
- Contributing to a just and equitable South Africa;
- Protecting water ecosystems;
- Implementing water use efficiency, conservation and water demand management;
- Optimising and stretching our water resources;
- Achieving effective water governance and developmental water management;
- Embedding sustainable business principles and practices;

- Implementing a water sector investment framework; and
- Engaging the private and public water use sectors.

3.1 Summary of all water uses

Water resources in the Republic of South Africa are regulated under the NWA. The Minister of Water and Sanitation is the custodian of all water resources in South Africa on behalf of the people of South Africa. It is worth noting that, in terms of the NWA, it is an offence to pollute any water resources, to render it unfit for use, including rainwater, seawater, and subterranean water. Under the Act, all water uses identified under Section 21 are to be licenced as prescribed in Section 40 of the NWA.

Details of the applicable water uses are provided in Table 2-1

3.2 Existing lawful water uses

An Existing Lawful Water Use (ELU) is a water use that lawfully took place in the period two years before the commencement of the NWA. No ELU exists for the DCM East operations as all water uses taking place as a result of the mining activities have been licensed in terms of Section 21 of the NWA be means of an IWUL issued by the DWS.

3.3 Relevant Exemptions

DCM East operations has applied for a number of exemptions as presented in Section 3.3.1 to and 3.3.2.

3.3.1 2008 Exemption Application

In the 2008 WULA submitted to DWS, exemption from Government Notice No. 704 (GN 704), Regulation 4 (Restriction on locality) was requested for mining within 100 meter of a watercourse at Opencast Pit 2. In terms of the linkages of GN704 with other requirements of the NWA it is stated in Operational Guideline No. M6 that should an exemption from any requirements of GN704 imply the necessity for a water use licence, the person in control of the mine or activity need only apply for a licence. The licence has higher authority than the GN704 and all water uses activities pertaining to the mining operation have been authorised in terms of the IWUL issued.

3.3.2 2009 Exemption Application

The relevant exemptions applied for as part of the 2009 application for the conveyor and rail loop system are displayed in Table 3-1 below:

Table 3-1: 2009 GN 704 Exemption Application

GN 704	Condition	Applicability to DCM East Conveyor and Rail Loop
4	Minister may authorise exemption from requirements of Regulations 4. 5. 6, 7, 8, 10 or 11	Exemption is required from regulation 4a and 4b

GN 704	Condition	Applicability to DCM East Conveyor and Rail Loop
4a	Locate or place any residue deposit, dam, reservoir, together with any associated structure within 1:100 year flood-line or within a horizontal distance of 100 m of a watercourse or borehole, excluding boreholes drilled specifically to monitor the pollution of groundwater, or on ground likely to become water-logged, undermined, unstable or cracked.	The PCD will be constructed within a horizontal distance of 100m of a wetland
4b	No opencast mining, prospecting or any other operation or activity under or within the 1:50 year flood-line or within a horizontal distance of 100 m from any watercourse	The conveyor is crossing a number of water courses (refer to Table 3.1 for details of the crossings)

No reference to the respective exemptions was made in the IWUL issued for the DCM East operations. It is assumed that these exemptions have been approved as part of the IWUL issued.

3.4 Generally authorised water uses

There are no generally authorised water uses.

3.5 New water uses

The water uses to be licenced are provided in Table 2-1.

3.6 Waste management activities

The NEMWA follows the principle that waste generation be avoided or if it cannot be avoided that it is reduced re-used, recycled or recovered and as a last resort treated and/or safely disposed of.

DCM East will continue to employ and implement the following waste management hierarchy principles:

- Dirty water is captured into the various dirty water containment facilities [Erikson Dams, Pollution Control Dam (PCD), Return Water Dam, etc.] and re-used in the processing activities;
- Clean storm water is diverted from the site and directed to the natural environment;
- Oil is collected by a contractor and is re-used; and
- There is an existing waste sorting area at DCM. Segregation and recycling of waste is therefore practiced.

Decision making at DCM takes into account the hierarchy of waste management:

- Prevention;
- Minimisation;
- Re-use;
- Recycling;
- Energy recovery; and
- Disposal.

Please refer to Section 5.6 of this report for the details of the waste generated and the management thereof.

3.7 Waste related authorisations

There are no waste management activities as listed in GN R634 under the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM: WA) undertaken by ECC at DCM East. The DME Pit 1 extension project and associated pipeline will not trigger any activities listed in terms of the NEM: WA and will therefore not require a waste management licence.

3.8 Other authorisations and regulations (EIA's, EMPs and RODs)

The DCM East Environmental authorisations were undertaken and applied for in terms of the following legislation:

- The Mineral Petroleum Resource Development Act (Act 28 of 2002) (MPRDA);
- The National Environmental Management Act (Act No. 107 of 1998) (NEMA); and
- The National Water Act (Act No. 38 of 1998) (NWA).

Approvals for the DCM East operations obtained in terms of both the MPRDA and NEMA are presented in Table 3-2.

Table 3-2: Authorisations for DCM East

Authorisation	Relevant Authority	Ref Number
NEMA for DCM East Mine	Mpumalanga Department of Agriculture and Land Administration (MDALA)	17/2/2/1s MP-7
NEMA for Conveyor and rail loop	Mpumalanga Department of Agriculture and Land Administration (MDALA)	17/2/2/2 NK-7
MPRDA EMP for the Dorstfontein mine (amended)	Department of Minerals and Energy (DME)	MP 30/5/1/2/3/2/1 (51) EM

4 Present environmental situation

4.1 Climate

The Dorstfontein Mine is located in the Highveld climatic region of South Africa, which is a summer rainfall area. Temperature classifications for the region are hot in summer and mild to warm in winter, with significant diurnal fluctuations. Climate Data was obtained from the South African Weather Service (SAWS) and databases of WR2005. The local climate can be described as semi-arid high-veld conditions, with warm summers and moderate dry winters. Average daily summer temperatures of approximately 27°C are experienced, while peak temperatures of up to 36°C do occur. Average daily winter temperatures are approximately 4°C, with minimum temperatures reaching around -4°C. The number of days when heavy frost occurs is however, limited and freezing of wet soils, frost heave and permafrost do not occur (SAWS, 2017).

4.1.1 Rainfall

Relative humidity ranges from a minimum of 34% to a maximum of 94%, with dry atmospheric conditions dominating. The average annual rainfall of 700 mm is considerably less than the average

annual A-pan evaporation of 1 840 mm. This results in the project area experiencing a negative water balance in relation to rainfall and evaporation. Evaporation, off open surfaces of water (lake evaporation), though less than A-pan values, will be significant (calculated at 1500 mm per annum) and plant-life in natural local grasslands will be dormant for long periods during the year. Although local climate change assessments do not indicate significant changes between long-term Mean Annual Precipitation (MAP) and modelled 'now climate', a trend of increased early summer rainfall and decreased late summer rainfall is evident. Normal Dry Weather Conditions (rainfall and runoff values exceeded on average 70% of time) are used to describe climate change impacts. Trends of change in rainfall are magnified in modelled runoff. Table 4-1 illustrates the average rainfall patterns in millimetres.

Table 4-1: Average Rainfall Patterns

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Minimum	18.0	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	5.3	28.4	25.6	307.2
Average	119.5	91.4	77.3	40.1	18.0	6.4	6.7	9.5	24.3	79.5	121.7	116.6	710.9
Maximum	231.6	317.4	235.5	144.1	184.1	78.3	67.8	66.6	179.7	204.4	458.0	278.2	1382.3

4.1.2 Evaporation

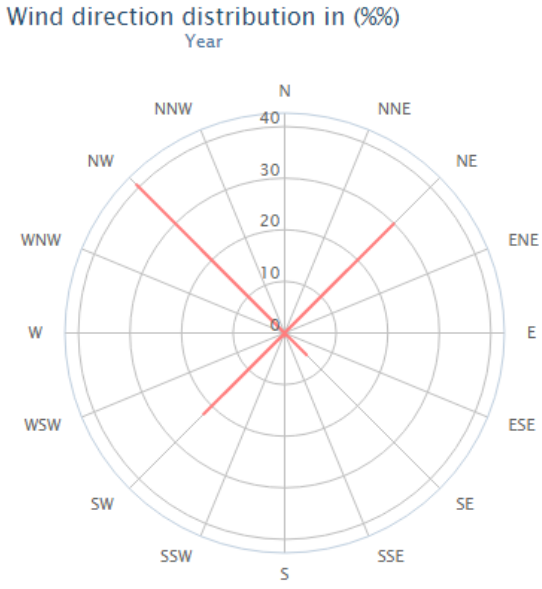
Refer to Table 4-2 for the Mean Average Evaporation (MAE) for the project area. It can be seen from the tables presented in this section of the report that evaporation is greater than rainfall for the project area. This results in the project area experiencing a negative water balance in relation to rainfall and evaporation.

Table 4-2: Mean Average Evaporation (mm)

Month	Mean (mm)		
	S pan	A pan	Lake
Jan	230	297	230
Feb	175	221	175
Mar	186	244	186
Apr	147	188	147
May	128	165	128
Jun	96	120	96
Jul	106	138	85
Aug	152	198	122
Sep	168	234	135
Oct	241	289	171
Nov	239	301	239
Dec	237	292	237
Annual Mean	2 078	2 687	1 950

4.1.3 Wind Speed

The predominant wind direction within the proposed project area arises from the northwest to the southeast. Winds mainly ridge of the Indian Ocean high from the east but also occasionally passage of fronts from south or south-west. The winds generally bring in cold fronts. Mpumalanga has strong hourly mean winds in the northeast. On average, the wind probability is 33 % (Windfinder, 2017). The wind rose illustrating the wind direction and distribution for the area can be found in Figure 4-1.



srk consulting	**PIT EXTENSION AND PIPE CONSTRUCTION** Wind Direction and Distribution	Project No. 499507

Figure 4-1: Wind Direction and Distribution (Windfinder, 2017).

4.2 Surface Water

The area is strongly influenced by the Olifants River to the north of the mining area. The streams in the western area of the project flow west and north west into the Steenkoolspruit, which flows north into the Olifants River. The main stream on the eastern area of the project flows north into the Olifants River.

4.3 Water management area

The Dorstfontein Mine is located within the B11B and B11D quarterly catchments of the Olifants Water Management Area (WMA), which is situated in the north-eastern part of South Africa, in the Mpumalanga Province (Figure 4-2). The Olifants River originates to the east of Johannesburg and initially flows northwards before curving eastwards towards the Kruger National Park (KNP), where it is joined by the Letaba River before flowing into Mozambique. The Olifants water management area corresponds with the South African portion of the Olifants River catchment, excluding the Letaba River catchment, which is a tributary catchment to the Limpopo Basin shared by South Africa, Botswana, Zimbabwe and Mozambique. Distinct differences in climate occur; from cool Highveld in the south to subtropical east of the escarpment. Mean annual rainfall is in the range of 500 mm to 800 mm over most of the WMA.

Economic activity is highly diverse and ranges from mining and metallurgic industries to irrigation, dry land and subsistence agriculture, and eco-tourism. With one of the main rivers, the Olifants, flowing through the Kruger National Park (KNP), which is located at the downstream extremity of the water management area, the provision of water to meet ecological requirements is one of the controlling factors in the management of water resources throughout the water management area.

Most surface runoff originates from the higher rainfall southern and mountainous areas and is controlled by several large dams. The most promising options identified for the further development of surface water resources are the raising of Flag Boshielo Dam, the construction of a new dam at Rooipoort on the middle Olifants River and a dam on the Steelpoort River.

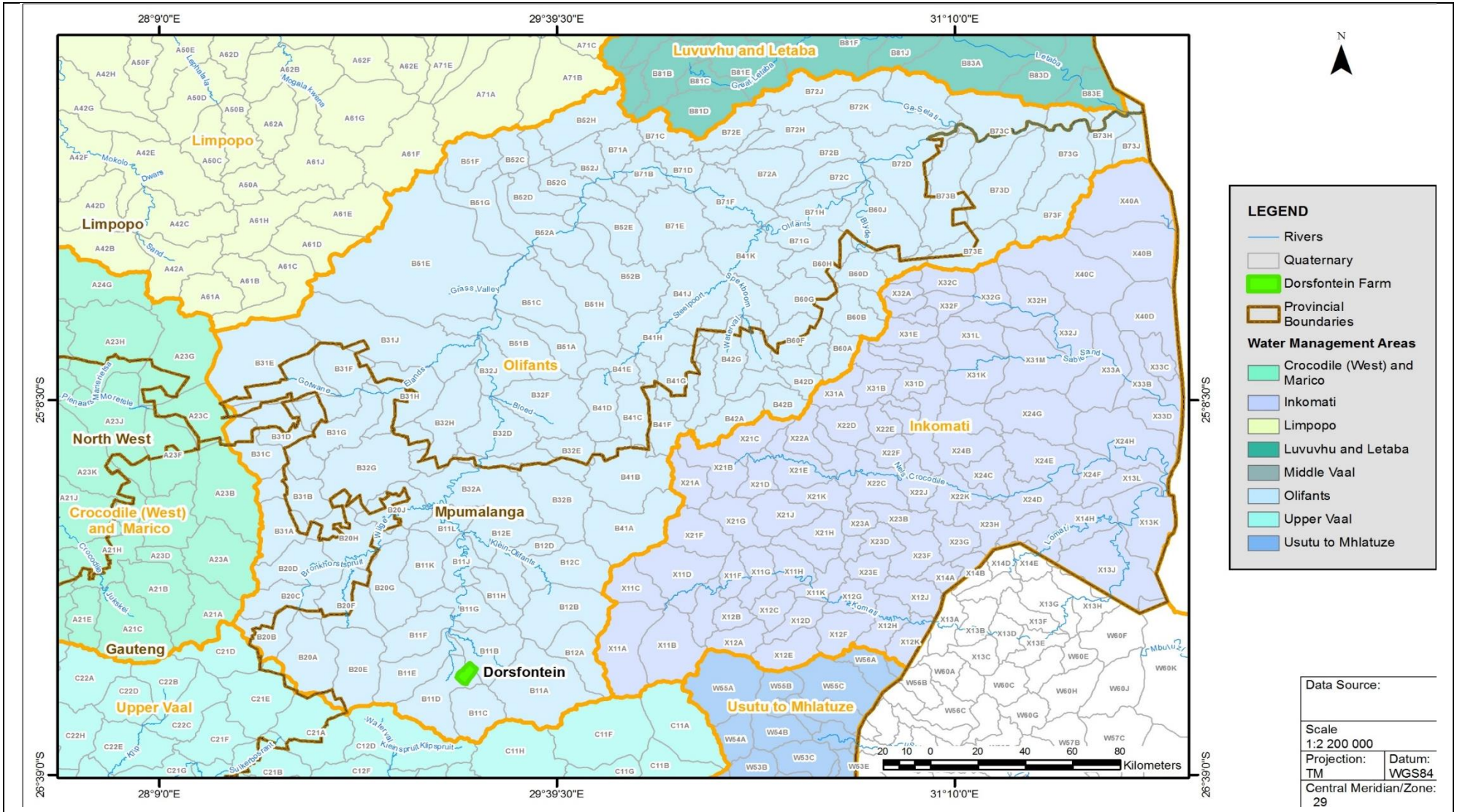
Large quantities of groundwater are abstracted for irrigation in the north-west of the water management area, as well as for rural water supplies throughout most of the area. Potential for increased groundwater utilisation has been identified on the Nebo Plateau north-east of Groblersdal. Substantial amounts of water are transferred into the water management area as cooling water for power generation, while smaller transfers are made to neighbouring water management areas.

The scenarios for population growth show little if any increase in the rural areas beyond 2025. Economic growth and population increases are expected to be centred on the main industrial and mining towns of Witbank, Middelburg and Phalaborwa, as well as at new mining developments foreseen along the eastern limb of the Bushveld Igneous Complex in the Mogoto/Steelpoort area. Water requirements for power generation in the upper Olifants sub-area are also expected to increase.

Water for mining developments in the Mokopane area (Limpopo water management area) may have to be supplied from the Olifants River.

4.4 Surface water hydrology

The project area falls within segment 1-8, which is the upper reaches of the Olifants River from its source to the confluence with the Steenkoolspruit. According to the intermediate reserve determination study conducted by DWS in 2001, the upper reaches of the Olifants River are relatively undisturbed with dryland agriculture being the main land-use and some coal mining at the bottom end of the reach. The Present Ecological State (PES) of the Upper reaches of Olifants River segment 1-8 is moderately modified which is a Class C.



srk consulting	PIT EXTENSION AND PIPE CONSTRUCTION Illustration of Surrounding Catchments	Project No 599507

Figure 4-2: Water Management Area

4.5 Surface water quality

DCM East has a number of water quality sampling points located on the Olifants River and affected tributaries. The Olifants River flows to the north of the mining area with sampling points MP3, MP4, MP5 and MP6 located on the Olifants River. MP6 is upstream of MP5 and all mining activities.

Samples MP1 and MP2 are located on the western tributary of the Olifants River and samples DCM6 and DCM7 are located on the eastern tributary of the Olifants River. Figure 4-3 shows the location of the sampling points.

4.5.1 Olifants River Monitoring Points

The results of the water quality sampling of the Olifants River shows that the water quality remained good and complied with South African National Standards (SANS) limits in the first quarter 2015 with only occasionally elevated aluminium at MP3, MP5 and MP6.

4.5.2 Western Tributary Monitoring Points

Sampling point MP1 was dry throughout the first quarter of 2015 and MP2 could only be sampled in January 2015 as it was also mostly dry. When sampled MP2 still slightly exceeded the SANS limit indicating a possible impact related to mining, but due to the low water content might be a result of evaporation.

4.5.3 Eastern Tributary Monitoring Points

Sample points DCM6 (upstream) and DCM7 (downstream) monitor the impact of DCM East Mine on the small eastern tributary flowing to the east of the mine. It was not possible to sample DCM7 in February and March 2015 as it was dry. Both sample sites continued to have good water quality in the first quarter 2015 in term of compliance to SANS limits.

Slightly higher sulphate concentrations were observed at MP4 than the rest of the sampling points. The sulphate concentration at MP5 and MP6 were relatively the same as downstream at MP3.

4.5.4 Decanting

The groundwater study found that decant from pit 1 will flow towards the western tributary of the Olifants River. The decant from Pit 2 and 3 will flow towards the eastern tributary of the Olifants River. Potentially the quality of decant water could be in the range of 3000 mg/l. The calculated volumes and quality of the potential decant indicates a high impact on the water quality of the Olifants River and the tributaries on the site. To reduce the impact on surface water quality a water treatment plant may be needed to increase the water quality emanating from the opencast areas.

4.6 Mean Annual Runoff (MAR)

The Mean Annual Runoff (MAR) for the Olifants WMA is 2 042 million m3/a (Olifants ISP, 2004). According to the Hydrology and Surface Water Impact Assessment Study conducted by SRK

Consulting, the 0.85 km2 open cast pit extension will reduce runoff generated within the immediate catchment. The catchment in which the pit extension is located is 17.4 km^2. In addition, the Digital Elevation Model (DEM) is situated in quaternary catchment B11B, which is 435 km^2. The catchments are shown in Figure 4-4.

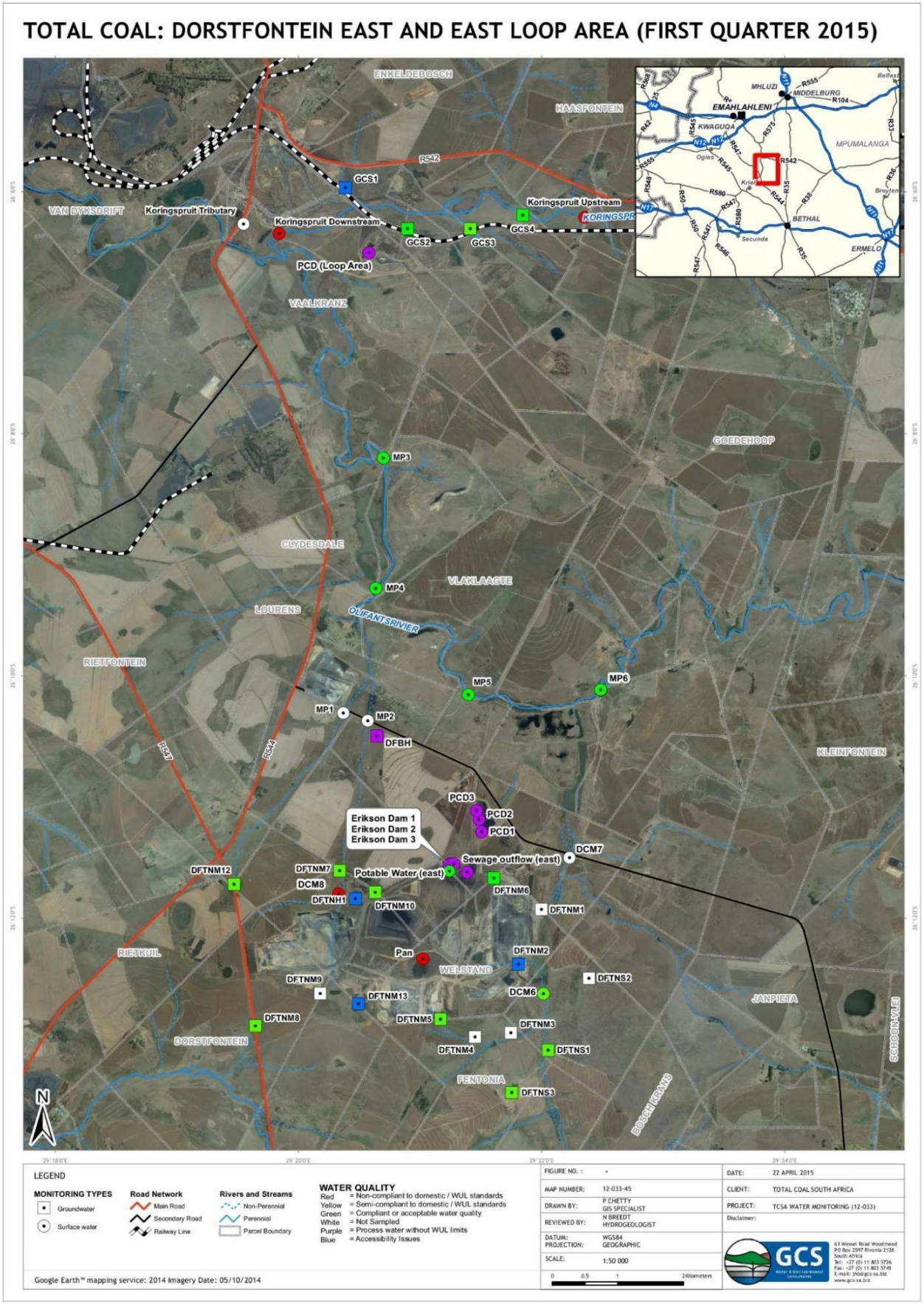


Figure 4-3: Surface Water Quality Sampling Points

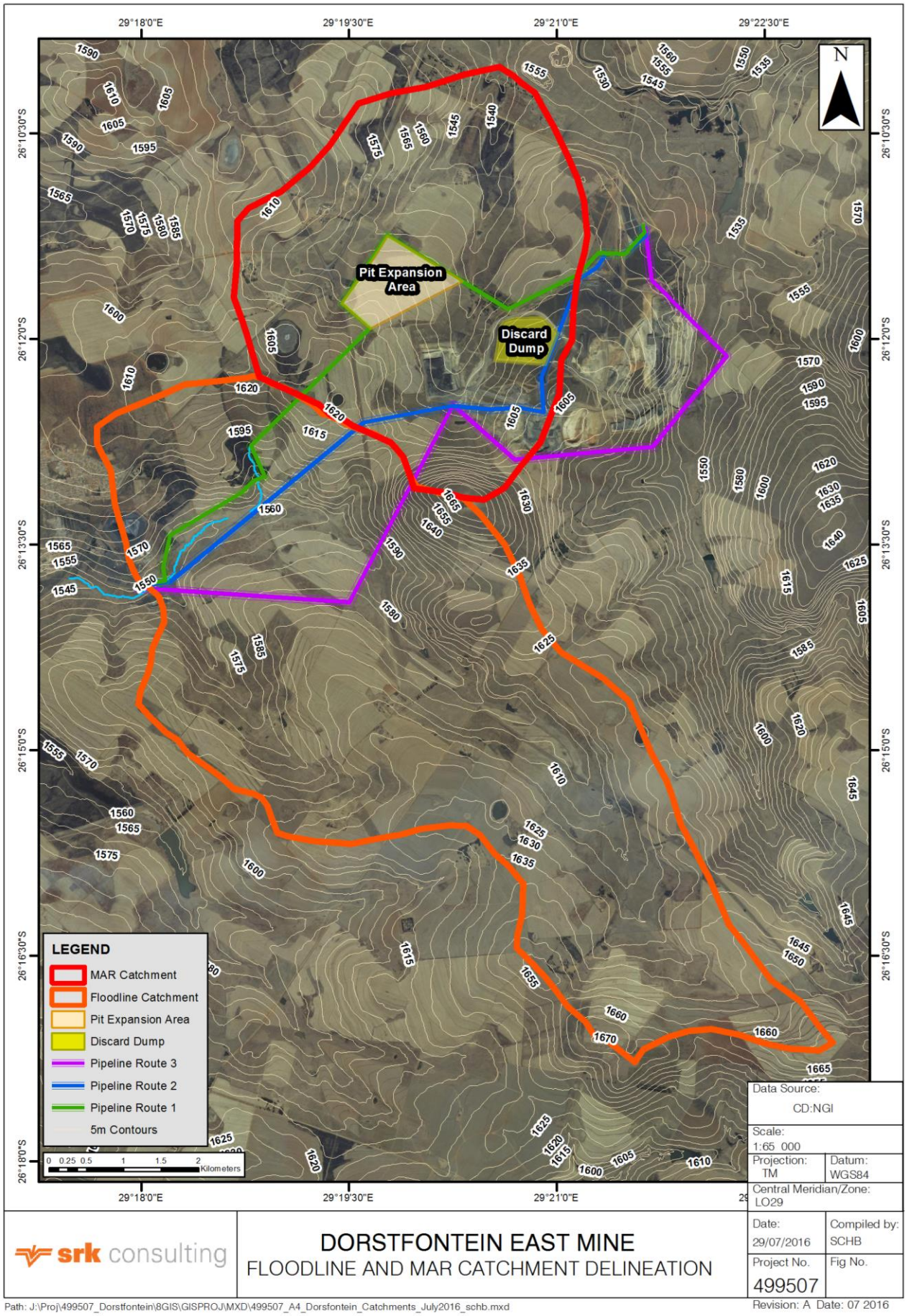


Figure 4-4: Dorstfontein local catchments

The pipeline falls across two quaternary catchments; B11B and B11D. The study found that the pipeline will not have any effect on the MAR. As a result, B11D will not be affected by a change in MAR. The MAR for the unnamed tributary is shown in Table 4-3.

Table 4-3: Natural mean annual runoff (MAR) (from WR2012) at conveyor

Catchment	Area (km^2)	B11D MAR contributing rainfall (mm)	MAR from Pit Catchment (mill m^3)	Dirty water area (km^2)	MAR from dirty water (m^3)	Loss of MAR (%)
Pipeline	34	54	1.84	0	0	0

The effects of mining activity on the catchment MAR in which the pit extension is located, will be a reduction in MAR. The results for the localised investigation are shown in Table 4-4. The captured dirty water will result in a reduction of MAR of 45 900 m^3.

Table 4-4: Natural MAR (from WR2012) and loss of MAR due to dirty water containment

Catchment	Area (km^2)	B11B MAR contributing rainfall (mm)	MAR from Pit Catchment (mill m^3)	Dirty water area (km^2)	MAR from dirty water (m^3)	Loss of MAR (%)
Pit Extension	17.4	54	0.94	0.85	45,900	4.9

In the greater context, the pit extension is located within quaternary catchment, B11B. The catchment area and the associated MAR are presented in Table 4-5. The reduction in MAR included in Table 4-5 was estimated using the runoff depth given in WR2012 (Midgley, Pitman and Middleton, 1994).

Table 4-5: Quaternary natural MAR (from WR2012) and loss of MAR due to dirty water containment

Catchment	B11B Area (km^2)	B11B MAR contributing rainfall (mm)	MAR from B11B (mill m^3)	Dirty water area (km^2)	MAR from dirty water (m^3)	Loss of MAR B11B (%)
B11B	435	54	23.65	0.85	45,900	0.2

4.7 Resource class and river health Receiving water quality objectives and the reserve

An Intermediate Reserve Determination was done for the whole Olifants WMA in July 2001. The In stream Flow Requirements to cater for the basic human needs and the ecological environment were first determined for certain reference points (IFR sites) in the Olifants River WMA. The water quantity reserve for the IFR sites was used to determine the water quality reserve for the basic human needs and the ecological environment. The water quality reserve is termed the resource quality objectives. DCM East falls within the River Reach Segments 1-8 of the Upper Olifants River. The Olifants River is currently a Class C River in terms of the PES.

In 2015 the DWS released the proposed classes and resource water quality objectives of water resources for catchments within the Olifants River catchment in terms of Section 13 (1) (A) of the NWA. The WMA was divided into Integrated Units of Analysis (IUA). The IUA are classified in terms

of their extent of permissible utilisation and protection. According to the IUAs, quaternary catchment B11B is classified under Hydrological Node (HN) 1, (Olifants (confluence with Steenkoolspruit)) and B11D is classified under HN4, (Steenkoolspruit at the outlet of quaternary). Quaternary B11B is located within Resource Unit (RU) 1 and B11D, within RU4.

According to GN R619, there are no resource quality objectives that have been set for Resource Units 1 and 4 where the project is located. It must also be noted that the resource class objectives are not applicable to the DCM East operations as there is no discharge from the site to the receiving water resources.

4.8 Surface water user survey

Water use from the catchment comprises of the uses related to the Reserve, as well as the following uses:

- Agriculture;
- Industry (primarily related to the underground coal mining);
- Domestic (primarily related to water abstracted from Witbank dam for supply to urban areas); and
- Recreation on Witbank dam.

4.9 Sensitive areas survey: Wetlands

According to the wetland delineation and impact assessment conducted for the project, there is one freshwater resource, comprising three Hydro Geomorphic types (HGM) located along the proposed pipeline routes. The resource was characterised as an inland system (i.e. a system having no existing connection to the ocean but which is inundated or saturated with water, either permanently or periodically), located within the Highveld Aquatic Ecoregion. The applicable WetVeg group is the Mesic Highveld Grassland Group 4. The characterisation of this resource is summarised in Table 4-6 and shown in Figure 4-5 and Figure 4-7.

Table 4-6: Characterisation of the resources identified along the linear development.

Freshwater Resource	Level 3: Landscape unit	Level 4: HGM Type
Dorstfontein Wetland	Valley: The typically gently sloping, lowest surface of a valley.	Channelled valley bottom: A valley bottom wetland with a river channel running through it.
		Unchannelled valley bottom: A valley-bottom wetland without a river channel running through it.
	Slope: an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley.	Hillslope Seep: a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

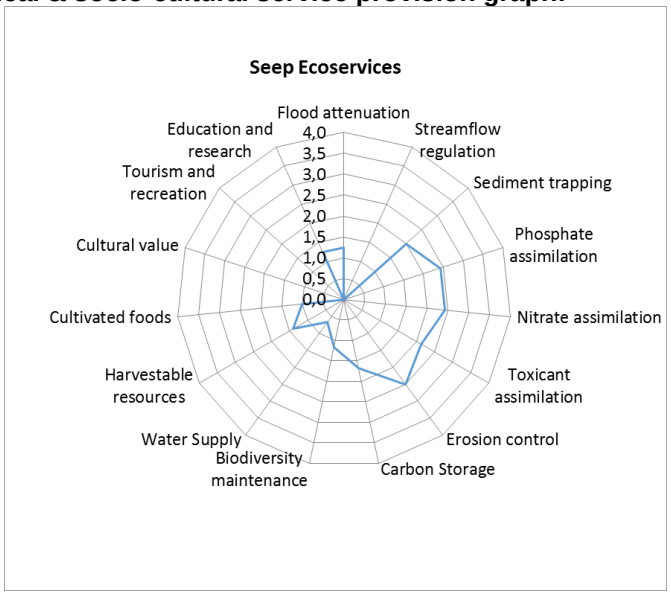
It was also noted during the site assessment that a number of small artificial dams have been excavated in some of the areas nearby the proposed linear development routes. Route 1 traverses one of these artificial dams, however the dam at the time of assessment was dry, with a portion of the dam wall broken, so that the dam is no longer functional and does not retain any water.

No wetlands were observed within the pit extension area, with this area being characterised almost wholly of agricultural land. However, a wetland system was observed approximately 120 m to the east of the proposed pit extension area. As such it must be noted that the extension pit may impact on this system.

Summaries of the findings of the field assessment in terms of relevant aspects (hydrology, geomorphology and vegetation components) of freshwater ecology are provided in **Table 4-7** to **Table 4-9**

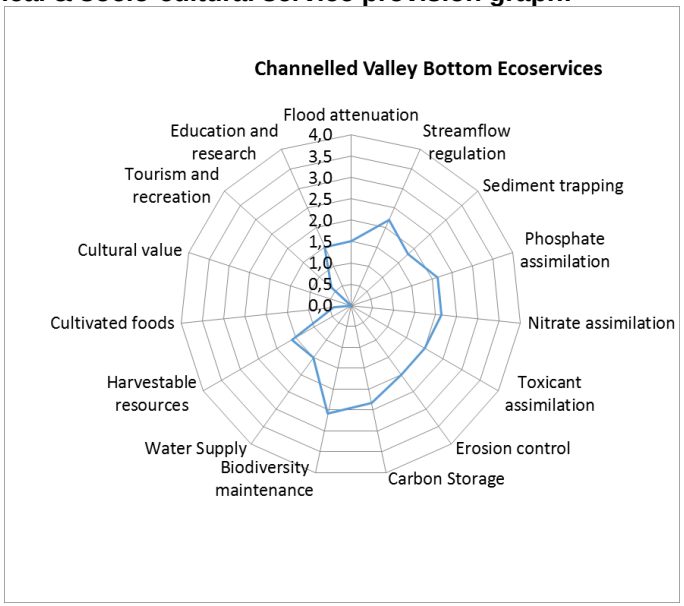
A full Wetland Delineation Report is attached as Appendix Q of the attached EIR which is attached to this report as Appendix C.

Table 4-7: Summary of the assessment of Hillslope Seep wetlands

<table>
<tr><td colspan="3">Resource: Hillslope Seep wetlands
Ecological & socio-cultural service provision graph:
 
</td><td colspan="4">  </td></tr>
<tr><td>Feature HGM Unit Description</td><td>Hillslope Seep</td><td>Fatal Flaw?</td><td></td><td>Photograph notes</td><td>Photos illustrating various seeps observed along the proposed linear development, as well as soil with mottling. Some of the seeps are located between agricultural lands (bottom left) and are dominated by alien vegetation. Less impacted seeps (bottom right) had a very low soil moisture content and are utilised for cattle grazing.</td></tr>
<tr><td>PES discussion</td><td colspan="2">PES Category: B
In general, the seeps observed are considered to be in a good condition, proving suitable habitat for floral and faunal species. Modifiers to these features include agricultural activities and an increase in alien vegetation due to edge effects from surrounding farming and mining activities. The ecological integrity and hydrology of this feature may degrade as a result of erosion and increased sediment deposition should mitigation measures not be adhered to during the construction of the linear development.</td><td colspan="4">Watercourse characteristics:
a) Hydraulic regime
The hydraulic regime of the seep wetlands have been altered as a result of current impacts related to crop cultivation and soil disturbance activities. A number of dirt roads and cultivated lands are located alongside the hillslope seep wetlands, which as a result have impacted upon the natural hydrological regime. Following such, there is now an increased potential of water ponding in areas which may have previously been classified as terrestrial ecosystems. Many of the seeps observed were dry, possibly as a result of a loss of hydrological connectivity or as a result of the decreased water input into the systems from natural discharges (ground water, rainfall).</td></tr>
</table>

Eco service provision		**Intermediate**: Despite the modifications to the wetland and the subsequent effects on the ecological integrity thereof, the hillslope seeps are deemed to provide intermediate levels of ecological functioning, particularly in terms of nitrate, phosphate and toxicant assimilation.as well as erosion control. Whilst the vegetation community composition has been slightly altered from reference conditions, the structure and basal cover is nevertheless deemed to be adequate for the provision of certain ecological services. The hillslope seeps however are not considered important for education and research purposes or for water supply for human use.	**b) Water quality** No water was observed within the seeps at the time of assessment. However, the water quality is presumed to be of a moderate to moderately high quality. No waste water discharge from local sewage works into the wetland systems was observed, however water runoff from the agricultural lands containing chemicals and fertilizers is likely to impact upon the water quality, the water.
EIS discussion		**EIS Category C:** Although the ecological integrity of the wetland has been compromised to a degree, sufficient habitat remains at a reasonable level of integrity to retain ecologically important processes. Furthermore, species such as Asio *capensis* (Marsh Owl) and *Sagittarius serpentarius* (Secretarybird) were observed foraging within the seep wetlands. Evidence of the small carnivore species *Leptailurus serval* (serval) were also observed, with the tall grass structure providing suitable hunting habitat for this species. In conclusion, the hillslope seep wetlands are considered to be of moderate ecological importance and sensitivity.	**c) Geomorphology and sediment balance** It was apparent during the field assessment that several modifiers have impacted upon the geomorphology of the hillslope seeps, notably the ploughing of agricultural fields and presence of dirt roads. These modifiers have resulted in hard surfaces (roads) around the HGM allowing for greater water and sediment runoff into the water, as well as increased sediment loads from the loose soils of the ploughed fields.
REC Category		**Category C:** This feature is considered to be ecologically moderately intact. This REC category indicates that management measures should be implemented to ensure that present levels of ecological services and functioning of this feature are retained and are not permitted to deteriorate further.	**d) Habitat and biota** Since the assessment took place in late autumn, some floral species with a spring/summer flowering season could not be identified, and some species may have already entered a period of dormancy The majority of this feature is well vegetated, however, areas of the temporary zones have been ploughed and utilised for crops. Alien plant proliferation is evident in a number of the hillslope seeps that are in close proximity to agricultural lands, with a stands of Populus x canescens, Salix babylonica and Tagetes minuta observable. Nevertheless, several indigenous graminoid species were identified, including Eragrostis curvula, Eragrostis gummiflua, Imperata cylindrica and Cirsium vulgare, indicating that although vegetation communities have been impacted upon, the alterations are not deemed severe. Faunal species such as Asio capensis (marsh owl) and Sagittarius serpentarius (Secretarybird) were observed, indicating that the seep wetlands are still viable and utilised by faunal species.
Impact significance prior to mitigation	**M H**	The hillslope seep wetlands will be impacted upon as a result of the linear development. Impacts could alter the habitat and sensitivity of the system. Therefore, impacts will be of “medium high” level without mitigation measures. However, if mitigation measures are implemented, impacts will be of “low” level.	**Business case, Conclusion and Mitigation Requirements:** Although much of the area has been ploughed or is being mined out, there has been notably intermediate levels of disturbance to the seep wetlands. These wetlands still provide suitable habitat and good vegetation cover for floral and faunal species. Potential impacts on the wetland arising from the proposed linear development include increased erosion potential, disturbances to vegetation (and therefore reduced capacity to perform certain functions) and an increased proliferation of alien invasive flora as a result of disturbances to the soils. Although the ecological integrity of the feature has been compromised as a result of the surrounding farming activities, the feature is not considered severely modified, and further degradation should not be permitted. Strict enforcement of mitigation to prevent further impacts on the feature during all phases of the proposed development must take place.
Impact significance post mitigation	**L**		

Table 4-8: Summary of the assessment of Channelled Valley Bottom wetlands

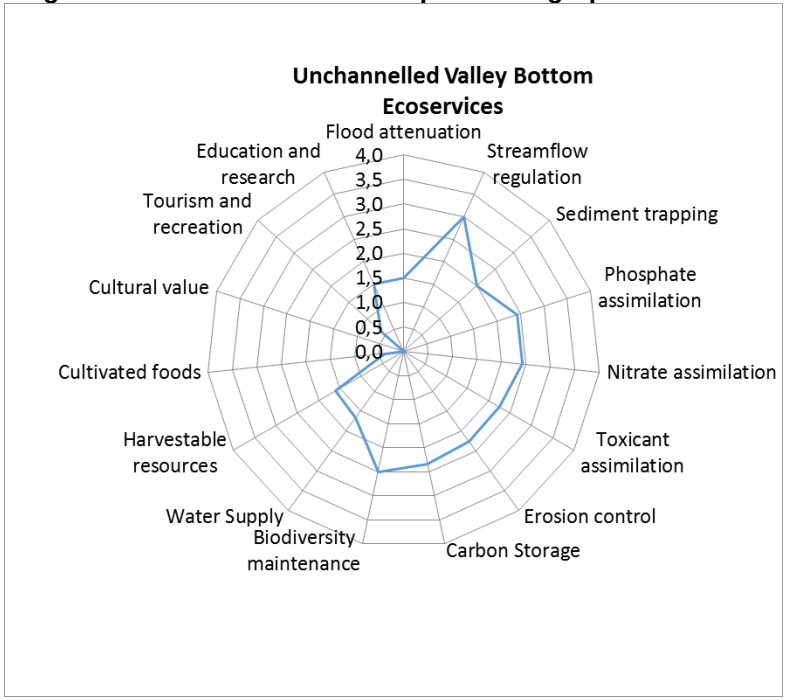
<table>
<tr><td colspan="3">Resource: Channelled Valley Bottom wetland
Ecological & socio-cultural service provision graph:
 
</td><td colspan="4">  </td></tr>
<tr><td>Feature HGM Unit Description</td><td>Channelled Valley Bottom</td><td>Fatal Flaw?</td><td></td><td>Photograph notes</td><td>Top: Surface water present within the wetland feature.
Bottom: Alien plant species (Salix babylonica) growing in one of the smaller channelled valley bottom wetlands.</td></tr>
<tr><td>PES discussion</td><td>PES Category: C
The channelled valley bottom wetland is considered to be in a moderately modified condition. The wetland provides suitable habitat for floral and faunal species, with specific mention of Asio capensis (Marsh Owl) and Crinum spp. The surrounding agricultural activities and grazing of the wetlands is the primary system modifier, which has also resulted in an intermediate increase in alien vegetation proliferation. Should suitable mitigation measures not be implemented, it is probable that the ecological integrity and hydrology of this feature will degrade.</td><td colspan="4">Watercourse characteristics:
a) Hydraulic regime
The channelled valley bottom intercepted by the proposed linear development forms part of a much larger wetland system. A number of in-stream farm dams are located further upstream and within a few of the smaller tributaries. These small farm dams are likely to aid in the attenuation of flood waters but also possibly decrease the base flows in the valley bottom channels during the dryer winter months.</td></tr>
</table>

<table>
<tr><td>Eco service provision</td><td colspan="2">Intermediate: Despite the large scale agricultural practices and coal mining activities occurring within the vicinity of the features, the channelled valley bottom wetlands do not appear to have been heavily impacted upon by the surrounding modifying activities. However, some areas appear to have been subject to an increased grazing regime, most likely attributed to the dry conditions currently being experienced. The channelled valley bottom wetlands are considered of high importance in terms of biodiversity maintenance, carbon storage and streamflow regulation. Nitrate and phosphate assimilation are also considered to be important. Not considered important for cultivated foods, cultural values or tourism and recreation.</td><td>b) Water quality
The water quality within the wetland feature is likely to be in a good state. Although surface water was only observed within certain sections of the channelled valley bottom, the water that was present had a very low turbidity. With the exception of additional nutrients being added to the water from the surrounding agricultural areas, there are no waste water inputs into the wetland system. Mining activities are not likely to have a large impact upon the channelled valley bottom wetlands assessed, as the wetlands are on an opposite catchment divide to the current mining area.</td></tr>
<tr><td>EIS discussion</td><td colspan="2">EIS Category B: This feature has undergone marginal changes to ecosystem processes. Although there is large scale crop farming and mining activities occurring alongside the larger wetland system, natural habitat of the wetland is predominantly intact and capable of supporting a number of faunal and floral species. This feature is considered ecologically important and sensitive.</td><td>c) Geomorphology and sediment balance
Geomorphology of the channelled valley bottom wetlands is considered to be largely natural, with minimal impacts as a result of the surrounding crop lands, dirt roads and the small artificial farm dams found further up the system. Windblown dust and surface soil runoff from the surrounding dirt roads and crop fields are likely to increase the sediment balance of the channelled valley bottom wetland.</td></tr>
<tr><td>REC Category</td><td colspan="2">Category B: This feature is considered to be ecologically moderately intact. This REC category indicates that management measures should be implemented to ensure that present levels of ecological services and functioning of this feature are retained and are not permitted to deteriorate further.</td><td>d) Habitat and biota
The majority of this feature is well vegetated, with little to no evidence of vegetation clearing taking place. Although there were a small number of areas where alien plant species such as Salix babylonica were observed growing, the majority of the vegetation within the feature is considered to be natural, with species such as Cyperus rupestris and Imperata cylindrica being observed. The faunal species Asio capensis (marsh owl) were observed within this feature, as well as a number of other smaller avifaunal species. The channelled valley bottom is also likely to provide hunting grounds and corridors for movement to species such as Canis mesomelas (blackback jackal) and Leptailurus serval (serval).</td></tr>
<tr><td>Impact significance prior to mitigation</td><td>MH</td><td rowspan="2">The channelled valley bottom wetlands will be impacted upon as a result of the linear development. Impacts could alter the habitat and sensitivity of the system. Therefore, impacts will be of “medium high” level without mitigation measures. However, if mitigation measures are implemented, impacts will be of “low” level.</td><td rowspan="2">Business case, Conclusion and Mitigation Requirements:
The wetland is considered to be moderately modified, and thus still provides essential ecological services, including habitat provision for various fauna and wetland associated flora. Potential impacts on the wetland arising from the proposed linear development include increased erosion potential, disturbances to vegetation (and therefore reduced capacity to perform certain functions) and an increased proliferation of alien invasive flora as a result of disturbances to the soils. Although the ecological integrity of the wetland has been compromised, the wetland is not considered severely modified, and further degradation should not be permitted. Strict enforcement of mitigation measures to prevent further impacts on the wetland during all phases of the proposed development must take place. It is highly recommended that directional drilling is utilised in order to lay the pipes under the wetland systems in order to minimise impacts.</td></tr>
<tr><td>Impact significance post mitigation</td><td>L</td></tr>
</table>

Table 4-9: Summary of the assessment of Unchannelled Valley Bottom wetlands

Resource: Unchannelled Valley Bottom wetland

Ecological & socio-cultural service provision graph:



Feature HGM Unit Description	Unchannelled Valley Bottom	**Fatal Flaw?**		**Photograph notes**	Photos illustrating the Unchannelled valley bottom wetland found to the east of the mine encountered along route 3. The wetland is extensive with some areas inundated with water. Vegetation such as *Typha capensis* was noted throughout the feature, whilst soils encountered showed strong signs of hydromorphy.
PES discussion	**PES Category: C** The close proximity of mining and agricultural activities has impacted upon the hydrology, geomorphology and vegetation characteristics of the wetland. The overburden dumps from the mine have encroached upon the wetland, increasing sediment deposition as well as altering water inputs into the wetland, which has decreased the ecological integrity of the wetland feature. Due to	**Watercourse characteristics:** **a) Hydraulic regime** The hydraulic regime of the wetland has been altered as a result of historical and current modifiers, notably from the surrounding mining and agricultural activities. Historical impacts include the placement of flow-altering infrastructure such as an old earthen dam wall located within the wetland which has resulted in decreased water flow downstream. Current impacts on the hydrology of the system primarily relate to the increased water runoff from the surrounding mining areas as water permeability is decreased in these areas. Further,			

	disturbances to the soil profiles, vegetation communities have been transformed and the presence of alien invasive species has increased.		upstream of the feature are a number of small earthen dams which have also altered the overall hydrological regime of the system.
Eco service provision	**Intermediate:** Considered of high importance for stream flow regulation, due to the overall width, surface roughness and low gradient of the feature. Similarly, the wetland feature is considered important for phosphate, nitrate and toxicant assimilation as well as biodiversity maintenance and carbon storage. Not considered important for any tourism or recreational activities, or delivering any cultivated foods.		**b) Water quality** Water quality was deemed to be good, no waste water input is occurring, however as a result of the artificial dam structure and subsequent water retention, there is an increased level of rotting plant mass present, however no strong odours suggesting sewage input were detected.
EIS discussion	**EIS Category C:** This feature has undergone marginal changes to ecosystem processes. Although there is large scale crop farming and mining activities occurring alongside the wetland system, natural habitat of the wetland is still considered to be relatively intact and capable of supporting a number of faunal and floral species. This feature is considered ecologically important and sensitive, forming part of a much larger wetland system both up and downstream.		**c) Geomorphology and sediment balance** Impacts on the geomorphology of the wetland are predominantly driving by the local mining and farming activities, as well as a number of dirt roads in the vicinity of the wetland feature. Increased sedimentation of the wetland has occurred as a result of runoff from the crop fields and overburden dumps, however due to the wetland being well vegetated the system has been able to capture and control the increased sediment levels.
REC Category	**Category C:** This wetland is considered to be of a moderate ecological level. This REC category indicates that construction activities associated with the linear development should be properly managed and adequate mitigation measures should be implemented to ensure that present levels of ecological services and functioning of this feature are retained and are not permitted to deteriorate further.		**d) Habitat and biota** Alien vegetation was observed within the wetland feature, however the degree of alien plant proliferation is low, with most of the vegetation in the wetland being natural wetland species. The inundated areas of the wetland are primary amphibian habitat, whilst a number of waterfowl were also observed, whilst spoor of Canis mesomelas (blackback jackal) were also observed along the periphery edges of the feature.
Impact significance prior to mitigation	**MH**	The Unchannelled valley bottom wetlands will be impacted upon as a result of the linear development. Impacts could alter the habitat and sensitivity of the system. Therefore, impacts will be of “medium high” level without mitigation measures. However, if mitigation measures are implemented, impacts will be of “low” level.	**Business case, Conclusion and Mitigation Requirements:** The features is considered to be moderately modified, thus are still capable of providing essential ecological services, including fauna and flora habitat provision, trapping of sediments and management of storm water flows. Potential impacts on the wetland arising from the proposed linear development include increased erosion potential, disturbances to vegetation (and therefore reduced capacity to perform certain functions) and an increased proliferation of alien invasive flora as a result of disturbances to the soils. Although the ecological integrity of the wetland has been compromised, the wetland is not considered severely modified, and further degradation should not be permitted. Strict enforcement of mitigation to prevent further impacts on the wetland during all phases of the proposed development must take place.
Impact significance post mitigation	**L**		

4.10 Groundwater

The following section describes the geo-hydrological conditions around the immediate surrounding of the proposed Pit 1 extension. This information was extracted from the geo-hydrological study conducted for the project. The report can be found in Appendix J of the attached EIR which is attached to this report as Appendix C.

4.11 Aquifer characterisation

The conceptual Geohydrological model of the area used is based on the generally accepted model for the Mpumalanga coal fields. Three principal aquifers were identified: the weathered aquifer; the fractured Karoo aquifer; and the fractured pre-Karoo aquifer. The Karoo rocks are not known for the development of aquifers but occasional high yielding boreholes may be present. The aquifers that occur in the area can therefore be classified as minor aquifers (low yielding), but of high importance.

According to WRC report 291/1/98, three distinct superimposed groundwater systems are present within the Olifants River Catchment. They can be classified as:

- The upper weathered Ecca aquifer (shallow aquifer formed in the weathered zone of the Karoo sediments and which is locally perched on the fresh bedrock);
- The fractured aquifers within the unweathered Ecca sediments; and
- The aquifer below the Ecca sediments (deeper aquifer formed by fracturing of the Karoo sediments and dolerite intrusions).

These types of groundwater systems are common to the groundwater regime that characterises a Karoo environment. The systems do not necessarily occur in isolation of one another; more often than not forming a composite groundwater regime that is comprised of one, some, or all of the systems. Good hydraulic connectivity often exists between the two top aquifers and they have consequently been treated as a single unit in the modelling of groundwater flow. Intrusion-related systems are also often characterised by discrete and/or erratic development.

The weathered aquifer is perched and occurs at depths of 0 – 15 metres below ground level (mbgl). The lower 5 to 10 meters of the perched aquifer is saturated due to the impervious nature of the competent, horizontally stratified lithology of the underlying Vryheid Formation, which occur at depths of 5 – 15 mbgl. The saturated depth of this aquifer is dependent on rainfall recharge, thus influx of water into a bord and pillar or opencast mining operation is also expected to vary seasonally. Highly variable recharge occurs over the area, but generally values are between 1 and 3% of the Mean Annual Precipitation (MAP) (GCS (Pty) Ltd, 2016).

4.11.1 Shallow Weathered Aquifer

The Ecca sediments consist of in-situ weathered material and transported material with a thickness which varies between 5 to 15 meters below surface in the area surrounding the DCM. The upper aquifer is associated with this weathered zone and water is often found within a few meters below surface. This aquifer is recharged by rainfall.

Rainfall that infiltrates the weathered rock soon reaches an impermeable layer of shale underlying the weathered zone. The movement of groundwater on top of this shale is lateral and in the direction of the surface slope. This water reappears on surface at fountains where the flow paths are obstructed by a barrier, such as a dolerite dyke, paleo-topographic highs in the bedrock, or where the surface topography cuts into the groundwater level at streams.

The aquifer within the weathered zone is generally low-yielding (range 100 – 2000 l/h) because of its insignificant thickness. Few farmers therefore tap this aquifer by borehole. Wells or trenches dug into

the upper aquifer are often sufficient to secure a constant water supply of excellent quality (GCS (Pty) Ltd, 2016).

4.11.2 Fractured Karoo Rock Aquifer

The pores within the Ecca sediments are too well cemented to allow any significant permeation of water. All groundwater movement is therefore along secondary structures, such as fractures, cracks and joints in the sediments. These structures are better developed in competent rocks such as sandstone, hence the better water-yielding properties of the latter rock type.

Of all the un-weathered sediments in the Ecca, the coal seams often have the highest hydraulic conductivity. Packer testing of the No. 2 seam and underlying Dwyka tillite has hydraulic conductivity distribution.

In terms of water quality, the fractured Karoo aquifer always contains higher salt loads than the upper weathered aquifer. These higher concentrations are attributed to the longer contact time between the water and the rock. The occasional high chloride and sodium levels are attributed to boreholes in the vicinity of areas where salts naturally accumulate on surface, such as pans and some of the fountains.

4.12 Groundwater Quality

The groundwater study found that the main potential on –site contamination sources for Dorstfontein East are the opencast and underground mine workings and the co-disposal facility, and to a lesser extent the PCD's, coal stockpile and plant area. Groundwater samples were collected from six hydro-census boreholes. Sample analyses results were compared to the South African National Standard (SANS) 241:2011 Class 1 water quality standards for drinking water. No measured parameters exceeded the SANS standards. In DTNM18 the nitrate concentration of 8.03 mg/l was slightly elevated, exceeding 50% of the SANS standard of 11 mg/l.

It can be concluded that the groundwater quality measured in third party boreholes is of good quality when compared to drinking water standards. There is no indication that mining activities are impacting on the groundwater quality in these boreholes (GCS (Pty) Ltd, 2016).

Groundwater monitoring results indicate that there is a sulphate plume localized down gradient of the co-disposal facility (GCS (Pty) Ltd, 2016).

4.13 Hydro-census

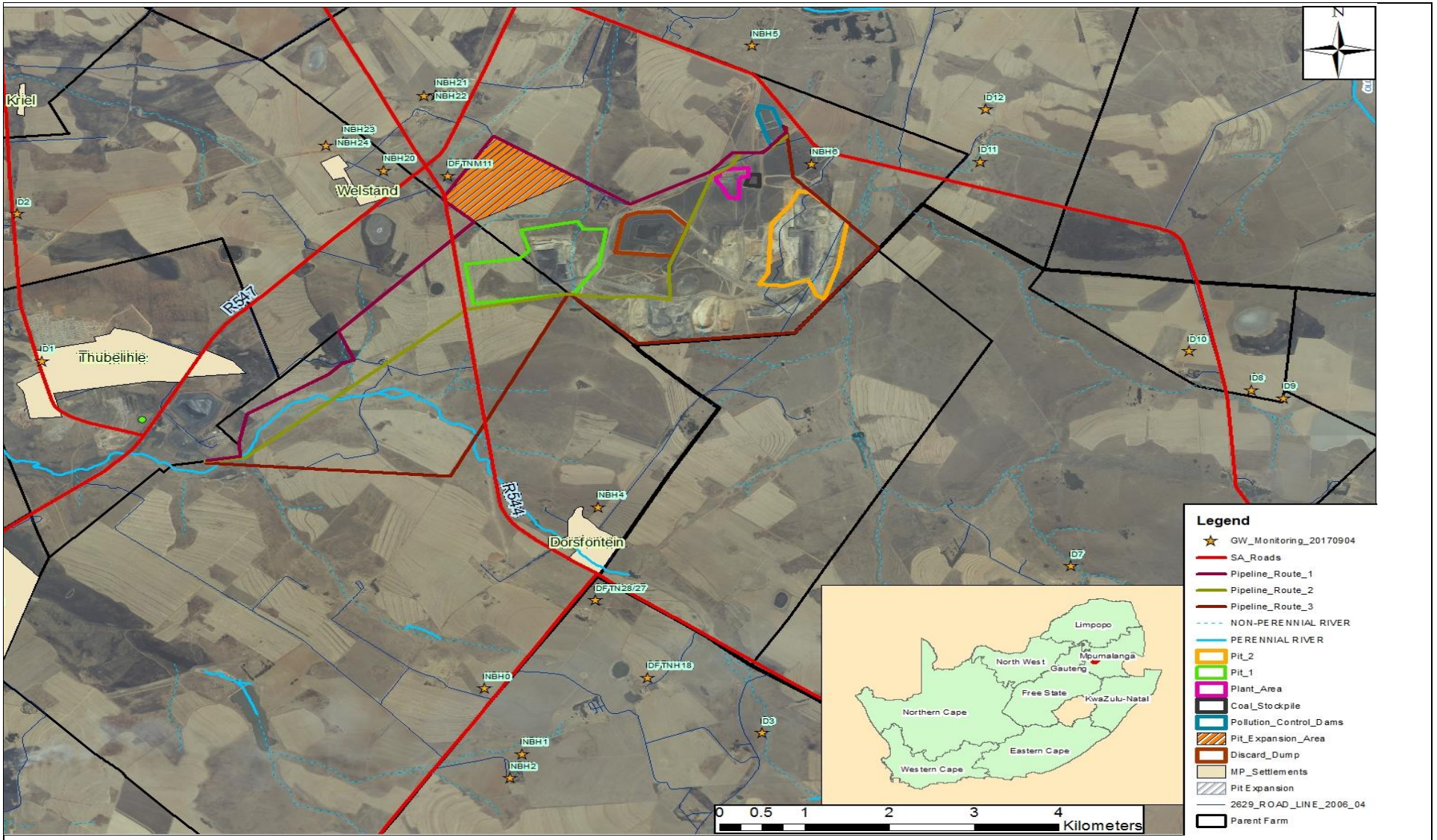
A hydro-census was conducted within a 5 km radius of the Dorstfontein West and East workings. A total of 26 boreholes were visited. The purpose of the hydro-census was to update regional groundwater users and hydrogeological information. The scope of this task included the following:

- Identify/update all water users within this surrounding area;
- Obtain GPS locations all production boreholes, monitoring boreholes, and springs;
- Verify the general status of boreholes;
- Update the groundwater user information, including purpose of abstraction, abstraction rates etc.; and
- Take hydrogeological field measurements (static water levels and borehole depths).

All of the data collected during both of the hydro-census investigations were captured and analysed. The location of the boreholes is shown on Figure 4-5. Information pertaining to water use of the 26 boreholes is shown below:

- 21 boreholes were used for domestic, stock watering purposes and irrigation;
- 3 boreholes were dormant/not in use;

- 2 boreholes, owned by ECC and BHP Billiton respectively, are used for monitoring purposes; the borehole owned by ECC is still part of the current monitoring network.



srk consulting	**PIT EXTENSION AND PIPE CONSTRUCTION** Groundwater Monitoring Locations	Project No 599507

Figure 4-5: Groundwater Monitoring Locations

4.14 Potential pollution source identification

The following facilities / areas have the potential to contaminate the ground water as a result of mining activities:

- Opencast Pits;
- PCDs;
- Stockpile Areas;
- Storage of waste; and
- Washing of equipment (grease).

The impact on the groundwater quality will be due to mobilisation of chemicals through the ground to reach the groundwater. The oxidation of the pyrite present in the coal seam and the roof and the floor of the underground mine workings will lead to the formation of Acid Mine Drainage (AMD) and an increase in Total Dissolved Solids (TDS) as the acidification is countered by the neutralising potential of the local geology.

4.15 Groundwater model

The objective of the model is to simulate groundwater ingress into the mine operations. Scenario modelling is typically used to run future scenarios on varying changes in the natural environment or anthropogenic inputs. The potential scenarios to be simulated using the Dorstfontein regional model include the following:

- Determine or confirm decant points for the Dorstfontein East operations;
- Determine short-term and long term pollution (post-closure) potential of the co-disposal facility and conduct necessary tests for such determination; and
- Determine the quantity and quality of water that might decant from the underground working post-closure also the timing of such decant.

The numerical model for the project was constructed using the Groundwater Modelling System (GMS) 10.0.5, a pre- and post-processing package for the modelling code MODFLOW. MODFLOW is a modular three dimensional groundwater flow model developed by the United States Geological Survey (Harbaugh et al., 2000). MODFLOW uses 3D finite difference discretisation and flow codes to solve the governing equations of groundwater flow. MODFLOW NWT (Niswonger et al., 2011) was used in the simulation of the groundwater flow model. Both are widely used simulation codes and are well documented.

The numerical modelling was undertaken in a number of steps, as detailed below.

4.15.1 Model construction and calibration

Model set-up and calibration involved the following:

- Model construction during which the model boundaries were identified and quantified, the project sub-catchment was discretized into a model grid, time steps were allocated and error criteria for heads and the water balance was set;
- Calibration of a flow model refers to a demonstration that the model is capable of reproducing field-measured heads and flows which are the calibration values;
- Calibration was achieved when a set of parameters, boundary conditions and stresses are found that produce simulated heads that match field measured data. This is a crucial step in the modelling project, which will aid in ensuring that model results are reliable; and
- Following calibration the model was used to simulate various scenarios for future mining and infrastructure development at the site.

4.15.2 Scenario modelling

Scenario modelling is typically used to run future scenarios on varying changes in the natural environment or anthropogenic inputs. Mine dewatering, rebound of water levels after mining ceased and contaminant transport (potential pollution plumes) will be simulated.

The deliverables from the modelling phase of the project include a calibrated groundwater flow and contaminant transport model. The results of the modelling will provide:

- The extent of potential dewatering;
- Potential impact on surrounding groundwater users;
- Groundwater inflows and decant positions and volumes; and
- Potential contaminant plumes that may originate from the mining areas or waste storage facilities (co-disposal facility, etc.).

4.15.3 Dewatering

The forward predictions show that the dewatering of the separate opencasts and underground mines will create a drawdown cone in the area surrounding the mining areas. As the pits and the underground voids increase in size, the cone of drawdown caused by the dewatering of the pits extends, with a maximum extent in 2027 as can be seen in Figure 4.30. As the mined out underground voids and opencasts start filling with water after 2032 the groundwater levels in the area will rebound. Groundwater levels are simulated to recover to pre-mining conditions within 35 years after the end of life (2032) of the DCM East mine. The following deductions were made:

- The water levels could be lowered over a relative large area around and in between the mining areas.
- As the pits and the underground voids increase in size, the cone of drawdown caused by the dewatering of the pits increases with a maximum extent in 2027. As the mined out underground voids and opencasts start filling with water after 2032 the groundwater levels in the area will rebound.
- There are several monitoring boreholes in the potential affected area that currently experience a decline in water levels of 5m or more. Two privately owned boreholes are in close proximity of the opencasts, namely NBH6 and NBH20. NBH6 is an old windpump and is not in use. NBH20 is in use as a communal well but has been dry since the beginning of 2014 according to locals. However, monitoring boreholes DFTNM11 and DFTNM12 are located close to NBH20 but show no impact on groundwater levels. Therefore it is not likely that NBH20 is impacted upon by the dewatering at DCM East. It is not expected that the dewatering activities will impact negatively on existing privately owned boreholes.

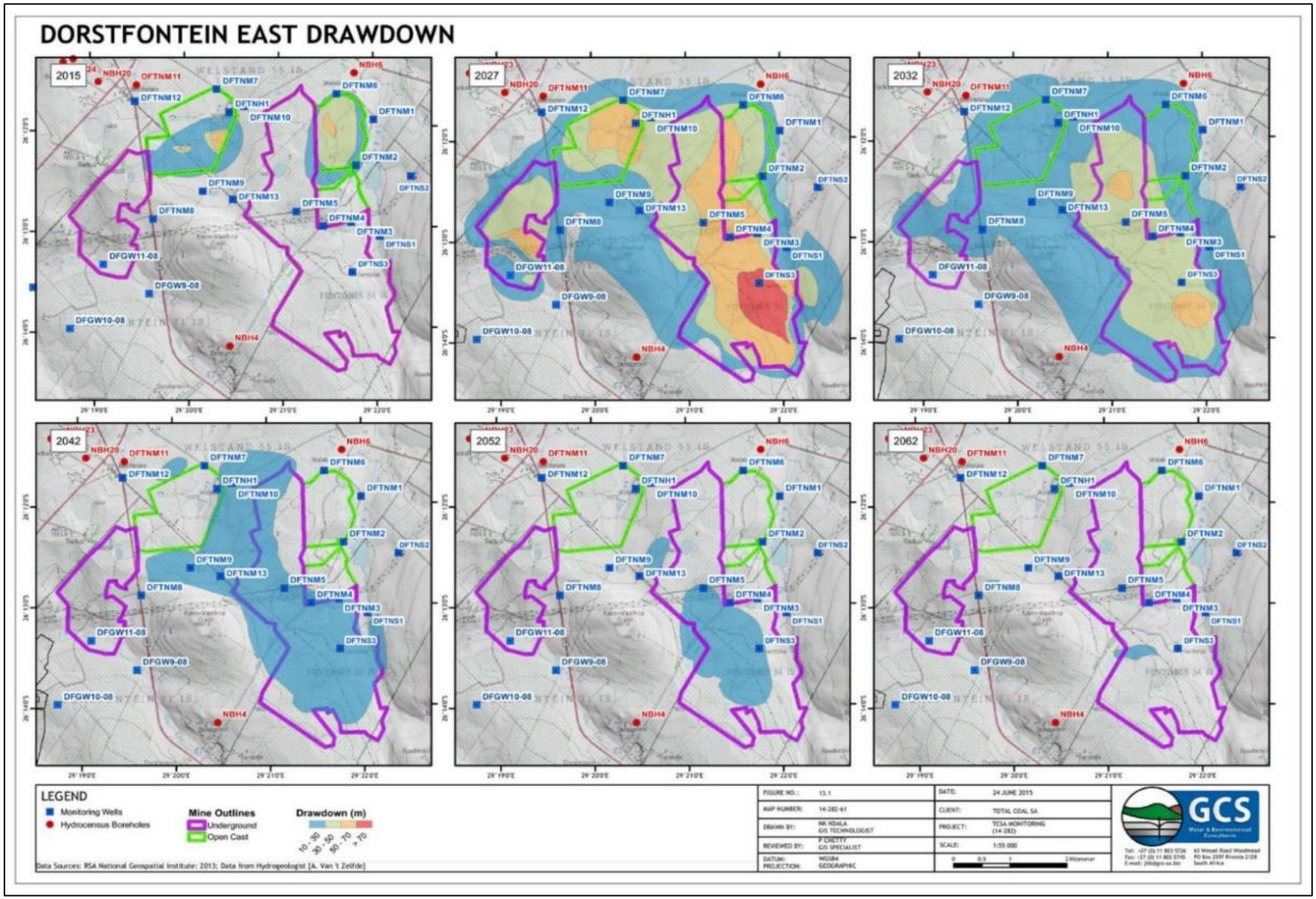


Figure 4-6: Modelled Drawdown at DCM East

4.15.4 Mine Inflow Volumes

The model shows that the inflow during the opencast mining increases between 2014 and 2017 from approximately 600 m^3/d to 1 000 m^3/d mainly due to the increase in size of the mined areas. Between 2017 and 2021, the underground 4 seam mining starts which increases the total groundwater inflow to approximately 1 500 m^3/d. The groundwater inflow increases significantly between 2021 and 2025 to approximately 3 500 m^3/d due to the increasing extent of underground mining of the deeper 2 seam. Between 2025 and 2029 the inflow decreases as in 2027 mining of the deeper 2 seam stops and the increase in mining area per year reduces. After 2029 the inflows are relatively stable around 800 m3/d.

It is important to view these volumes for the water make of the mine in relation to natural evaporation. Evaporation will take place over the whole area of the opencasts, and will remove large amounts of water, especially in the dry season.

4.15.5 Contamination of the Surrounding Aquifer

Operational Phase

The life of mine for the existing and proposed mining at DCM East is planned up to 2033. This allows sufficient time for chemical reactions to take place in the mined out areas, overburden dumps and other potential pollution sources to produce Acid Rock Drainage (ARD) conditions. Groundwater flow directions will be directed towards the mining areas due to the mine dewatering.

Therefore contamination will be contained within the mining area, and little contamination will be able to migrate away from the mining area. The water return dam and PCDs are lined, thereby preventing contamination of the underlying aquifers. The mine residue consisting of overburden and plant residue is stored as overburden dumps. The fine and coarse waste materials from the pits are stored in a Co-disposal facility.

Contamination from the mining areas is predominantly contained within the mining areas. It is furthermore evident that boreholes DFTNH1 and DFTNM10 have been impacted by contaminants related to the mining activities. These impacted monitoring boreholes are likely affected by sulphate emanating from the co-disposal facility.

Post Closure Phase

Once the mining has ceased, ARD is still likely to form given the unsaturated conditions in the facility and contact of water and oxygen through natural processes including rainfall. Therefore groundwater contaminant plumes are likely to migrate from the mining areas once the water level in the rehabilitated pits have reached long term steady state conditions (i.e. each pit water level has reached the decant level). The contaminant plumes emanating from the rehabilitated opencasts will have a cumulative impact on the groundwater quality as seen in the post mining simulations (Figure 4-9 andFigure 4-10). The migration of contaminated water from the opencasts has been simulated for 50 and 100 years after colliery closure (i.e. it is assumed that all opencast have been rehabilitated and backfilled). Experience has shown that the plume stagnates after about 80-100 years, and no further movement after such time is expected.

The contaminant plume emanating from the western opencast and the co-disposal facility will move in a northerly direction towards the Olifants River (maximum distance from the mining area is approximately 500 m). The contaminant concentration is likely to increase over time as the plume develops. Shallow contaminated seepage may impact on the non-perennial tributaries to the Olifants River. This impact is however likely to be moderate.

One private borehole, NBH6, located in the fractured Karoo aquifer is likely to be impacted upon based on the impact simulations. However, this borehole does not seem to be in use.

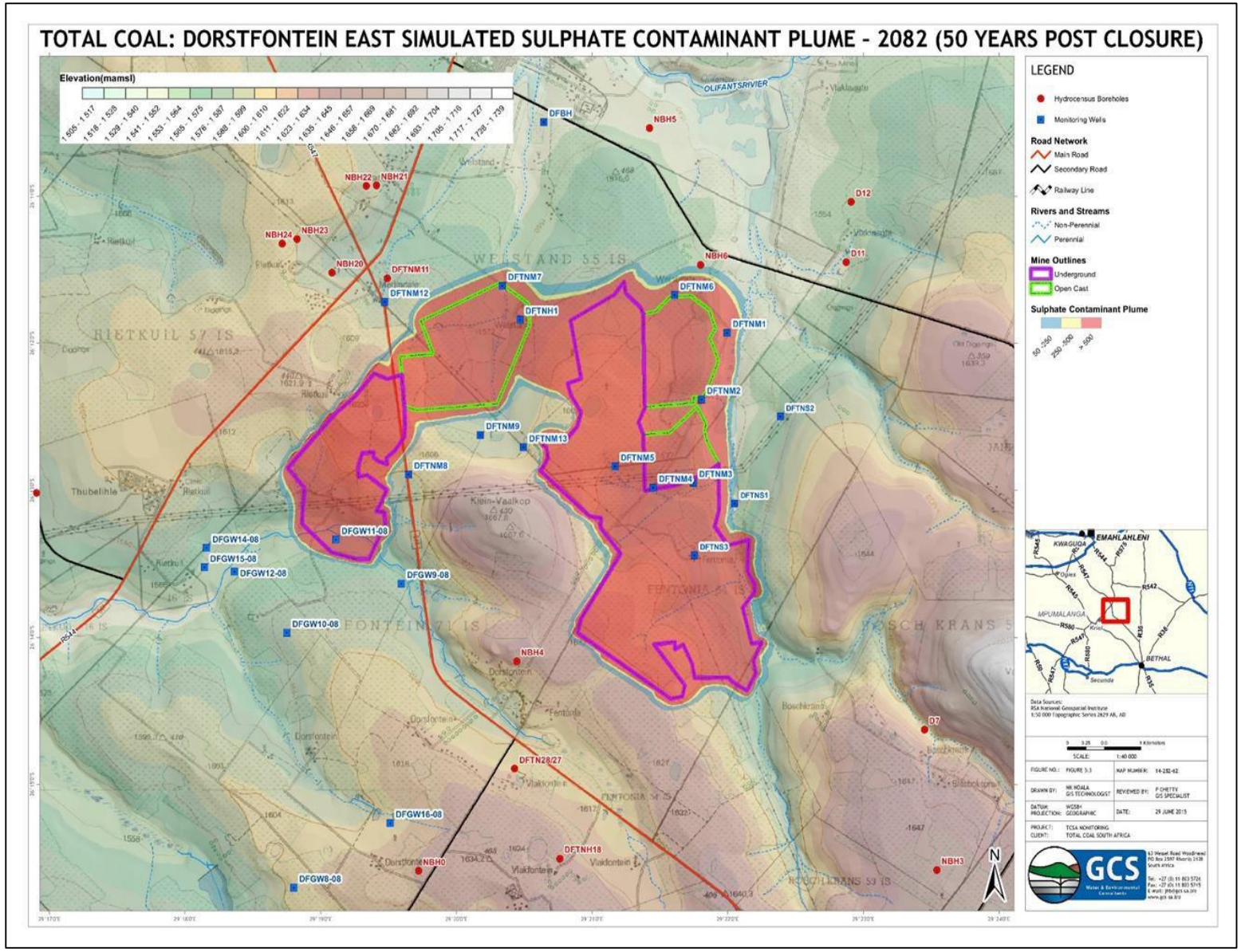


Figure 4-7: Sulphate Plume 50 years post closure

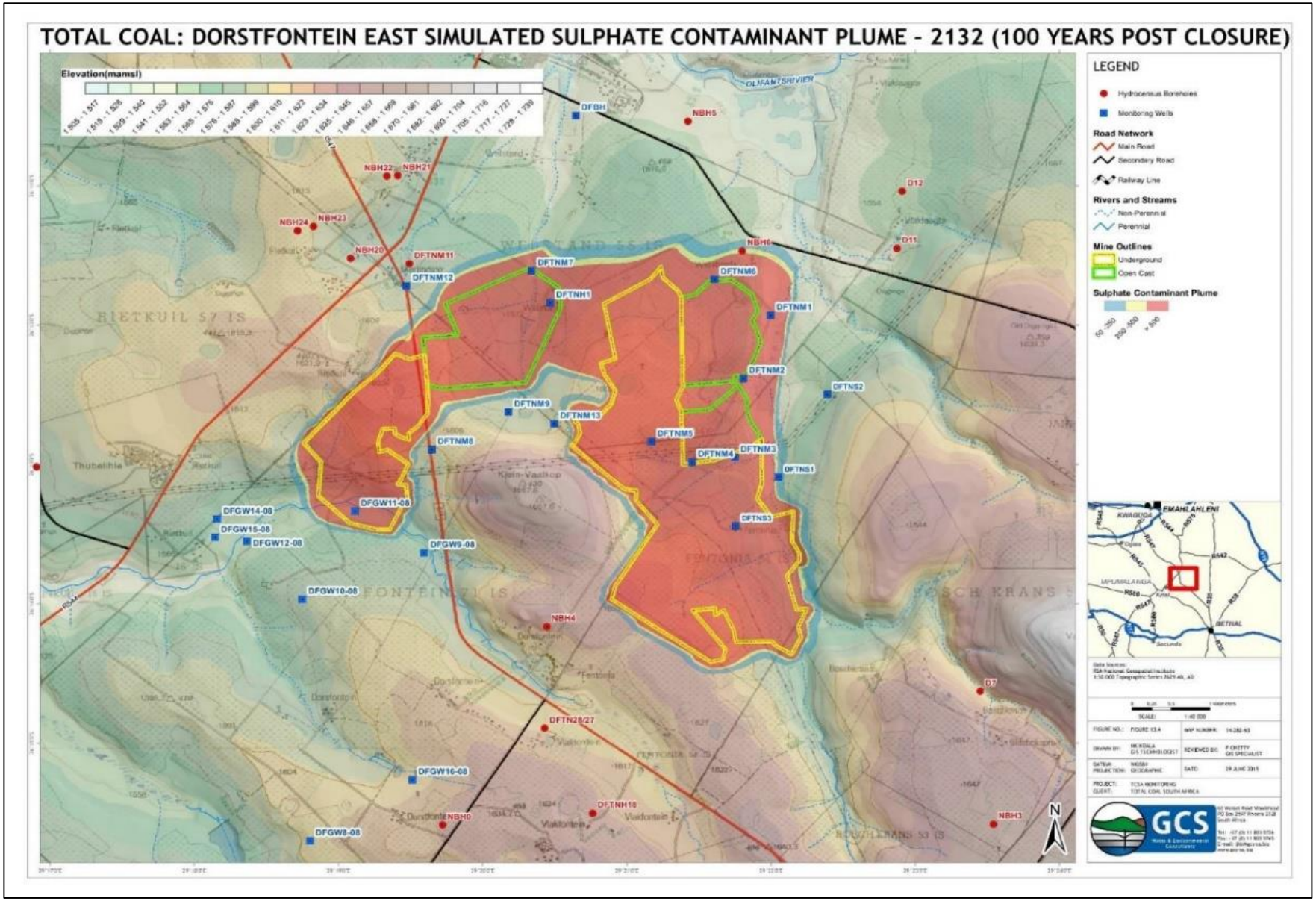


Figure 4-8: Sulphate Plume 100 years post closure

4.15.6 Decant

For open pit mining, the decant point can be established as the lowest topographical point of the pit outline at the end of life of mine. When dewatering from the opencast mining has ceased, the groundwater level will tend to recover to pre-mining conditions. Decant will occur when the groundwater level recovers to above the lowest surface elevation of the pit. The decant points were determined for each pit as provided in Figure.

The calculations show that the time-to-decant ranges between approximately 25 and 150 years. Decant volume calculations show discharge rates of between approximately 91 and 585 m3/d. However, decant discharge rates could be higher if the underground blocks stay interconnected with the opencasts.

Decant from Pit 1 will flow towards the western tributary of the Olifants River. The proposed decant from Pit 2 and 3 flow towards the eastern tributary of the Olifants River. The calculated volumes and quality of the potential decant indicates a high impact on the water quality of the Olifants River and the tributaries on the site.

To reduce the impact on surface water quality a water treatment plant may be needed to increase the water quality emanating from the opencast areas.

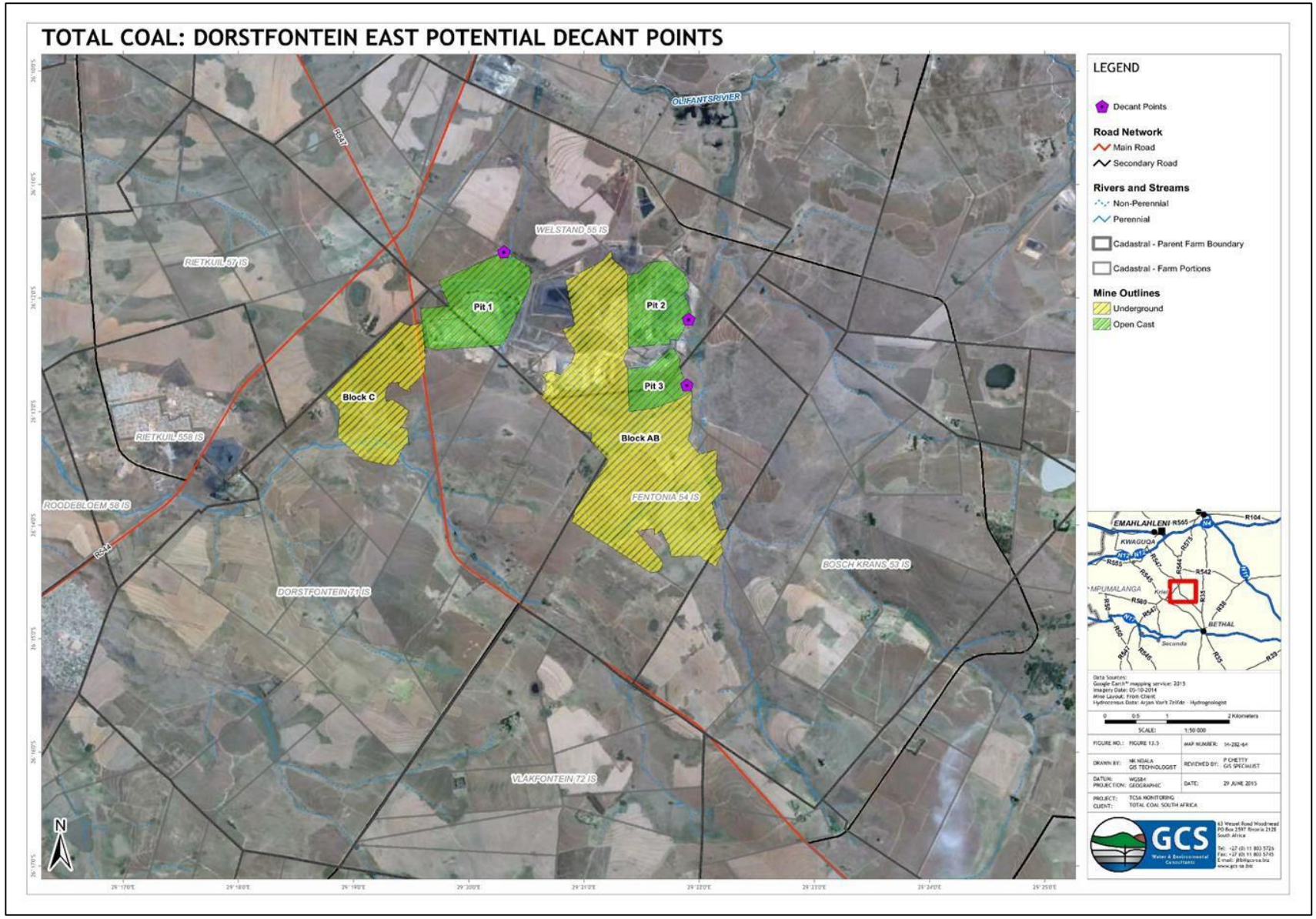


Figure 4-9: Potential Decant Points at DCM East

4.16 Socio-economic environment

This section provides an overview of the existing socio-economic environment in and around the proposed project area. The socio-economic information provided in this section is a summary of the information provided in the Socio-Economic Impact Assessment Report. Please refer to Appendix S of the attached EIR.

4.16.1 Regional Environment

EMalahleni Local Municipality has a population density of 148 people per km², and as per Table 4-10 ((Stats SA, 2016) and population growth rate of 3.6% between 2001 and 2011. The EMalahleni Local Municipality's population density is nearly two times higher than that of the Nkangala District Municipality, which has a density of 78 people per km².

A similar pattern is evident for the growth in the number of households, with EMalahleni Local Municipality and Nkangala District Municipality showing a growth of 3.6% and 2.6% respectively from 2001 to 2011. The size of households had decreased, and was at 3.2 persons per EMalahleni Local Municipality household in 2011. If the EMalahleni Local Municipality population continues to grow at or above 3.6% per annum, the following issues identified in the EMalahleni Local Municipality 2016/17 Integrated Development Plan will continue to be exacerbated:

- Growth in formal settlements and back rooms (it is estimated that 10 000 people reside in these);
- Water supply to informal settlements costing about R 800 000 per month and the residents are not contributing to the cost of these services;
- Strain on water, sanitation, electricity and roads resulting in quality and capacity problems;
- Increase in unemployment particularly amongst the youth and unskilled; and
- Issues of crime, prostitution and drug abuse.

From 2001 to 2011, the number of formal dwellings in the EMalahleni Local Municipality, the Nkangala District Municipality and Mpumalanga Province had increased by 23.1%, 9.3% and 20.0% respectively.

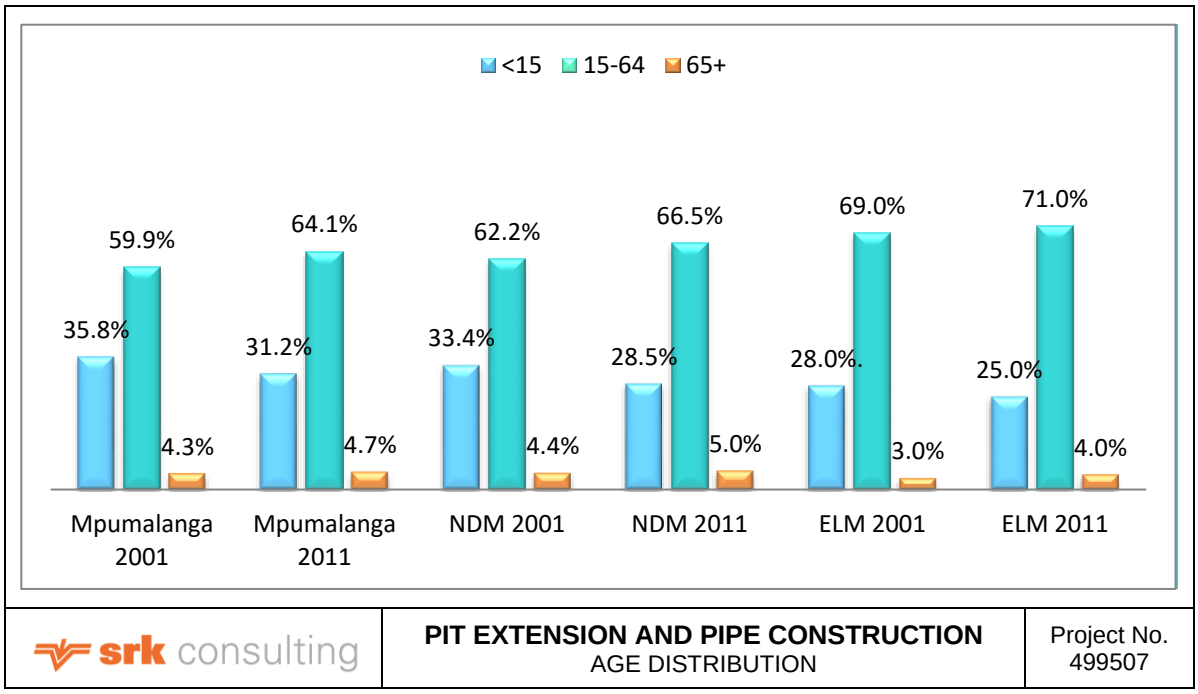
Table 4-10: Key Socio-Demographic Information

Variable	Mpumalanga Province	Nkangala District Municipality	EMalahleni Local Municipality
km²	76 495	16 758	2 678
2001 population	3 365 554	1 018 422	276 413
2011 population	4 039 939	1 308 129	395 466
% growth between 2001 and 2011	0.9	2.5	3.6
2001 households	785 424	245 429	74 917
2011 households	1 075 488	356 911	119 874
% increase from 2001 to 2011	20.0	9.3	23.1
Average household size 2011	3.8	3.4	3.2
% Female headed households 2011	40.0	36.0	27.9
% Formal dwellings 2001 and 2011	68.5 and 83.8	74.8 and 82.8	67.1 and 77.2

Source: StatsSA, census 2011

Figure 4-10 shows a similar age distribution pattern for the Mpumalanga Province, Nkangala District Municipality and the eMalahleni Local Municipality, with the highest percentage of 15 - 64 year olds in EMalahleni Local Municipality. This group is considered to be the working age group. Figure 4-11

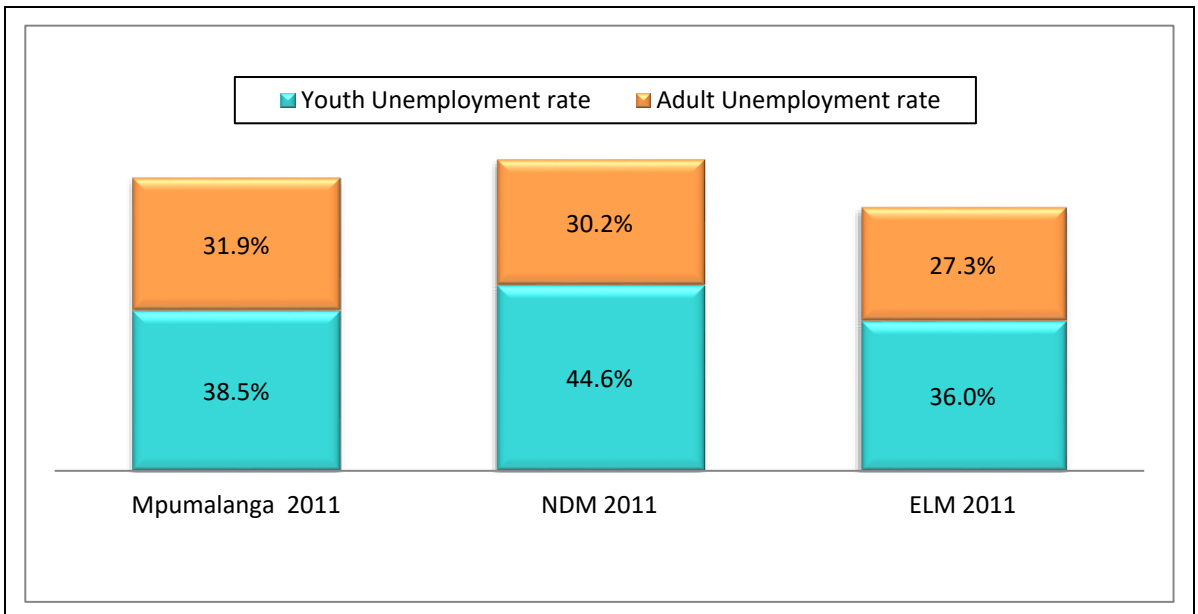
reflects the unemployment rate for the working age group and the youth (15-34). The unemployment rate for youth exceeds 40.0% and exceeds 30.0% for the working population.



srk consulting | **PIT EXTENSION AND PIPE CONSTRUCTION** AGE DISTRIBUTION | Project No. 499507

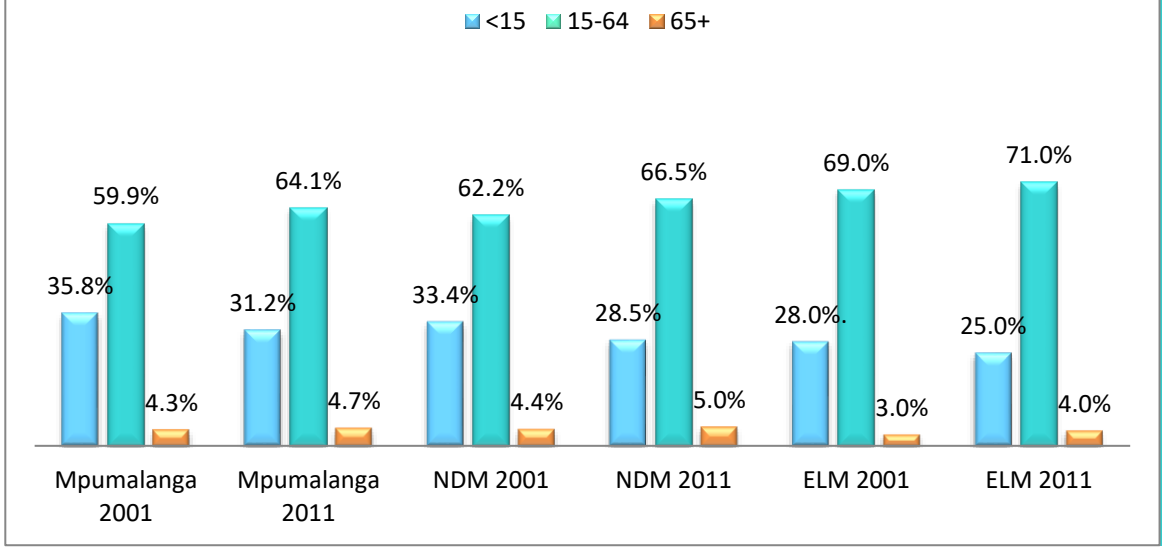
Figure 4-10: Age distribution

Source: StatsSA, census 2001 and 2011



srk consulting | **PIT EXTENSION AND PIPE CONSTRUCTION** UNEMPLOYMENT RATE | Project No. 499507

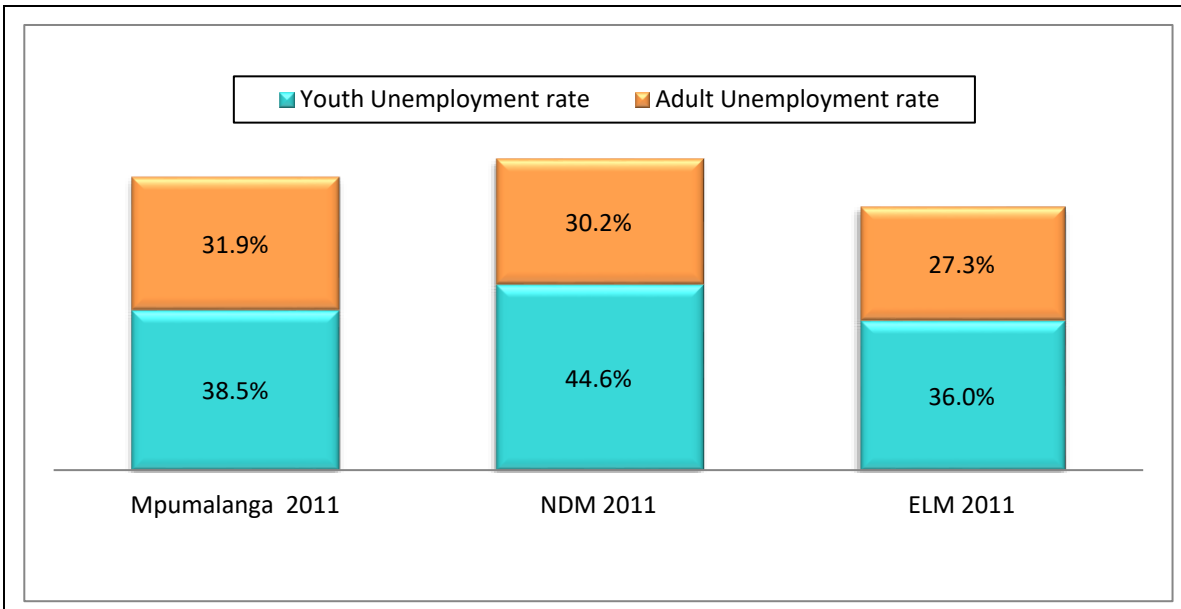
Figure 4-11: Unemployment rate



srk consulting	PIT EXTENSION AND PIPE CONSTRUCTIONAGE DISTRIBUTION	Project No. 499507

Figure 4-12: Age distribution

Source: StatsSA, census 2001 and 2011



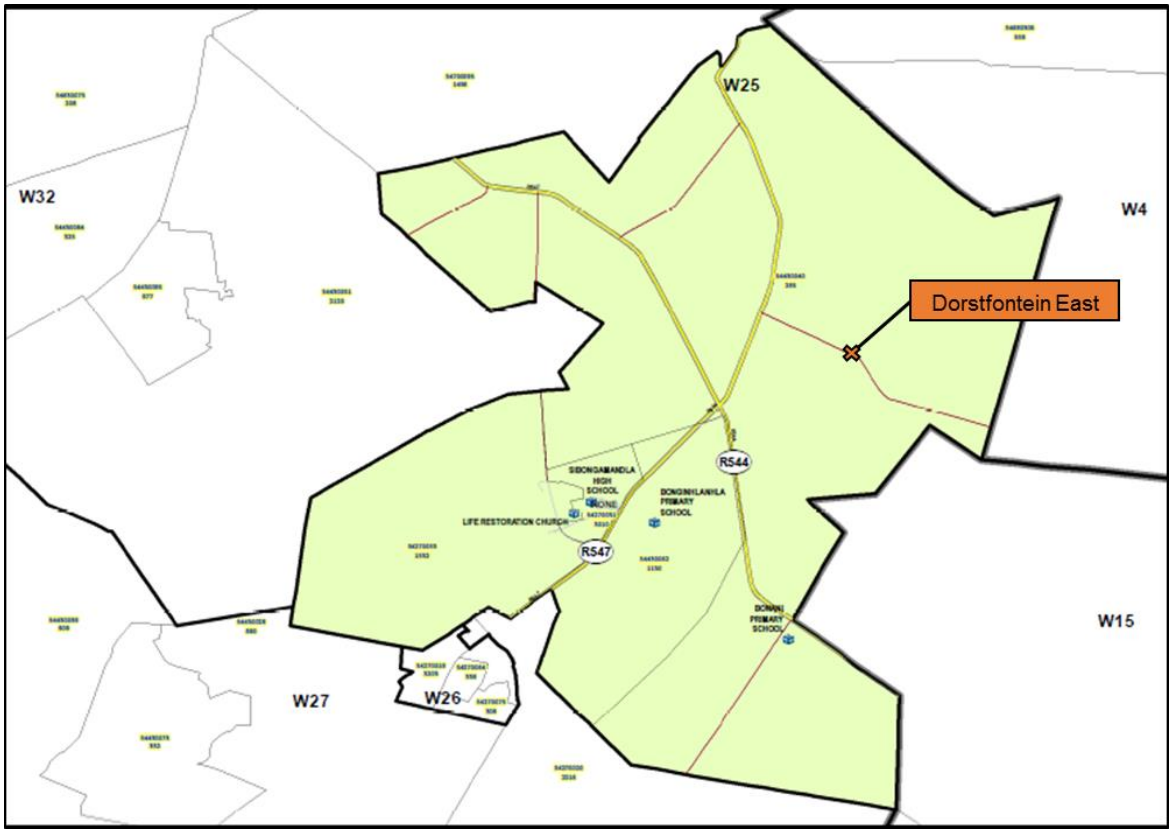
srk consulting	PIT EXTENSION AND PIPE CONSTRUCTION UNEMPLOYMENT RATE	Project No. 499507

Figure 4-13: Unemployment rate

Source: StatsSA, census 2001 and 2011

4.16.2 Project Specific Socio – Economical Environment

The project-affected socio-economic context is geographically determined to be located in Ward 25 of the eMalahleni Local Municipality (Figure 4-14). A baseline summary of key socio-economic information for the ward is provided in the sub-sections below.



srk consulting	PIT EXTENSION AND PIPE CONSTRUCTION WARD 25 LOCALITY MAP	Project No. 499507

Figure 4-14: Ward 25 locality map

4.16.3 Key Population Demographics

According to stats derived from StatsSA (see Figure 4-15), Ward 25 spans a geographical area of 219.7 km^2. It has a population of 14 938, with a median age of 25 and isiZulu (54.0%) being the most widely spoken language. The majority of the population is male (52.0%), and 76.0% of the population is currently residing in the ward were born in the Mpumalanga Province (Stats SA, 2016).

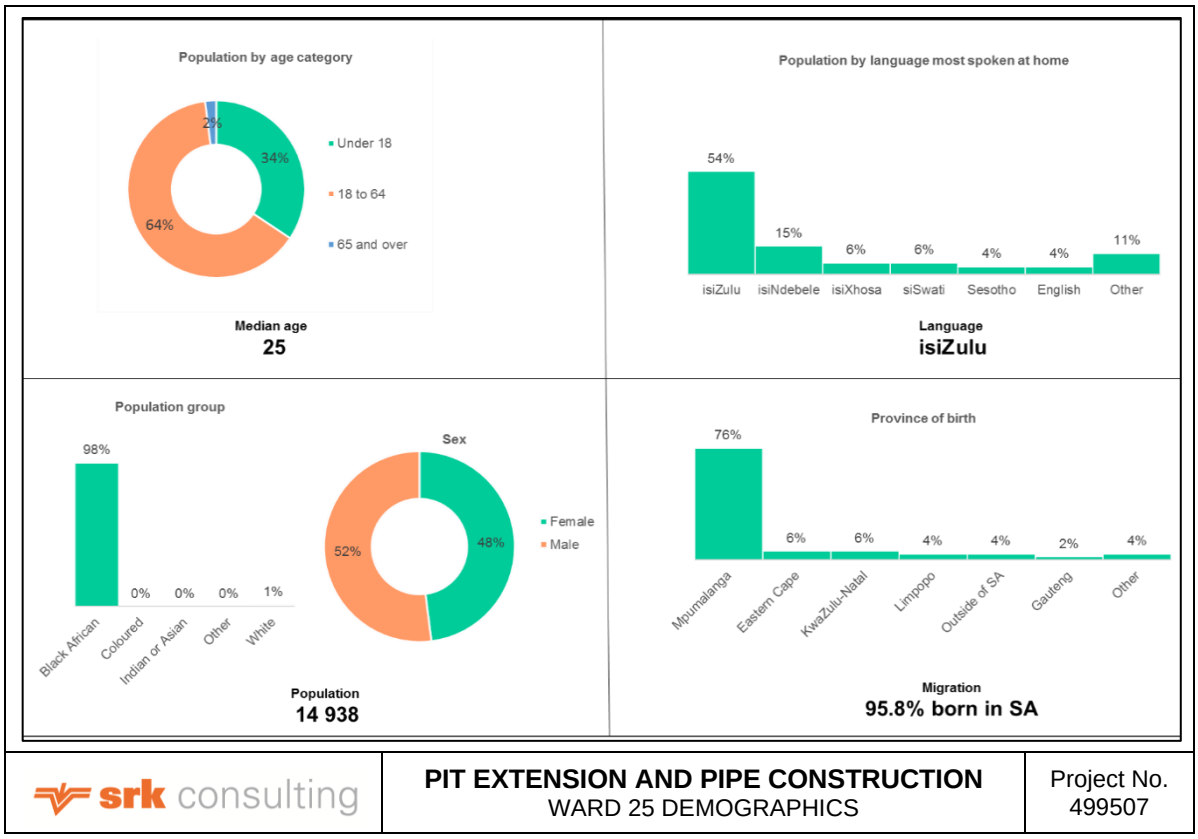


Figure 4-15: Ward 25 demographics

4.16.4 Key Household Information

Of the 4857 dwellings in Ward 25, 82.0% are considered to be formal, while 13.4% are informal (shack) dwellings. The majority of households are renters (41.0%), while 31.0% are owned and fully paid off. A significant amount of the households are female-headed (30.8%). These households, along with the 12 households that were identified as child-headed signify the presence of vulnerable groups in the study area (Stats SA, 2016).

The average annual household income in Ward 25 is R 29 400, signifying that a significant percentage of the population earn a low to moderate income. However, 13.0% of households do not earn a formal income, and would be reliant on subsistence lifestyles and grant systems. Like most surrounding wards, Ward 25 has developed around mining and energy generation activities, and as such those that are employed are often dependent on the mines for both income and social upliftment programmes (Stats SA, 2016).

See Figure 4-16 for a summary of household statistics for the study area.

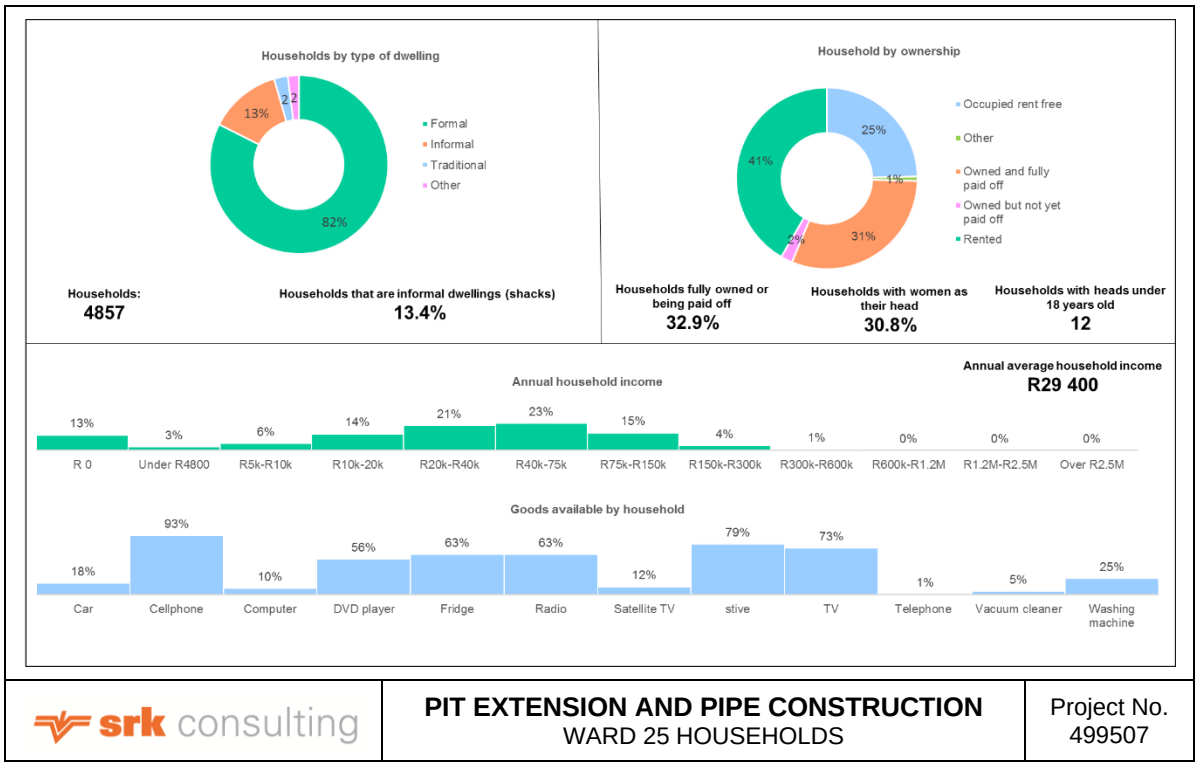


Figure 4-16: Ward 25 Households

4.16.5 Education

Education levels in the study area are lower than those in the province and district municipality. While 61.2% had competed Grade 9 or higher in the study area, the Nkangala District Municipality level was 65.3%, while the provincial level sat at 62.8%. The study area also demonstrates lower levels of students having completed Matric or tertiary education. The province recorded 37.5% of students having achieved matric or higher, Nkangala District Municipality 38.3% and the study area 27.1%. However, the statistics representing those having not received any formal education is the same as Nkangala District Municipality (1.0%) and lower than that of the province (14.0%) (Stats SA, 2016).

The reasons for low education levels in the study area could be attributed to the lack of educational infrastructure, transport restrictions and access to funding. Sustaining livelihoods, which require children to leave school early so as to help with work around the house and earning an income, also contribute to lower education levels in peri-urban parts of the country. This theory is supported by the fact that an estimated 15.9% of 15-17 year olds in the study area are in the labour force, which is significantly higher than the rate in both Mpumalanga (11.7%) and Nkangala District Municipality (11.5%) (Stats SA, 2016).

See Figure 4-17 for a summary of education levels in the study area.

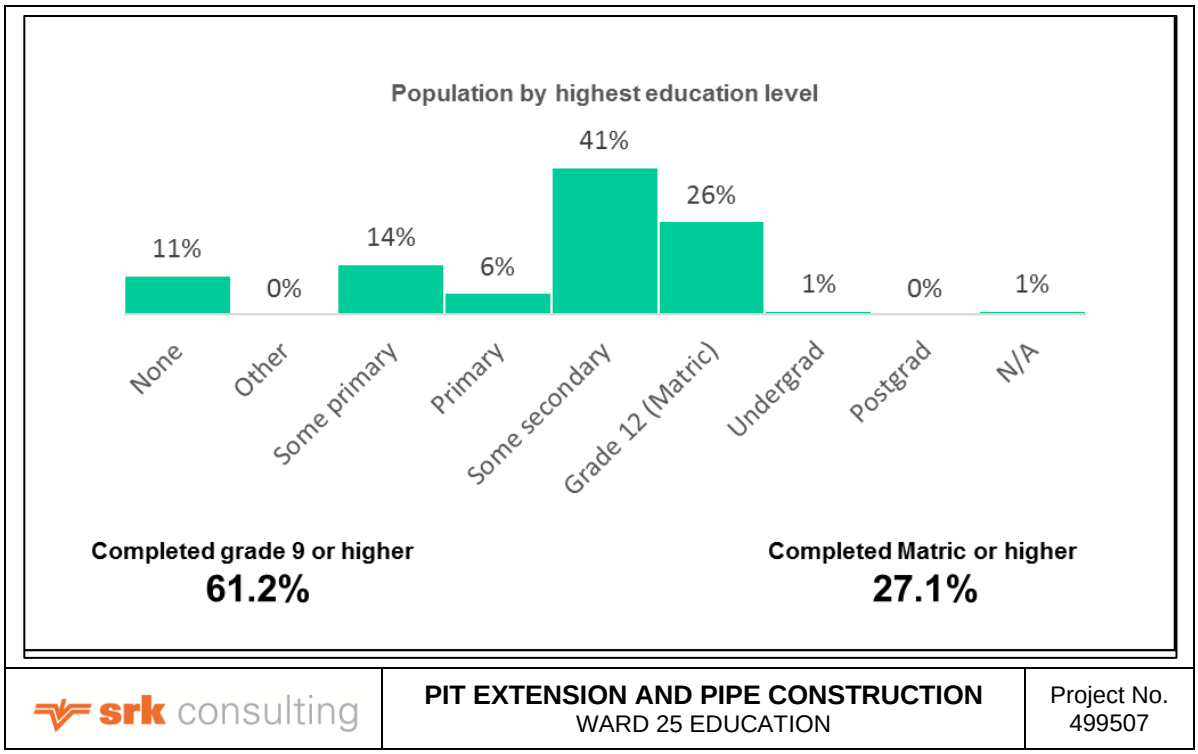


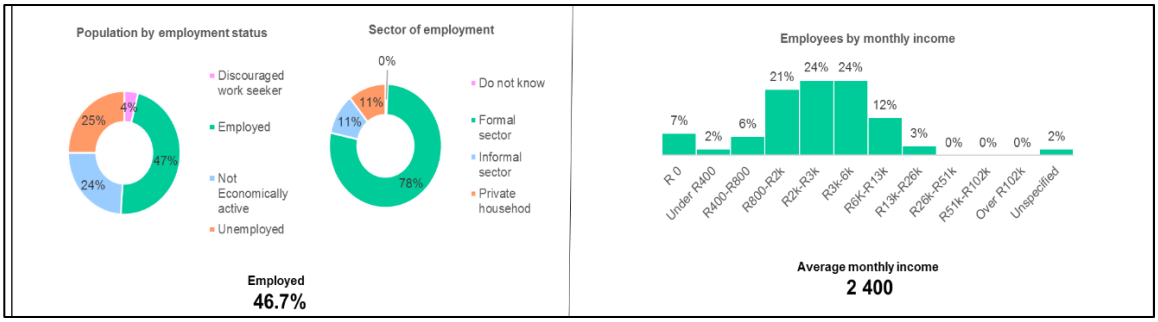
Figure 4-17: Ward 25 Education

4.16.6 Socio-economic Profile

See Figure 4-18 for a summary of socio-economics in the study area. The employment rate in the study area (46.7%) is superior to both Nkangala District Municipality (40.7%) and the province (37.5%). However, unemployment levels in the study area (25.0%) are poor when compared with those of the Nkangala District Municipality (18.0%) and the province (17.0%). There is also a large percentage of the working population currently not economically active (24.0%). This would indicate high levels of dependency on household members who are employed and vulnerability to poverty where breadwinners cease to be employed (Stats SA, 2016).

Most of those employed are employed in the formal sector (78.0%), however as is the case in many parts of South Africa, the informal sector employs 11.0% of the working population in the study area. Specialist feedback from the area suggest that many small spaza shops were to be found, particularly around busy road intersections and close to mine and energy generation activities, where workers and contractors were the foremost customers.

Average individual monthly income in the study area was as per that in both the province and Nkangala District Municipality, around R2 400. This is low; but, considered to be above the World Banks' poverty line ($1 a day) and just above the South African minimum wage, which is currently R 2 340 a month. Low income averages here are associated with low skills levels and low skilled job-requirements in many of the mining operations in the wider study area surrounds (Stats SA, 2016).



srk consulting	**PIT EXTENSION AND PIPE CONSTRUCTION** WARD 25 ECONOMICS	Project No. 499507

Figure 4-18: Ward 25 economics

4.16.7 Service Delivery

See Figure 4-19 for a summary of service delivery in the study area. The status of service delivery to the study area is better than that in both the province and Nkangala District Municipality, however ongoing service delivery constraints and legacy reliance on industry and not the municipality for provision is an ongoing issue that remains unresolved.

While there are a significant number of people living in informal dwellings (shacks), the vast majority (80.0 %+) have access to formalised water, electricity, refuse and sanitation services. However, access to electricity is varied, whereby only 57.0% of households have access to electricity for cooking, lighting and heating and 12.0% do not have access to electricity at all. The study area demonstrates particularly good sanitation statistics, as only 8.0% of households make use of pit latrines and 90.0% have access to chemical and/or flushing toilets (Stats SA, 2016).

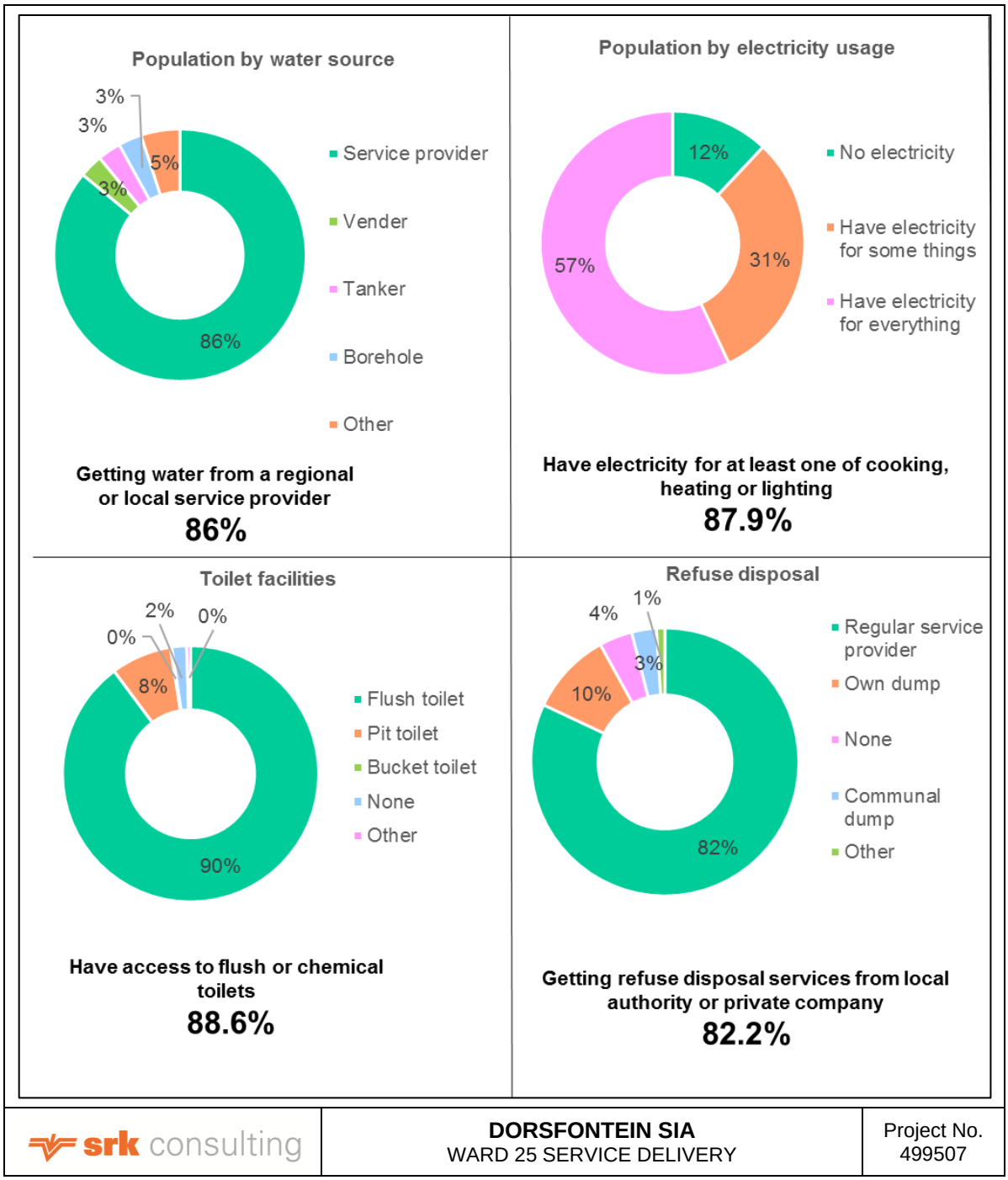


Figure 4-19: Ward 25 Service Delivery

5 Analysis and characterisation of the activity

5.1 Site delineation for characterisation

Please refer to Figure 1-2 for the extent of DCM East extension area, infrastructure and locality.

5.2 Water and waste management

5.2.1 Water Supply

The water requirements for the DCM East operations is sourced from:

- Groundwater from the old Transvaal Navigation Colliery (TNC) mine provides the start- up and further make-up water supply for the bulk process water supply. This water goes directly to the plant water reservoir/Erikson dam from where it supplied the mining sections as needed;
- Supplement water from the Return Water Dam (contains dirty storm water runoff from the plant and stockpile area, excess groundwater and rainwater seeping and falling into Opencast Pits 1 and 2, return water from the coal slurry and discard facility and excess groundwater removed to mine safely from the future underground sections). Water from the Return Water Dam is routed to the plant water reservoir/ Erikson dam as needed;
- Purified sewage effluent from the sewage plant at the DCM East operations. This water is routed to the plant water reservoir/Erikson dam; and
- Industrial make up water for the rail loop and conveyor is sourced from the current water supply to the existing DCM East Mine operations, where required, water is supplied through a 200mm water pipe from the East Mine area.
- The proposed pipeline will transport process water from Dorstfontein West to Dorstfontein East, and will assist ECC to optimise their water management.

5.2.2 Water Balance

SRK Consulting (SRK) was requested to prepare a water and salt balance for the DCME. The water and salt balance was undertaken as prescribed by the Best Practice Guideline G2: Water and Salt Balances by DWAF, 2007. The study included the workshops, offices and the pit. The average annual water balance is presented in Figure 5-1.

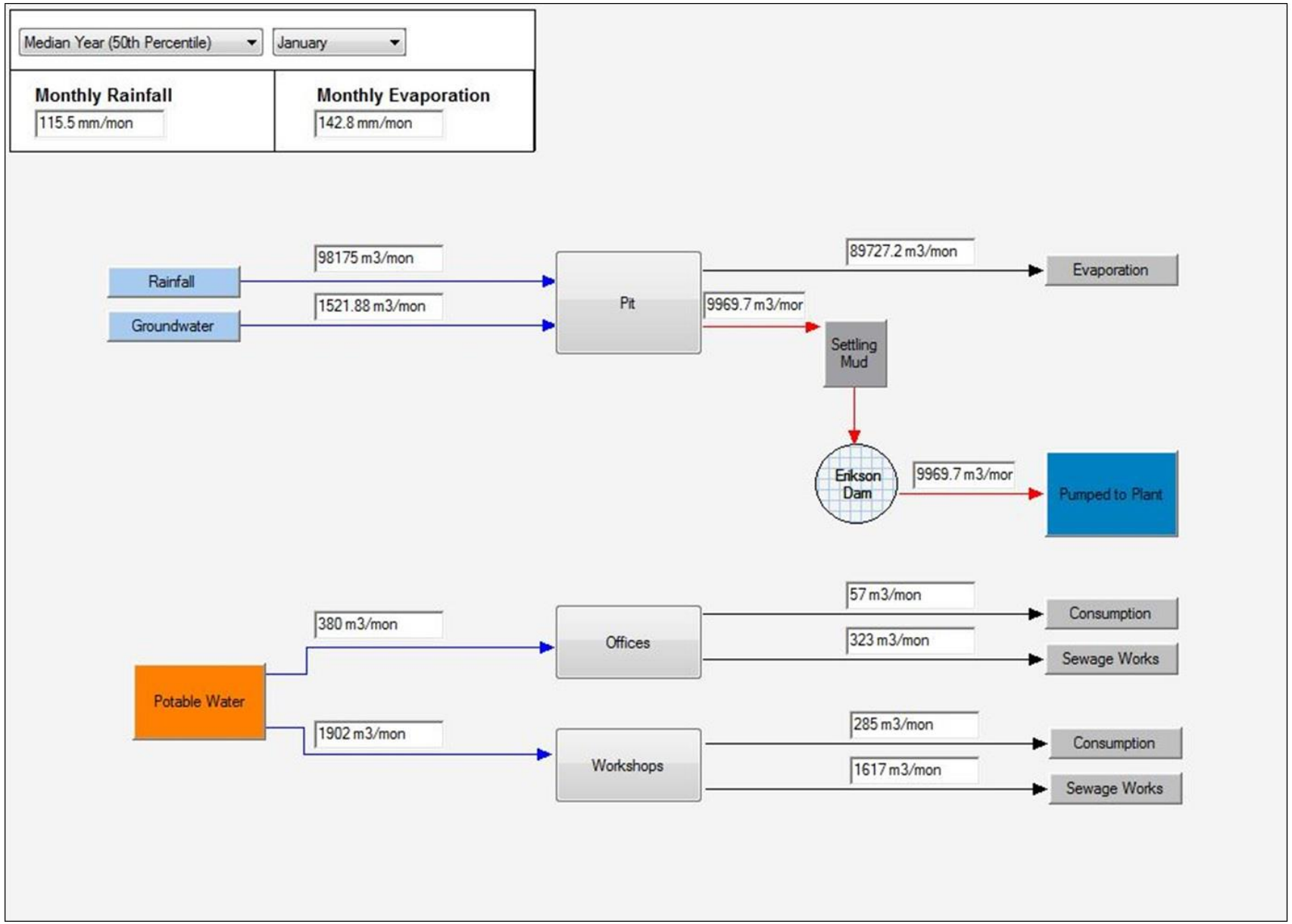


Figure 5-1: Annual average water balance

5.3 Process Water

Please refer to Section 5.2.1.

5.4 Storm water management

A hydrology study was conducted by SRK and a copy of the full report is attached as Appendix K of the attached EIR.

5.4.1 Dirty Water Management

The dirty water at DCM East is confined to the open cast pit extension. As per common practice, the edges of the open cast will have a berm built up to prevent ingress of surface water, in addition to the sized and designed clean water canal. The source of water to the open cast section is therefore limited to direct rainfall and ground water seep.

Removal of water from the open cast area requires a localised sump and installed pumping capacity to deal with collected water. The results for the volume of water captured and temporarily stored prior to pumping are shown in Table 5-1.

Table 5-1: Dirty water stormflow volume

Catchment Name	Area (km^2)	1:50 (m^3)	1:100 (m^3)
Pit Extension	0.85	100,755	115,093
Existing Pit	1.83	216,920	247,790
Total	2.68	317,675	362,884

The 0.85 km^2 East Pit extension is positioned mid-slope. The result is that it is a requirement to manage potential ingress of clean water, to the pit. A clean water diversion canal positioned uphill of the pit, will allow for the water to be collected and routed away from the dirty area, for release to the environment.

The clean water area and associated channel sizes are presented in Table 5-2 and Table 5-3.

Table 5-2: East clean water diversion canal

Label	Channel Slope (m/m)	Normal Depth (m)	Left Side Slope (m/m (H:V))	Right Side Slope (m/m (H:V))	Bottom Width (m)	Discharge (m^3/s)	Velocity (m/s)	Froude Number
Trapezoidal Channel - 1	0.012	0.16	2	2	1	0.2	0.92	0.81
Trapezoidal Channel - 2	0.042	0.19	2	2	1	0.48	1.85	1.53
Trapezoidal Channel - 3	0.005	0.63	2	2	1	1.72	1.22	0.61
Trapezoidal Channel - 4	0.007	0.83	2	2	1	3.72	1.68	0.75

Table 5-3: West clean water diversion canal

Label	Channel Slope (m/m)	Normal Depth (m)	Left Side Slope (m/m (H:V))	Right Side Slope (m/m (H:V))	Bottom Width (m)	Discharge (m^3/s)	Velocity (m/s)	Froude Number
Trapezoidal Channel - 1	0.046	0.12	2	2	1	0.21	1.48	1.51
Trapezoidal Channel - 2	0.005	0.33	2	2	1	0.46	0.86	0.57
Trapezoidal Channel - 3	0.034	0.25	2	2	1	0.72	1.93	1.43
Trapezoidal Channel - 4	0.02	0.83	2	2	1	6.2	2.83	1.27

5.5 Groundwater

The groundwater at the DCM East operations is sourced from the dewatering of the blocks and pits associated with the mining activities.

5.5.1 Opencast Mining:

Excess groundwater encountered during mining in the opencast blocks and rain falling into the pits is removed to the Return Water Dam. Water from the Return Water Dam supplements the raw water demand for the coal washing plant and mining activities.

5.5.2 Underground Mining:

Groundwater removed to mine safely in the underground sections will be generally reticulated underground and be used in coal cutting and dust suppression. Excess groundwater removed from the underground sections will be routed into a surface settling dam. Water from the settling dam will be routed to the Return Water Dam. Water from the Return Water Dam could be routed back to underground for coal cutting, drilling and dust suppression as needed.

5.6 Waste

5.6.1 Domestic Waste

Domestic waste is stored in clearly demarcated waste skips in designated areas on the mine. Domestic waste is disposed of at Ga-Nala (Kriel) Municipality's domestic waste handling facility. A contractor is employed to remove this waste.

The waste skips are demarcated as follows:

- Green: general waste;
- Black: Hazardous waste; and
- Blue: steel / scrap waste.

5.6.2 Industrial Waste

Industrial waste is contained in steel skips or bins and removed by a licensed contractor and disposed of in a licensed industrial waste disposal site located off the mine's property.

5.6.3 Sewage Effluent

The sewage treatment plant is an off-the-shelf design utilising bacteria for solid removal with the water overflow being pumped into a containing dam/pond before being pumped back into the water reticulation system, i.e. there is no maturation pond requirement. There is no discharge to a natural water resource as all the purified sewage effluent is routed to the plant water reservoir/ Erikson dam for mine service or plant requirements.

5.7 Operational management

5.7.1 Organisational structure

Please refer to Figure 5-2 for the DCME Organisational Structure.

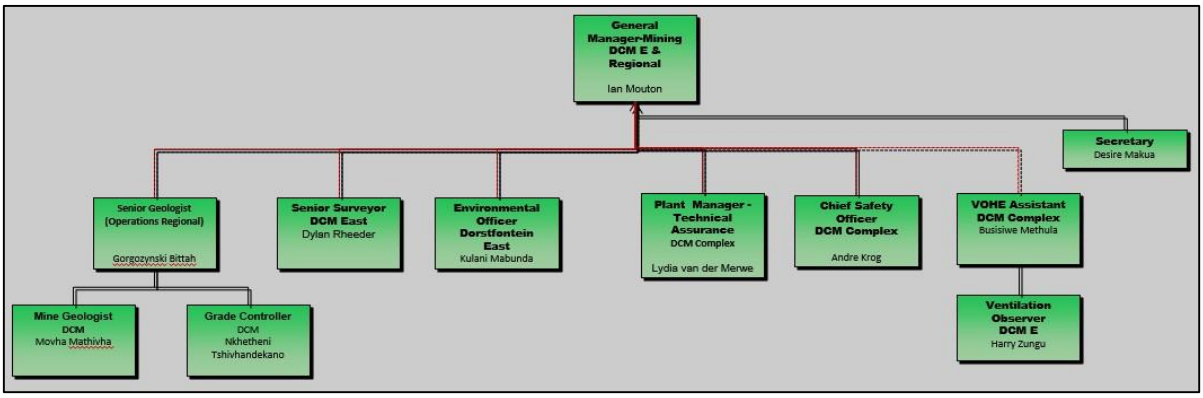


Figure 5-2: Organisation Structure of DCM East

5.7.2 Resources and Competencies

All staff at DCM East are expected to have a detailed understanding of Company policies and standards that directly relate to their job. It is every employee's responsibility to comply with the policies and standards relating to their work and to seek assistance from a manager or supervisor, ECC's legal adviser, or other source of advice listed if they do not fully understand a policy or how that policy should be applied. The various responsibilities of the managers and supervisors are presented in Table 5-4.

Table 5-4: Responsibility of Managers and Supervisors

Responsible Person	Responsibility
General Manager	• Approves environmental objectives and targets. • Advises project leaders (from an environmental point of view) with regards to the establishment of objectives and targets. • Chairing of Management Review meetings. • Bears ultimate responsibility in providing the necessary financial and other resources to meet training requirements. • Carries overall responsibility for legal compliance. • Provides resources to maintain legal compliance including potential and actual emergency situations. • Reports regularly on environmental, process and storm water management at ECC board meetings. • Takes ultimate responsibility for providing resources for the implementation of objectives and targets. • Proposes new objectives and targets. • Oversees the implementation of the water management strategy for the company

Responsible Person	Responsibility
	• Enhances environmental awareness of employees in their sections during internal meetings; • Makes employees available for training.
Mine Geologist and relevant on-mine personnel	• Ensure that the general storm water management measures are correctly operated and managed and that the process water is managed according to best management practices. • Record environmental objectives and targets.
Environmental Officer	• Collects samples as per schedule and submits to laboratory for analyses. • Communicates results once interpretations have been made. • Communicates internally and externally on process and storm water management. • Monitors water quality, interprets results, and reports to management. • Monitors measured parameters (e.g. water consumption) to keep track of legal compliance on a daily basis. • Monitors water consumption using the water balance. • Alerts relevant departments about deviations from allocated water use limits. • Identify requirements and implementation of conservation initiatives and monitoring schedules.
On-mine personnel	• Ensure that set objectives and targets are achieved.
Sustainability Manager	• Communicates internally and externally on environmental management in the company. • Addresses interested and affected party queries should these arise. • Ensure implementation of Integrated Water and Waste Management Plans. • Records incidents / non-conformance in an incident register; • Ensures that the incidents / non-conformance are followed up. • Ensures that all general waste bins that are part of the contract shall be emptied on a weekly basis. Ensures proper management of hazardous waste. • Ensures that any waste drums/containers are clean on the outside and that each drum is clearly identified with the appropriate label. • Ensures disposal of domestic waste to the Municipal landfill site. • Informs Contractor to collect waste drums/containers and to dispose the contents.
On-mine personnel	• Ensure that oil containers are sealed with a lid and indicated with a sticker.
HODs	• Ensure that environmental requirements in their areas of responsibility are addressed on a daily basis. • Ensure that the storm water management measures are correctly operated and managed in their specific areas of responsibility.
Financial manager	• Responsible for overseeing the identification of overall business risks including environmentally related ones.
Contractor(s)	• Issue proof of the safe disposal of all waste and this must be filed/kept on record and a copy supplied to the mine.
Training manager	• Provides the human resources in his/her department to conduct training on the job or theoretical training of plant employees;

Responsible Person	Responsibility
	• Makes financial provision in his/her department for the attendance by various personnel of short courses to improve knowledge in the environmental fields; • Maintains training records.

5.7.3 Education and training

Personnel need to be equipped with the knowledge, skills and training to enable them to manage their task competently. While management is ultimately responsible and accountable, personnel have also been given responsibility and accountability to report to management on certain aspects.

Basic water knowledge and water conservation training during induction has been implemented. A water awareness campaign to educate the community and employees on the importance of water conservation has also been initiated for DCM East.

All tuition offered by ECC is unit standard based, with a summative assessment conducted following completion of the particular programme. ECC continues to utilise only Mining Qualification Authority (MQA) accredited assessments and learning programmes.

The responsibility for training rests with the personnel as depicted within Table 5-5.

Table 5-5: Personnel Responsible for Training and Awareness

Responsible Personnel	Responsibility
General Manager	• Bears ultimate responsibility for providing the necessary financial and other resources to meet training requirements. • Enhance environmental awareness of employees in their sections during internal meetings; • Make employees available for training; and • Ensure that environmental requirements in their areas of responsibility are addressed on a daily basis.
Training manager	• Provides the human resources in his/her department to conduct training on the job or theoretical training of plant employees; • Makes financial provision in his/her department for the attendance by various personnel of short courses to improve knowledge; • Maintains training records; and • Prepares regular training plans / schedules to keep managers and employees updated about the training that is taking place.
All personnel	• Participate actively in training to advance their skills and competence.

5.8 Internal and External Communication

5.8.1 Internal Communication

Stakeholder Communication

ECC has developed a stakeholder charter that serves as a guide to stakeholder involvement in its business operations. ECC's stakeholders include:

- Employees;
- Investors;
- Communities;
- Customers;

- Government bodies; and
- Media.

In establishing and maintaining relationships with stakeholders, the following principles serve as a guide:

- Employees: ECC believes that people and their competencies are a source of competitive advantage. They therefore maintain that building trust among employees through good ethics and management is important. This is largely driven by their values, which prioritise respect and dignity within the workplace by applying fair labour practices and communicating with employees. Formal participation structures exist at corporate and business unit level, where interaction with recognised organised labour on matters regarding the employment relationship takes place regularly. Direct two-way communication between management and employees by means of various communication channels is used extensively.
- Communities: ECC recognises and respects their host communities as partners and value the participation of communities in assisting them to meet the environmental and socio-economic challenges that are directly linked to the philosophy of sustainable development. In line with the requirements of the social and labour plan and mining charter, ECC is involved with the communities in the area around its operations. Thus, in meeting the requirements of the charter, all their business units are involved with communities, through established forums in dialogues that discuss developmental needs and community expectations. These forums have been established through consultation and comprise mine management, union representatives, local government representatives, local community leaders, and relevant development agents. The purpose of the forums is to address development issues relevant to the needs of the communities, thus avoiding a top-down approach to community development.
- Customers: ECC aims to establish and maintain mutually beneficial long-term relationships with its customers. A key characteristic is adding value to a customer's business through the quality of products, the reliability of services and business integrity. Local and national offices have programmes in place to interact closely with customers throughout the value chain, from product development to after-sales service and customer care. In support of this approach, marketing and technical support teams are commodity-focused and dedicated towards specific customers.
- Media: ECC acknowledges and appreciates that the media is a primary channel of communication in modern society. They are committed to open and transparent interaction with members of the media, whom they treat as partners for the benefit of fair, balanced and objective reporting. They maintain close working relationships with key media, which involves a constant flow of company information to the media, and ease of access to management for comment and opinion, interviews and briefings.
- Governmental bodies: ECC respects the laws and regulations that govern its business. As such, in all their corporate social investment programmes, they seek partnership with government bodies. Through this partnership, they aim to ensure that their corporate social investment programmes are aligned with national imperatives. At business unit level, corporate social investment projects are directly linked with the integrated development plans of local authorities where they conduct business. To guarantee constant contact and direct contribution of government institutions to their projects, local governing structures such as local authorities are represented in the community development forums established to determine development priorities and to facilitate dialogue about the development needs of host communities.

5.8.2 External Communication

The following various external committees and forums to be developed according to legislation have been brought to the attention of ECC, although most of them have not yet been formed within the area:

- Landfill monitoring committee;
- Catchment Management Agency;
- Water User Associations;
- Advisory Groups;
- Stakeholder consultation processes; and
- Citizen Advisory Committees.

Currently ECC forms part of:

- Olifants Water Forum;
- Controlled Release; and
- South African Colliery Environmental Practitioners' Association (SACEPA).

Parties that have been involved in information sharing and other types of communication include the following:

- Local residents;
- Business / Industry / Other Mines;
- Community / Development;
- Environmental;
- Services;
- National Authorities:
    - Department: Mineral Resources (DMR);
    - Department of Water and Sanitation (DWS);
    - Department: Environment Affairs (DEA);
    - Department of Agriculture; and
    - South African Heritage Resources Agency (SAHRA).
- Provincial authorities:
    - Mpumalanga Department of Agriculture and Land Administration;
    - Mpumalanga Parks Board;
    - Provincial Heritage Resources Agency;
    - Mpumalanga Department of Public Works;
    - Mpumalanga Provincial Administration;
    - Department of Economic Planning and Development;
    - Department of Health and Social Services;
    - Department of Local Government and Housing;
    - Department of Roads and Transport;
    - Department of Sports and Culture; and
    - Mpumalanga Tourism Authority.
- Local authorities:
    - EMalahleni Municipality.

5.8.3 Communication Strategy

A system of information sharing with regulatory authorities and Interested and Affected Parties (I&APs) was developed with the following objectives:

- Keep them updated on environmental management progress at the ECC's operations;
- Inform them about new developments at ECC and provide them with an opportunity to express their concerns about these;
- Provide them with a means to discuss environmental matters with ECC whenever necessary;
- Simplify involvement in the processes of updating existing and obtaining new permissions; and
- Provide a forum for detailed discussion of issues when necessary.

Three main forms of long-term information sharing with I&APs have been identified and are depicted within Table 5-6. Basic public involvement principles that are applied include:

- Involvement of all I&APs;
- Respect for the opinion of all I&APs;
- True two-way exchange of information, with listening on both sides;
- Follow up on commitments made;
- Feedback on how concerns expressed by I&APs have been or are being addressed;
- Clear channels of communication;
- Accurate records of every interaction with I&APs, including names and contact details of people involved;
- Accurate records of information exchanged with I&APs – including letters, reports and other documents that were exchanged; and
- Records of meetings circulated to I&APs so that they can check that the record of information shared is correct.

For public meetings, the following principles should be applied:

- Advance notice of any meetings (at least 21 days) to allow people sufficient time to attend the meetings; and
- Scheduling of meetings with consideration of people's time constraints.

Table 5-6: Long Term Information Sharing with I&APs

Form of information sharing	Purpose	Objectives	Responsible party	Technique	Comments
Telephone hotline	To record and attend to queries To record and address complaints	Provide I&APs with a means to rapidly access ECC Provide ECC with a means to ensure that it is aware of I&APs' comments and concerns.	ECC staff member	Dedicated telephone number(s) for information sharing with I&APs This could be coupled with e-mail and postal address	I&APs need to be informed of the availability of a hotline. It is important that the information sharing principles are observed. The ECC staff member should be trained to ensure that they understand the principles and can apply these. Failure to apply the principles could result in a breakdown in the relationship of trust and credibility between ECC and I&APs.
Regular newsletters	Regular information sharing with I&APs	Keep I&APs updated on environmental progress at ECC Inform I&APs about new developments at ECC	ECC staff member or a public relations / public involvement service provider	Brief newsletters sent to all I&APs	To maintain the relationship of trust and credibility with I&APs, ECC needs to ensure that the newsletters are transparent and unbiased. One or two newsletters per year should be sufficient. The person responsible for compilation of the newsletters must understand and apply the information sharing principles. The newsletter should inform I&APs that they could respond to information in the newsletter through the hotline.
Involvement in decisions on environmental permissions	Meet legal requirements Recognise the rights of I&APs to be involved in	Meet legal requirements Recognise the rights of I&APs to be involved in	An independent consultant with expertise in environmental	The appropriate techniques should be discerned by the consultant	While public involvement in decisions on environmental permissions is generally mandatory, the level and nature of public involvement is

Form of information sharing	Purpose	Objectives	Responsible party	Technique	Comments
	decisions that could affect them. Recognise the need for regulatory authorities to make informed decisions and to clarify their roles in the decision making process.	decisions that could affect them. Recognise the need for regulatory authorities to make informed decisions and to clarify their roles in the decision making process.	assessment and public involvement	Scoping: Advertisements (newspaper and site); and Letters; and/or Background information documents; and/or Meetings and/or open days Feedback: Advertisements; and/or Letters and/or Feedback summary documents; and/or Meetings and/or open days.	discretionary. The independent consultant should discern the public involvement requirements with consideration of: • Basic public involvement principles; • The history of information sharing with I&APs at ECC; • The relevance of the previous information sharing records; • Issues likely to be of interest to I&APs; • The probability that there will be any parties directly affected by the development; The need for all regulatory authorities with an interest in environmental matters to be involved.

Table 5-7: Forms of Stakeholder Engagement

Our stakeholders	Interaction
Employees	• Employee representative structures
Investors	• Road shows and meetings; • Surveys of investor satisfaction; and • Presentations, site visits, website
Communities	• Representation on community forums, structures and processes; and • Partnerships in community initiatives
Customers and business partners	• Regular communication notices; • Operational communication processes; • Regular business partner workshops and presentations; • Employment equity, SHE forums; and • Active engagement with recognised trade unions.
Governmental bodies	• Local forums, structures and processes; • Formal community relations and structures; and • Site open days.
Media	• Interviews and briefings; • Site visits and presentations; • E-mail and website communication .

5.9 Awareness Raising

While management will ultimately be responsible and accountable, personnel is also given responsibility and accountability to report to management on certain aspects. Basic water knowledge and water conservation training during induction has been implemented. A water awareness campaign to educate the community and employees on the importance of water conservation is also conducted via monthly discussion topics.

Please refer to Section 5.9 for information pertaining to awareness and training.

5.10 Monitoring and control

The purpose of adhering to the monitoring program is to provide timely and accurate water quality data to the DWS and to manage impacts caused by the mining operations. This data is used for a variety of purposes which may be summarized in broad terms as the determination of status and trends in water quality. Specific objectives of the water quality monitoring program are as follows:

- Determine whether water quality at sampling sites exceeds water quality standards;
- Assess the status of water quality in the surrounding areas;
- Provide analytical quality information that describes the present conditions and changes (trends); and
- Provide timely data for other users.

The following monitoring is conducted at DCM East:

- Groundwater Monitoring;
- Surface Water Monitoring;
- Biomonitoring; and
- Waste Monitoring.

5.11 Surface Water Monitoring

DCM East is conducting surface water monitoring to establish impacts that may result from operational activities and to observe the conditions of surface water around the site. Table 5-6 provides a summary of the water quality monitoring points and the corresponding monitoring frequency.

Table 5-8: Water Monitoring

Surface Water Monitoring Points					
Points	**Latitude (S)**	**Longitude (E)**	**Surface Water Locations**	**Monitoring Status**	**Monitoring Frequency**
MP1	-26.17176	29.33949	Downstream on western tributary of the Olifants River	Dry in Jan, Feb, Mar 2015	Monthly
MP2	-26.17281	29.34283	Downstream on western tributary of the Olifants River	Sampled Jan. Dry in Feb, Mar 2015	
MP3	-26.13665	29.34498	Bridge upstream of the old Transvaal Navigation Colliery	Sampled Jan, Feb, and Mar 2015.	
MP4	-26.15458	29.34395	Confluence of the MP1 and MP2 tributaries with the Olifants River		
MP5	-26.16922	29.35663	Downstream Transvaal Navigation Colliery		
MP6	-26.16856	29.37476	Upstream of mining activities on Olifants River		
DCM6	-26.21044	29.36689	Upstream of Western tributary		
DCM7	-26.18519	29.36957	Downstream of Western tributary	Sampled Jan. Dry in Feb and Mar 2015.	
DCM8	-26.19470	29.33751	Pond downstream of Pit 1	Sampled Jan, Feb, and March 2015.	
PCD1	-26.18814	29.35843	PCD 1		
PCD2	-26.18643	29.35809	PCD 2		
PCD3	-26.18520	29.35775	PCD 3		
Pan	-26.20560	29.35039	Pan		
Erikson Dam 1	-26.192520	29.35406	Erikson Dam 1		
Erikson Dam 2	-26.19247	29.35433	Erikson Dam 2		
Erikson Dam 3	-26.19250	29.35458	Erikson Dam 3		
Potable Water Monitoring Points					
Point	**Latitude (S)**	**Longitude (E)**	**Potable Water Locations**	**Monitoring Status**	**Monitoring Frequency**
Potable water east	-26.19351	29.35401	Potable water	Sampled Jan, Feb, and Mar 2015.	Monthly
Sewage Outflow Monitoring Points					
Point	**Latitude (S)**	**Longitude (E)**	**Sewage Outflow Locations**	**Monitoring Status**	**Monitoring Frequency**
Sewage outflow east	-26.19337	29.35655	Sewage outflow	Bacteria sampled monthly in Jan, Feb, Mar 2015, Chemical sampled Mar 2015.	Monthly for bacteria and quarterly for chemical

Where applicable the results were compared to compliance standards specified in the IWUL. Where standards are not specified by the regulator, results were compared to the SANS 241:2011 South African National Standard for Drinking Water (SANS).

The water quality of the Pollution Control Dams and Erikson dams remained poor with elevated total dissolved solids, sulphate and manganese in Erikson dam 1 exceeding the SANS limits. As process water, this water is expected to be contaminated and should not be released into the environment. Process water should be stored in dams that comply with Government Notice 704 and Best Practice Guidelines A4: Pollution Control Dams (GCS (Pty) Ltd, 2015).

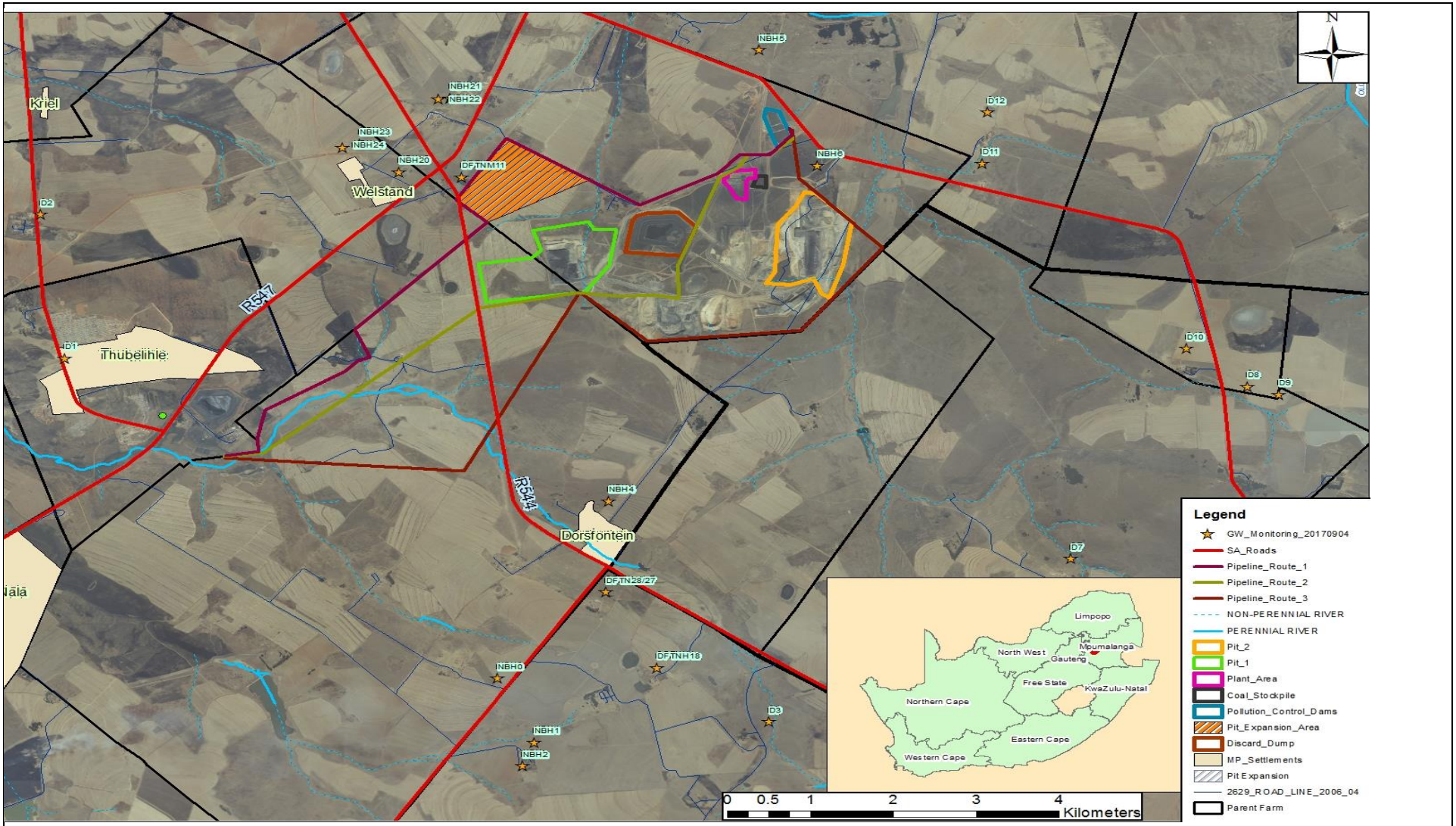
The water quality at the pond downstream from Pit 1, could be classified as unacceptable (Class 4) for domestic use for the variables analysed. The water quality of localities within the Olifants River, north east of the proposed project could be classified as good (Class 1) for domestic use (Aquatico (Pty) Ltd, 2015).

5.12 Groundwater monitoring

The ground water monitoring boreholes at DCM East are shown in Figure 4-5. The associated water level data and quality analyses are discussed in quarterly monitoring reports. Two (2) of the fourteen (14) groundwater monitoring sites are inaccessible due to being covered with soil and two boreholes are damaged or destroyed. All boreholes are sampled quarterly and water levels are taken monthly.

The existing groundwater monitoring results show that:

- At DFTNM10 the sulphate concentration has increased since March 2014 and exceeds the SANS limit of 500 mg/l in the last quarter of 2014;
- Nitrate was previously elevated at DFTNH1 as well as sulphate, although sulphate was still compliant;
- DFTNM7 only fluoride was elevated;
- Borehole DFBH indicated significant spikes in conductivity, total dissolved solids, sulphate and manganese in March 2011 and December 2013. As borehole in DFBH is drilled into the old underground workings contamination in this borehole could be related to the old underground mine.



srk consulting	**PIT EXTENSION AND PIPE CONSTRUCTION** Groundwater Monitoring Locations	Project No 599507

Figure 5-3: Groundwater Monitoring Locations

5.13 Biomonitoring

Dorstfontein East has been conducting bi-annual biomonitoring since 2010. The purpose of the biomonitoring is to determine the present aquatic ecological state of the Koringspruit-Olifants River System within which the DCM East conveyor and railway loop is located. The bi-annual biomonitoring programme at DCM East has been ongoing since 2010.The location of the biomonitoring sample locations are presented in Figure 5-4

Table 5-9 provides a summary of the monitoring data obtained for the DCM East monitoring points.

Table 5-9: Biomonitoring analysis results (Summer 2014)

DCM East Mine	DES1	DES2	DES3	DES5	DES7
Water Quality	Good	Poor	Good	Poor	Poor
Exceeding Both Targets	-	EC & TDS*	-	EC & TDS*	TDS & EC*
Exceeding Background Target	pH & DO	pH & DO	pH & DO	pH & DO	pH & DO
IHAS Class	Not Sampled	Not Sampled	Not Sampled	Not Sampled	Adequate / Fair
					C
SASS	Not Sampled	Not Sampled	Not Sampled	Not Sampled	Poor
					E/F
WET - Gupies mortality (%)	A	A	A	B	A
WET - Water Flea mortality (%)					

* = South African Water Quality Target values for Domestic Use (1996)

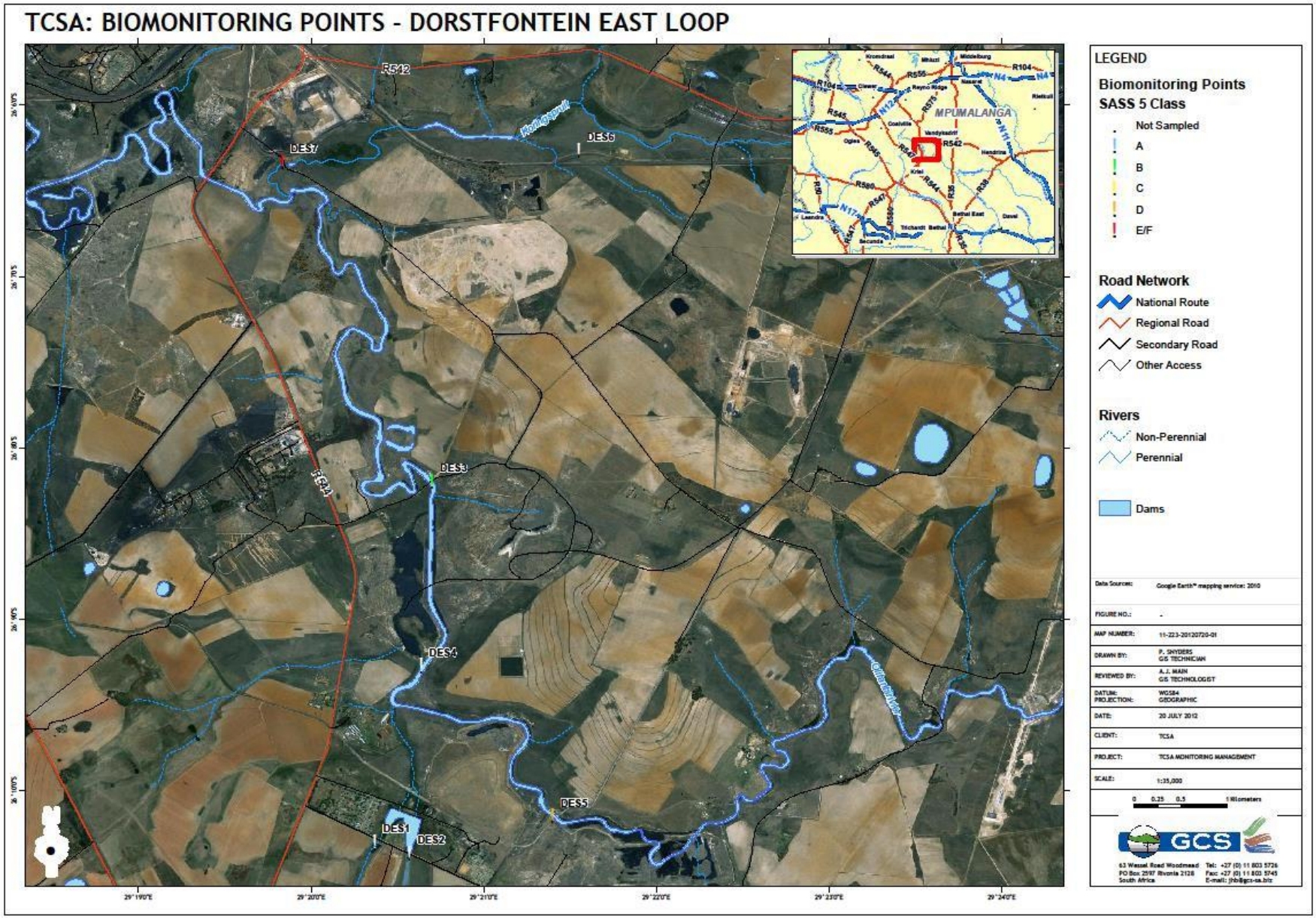


Figure 5-4: Biomonitoring Sample Locations

5.14 Waste Monitoring

DCM East monitors the co-disposal facility as well as the pollution control dams. The stability assessment and management of the co-disposal Facility is performed by an independent engineering consultant once a year. The Mine Metallurgical Engineer oversees the day-to-day management of the co-disposal facility.

For the pollution control dams, the Mine Metallurgical Engineer monitors the water levels in the PCDs in order to ensure adherence to the designed maximum operating capacities. Water quality samples are taken from the PCDs on a monthly basis. The samples are taken to a laboratory for chemical analysis.

5.15 Risk assessment/best practice assessment

A Risk Assessment (RA) addressing the aspects, impacts, and the severity and probability of the risks related to the identified water uses was conducted. The identification of the risks associated with the activity and the site characterisation process led to the identification of areas requiring no action, monitoring, management and mitigation, respectively.

5.15.1 Section 21 (e), g and j

Risk Assessment Methodology

The quantitative risk assessment methodology used was based on the requirements of the DWS's "*Operational Guideline*" (DWS, 2010). The quantitative Environmental Risk Assessment (ERA) process requires that all the relevant data for the water uses and the impact of the water uses on the water resources be identified and used in the assessment. The following data was considered in the identification of risks of the water uses on the water resource:

- Monitoring data collected and stored; and
- Specialist studies compiled during the authorisation processes.

All specialists were required to assess each identified potential impact according to the Impact Assessment Methodology as described below. This methodology has been utilised for the assessment of environmental impacts where the consequence (severity of impact, spatial scope of impact and duration of impact) and likelihood (frequency of activity and frequency of impact) have been considered in parallel to provide an impact rating and hence an interpretation in terms of the level of environmental management required for each impact.

The first stage of any impact assessment is the identification of potential environmental activities1, aspects2 and impacts which may occur during the commencement and implementation of a project. This is supported by the identification of receptors3 and resources4, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. Environmental impacts5 (social and biophysical) are then identified based on the potential interaction between the aspects and the receptors/resources.

The significance of the impact is then assessed by rating each variable numerically according to defined criteria as outlined in Table 5-10. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity6, spatial scope7 and duration8 of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity9 and the frequency of the impact10 together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix table as shown in

[1]An ***activity*** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organisation.
[2]An ***environmental aspect*** is an 'element of an organisations activities, products and services which can interact with the environment'. The interaction of an aspect with the environment may result in an impact.
[3]***Receptors*** comprise, but are not limited to people or man-made structures.
[4]***Resources*** include components of the biophysical environment.
[5]***Environmental impacts*** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. Receptors can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as aquifers, flora and palaeontology. In the case where the impact is on human health or well-being, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
[6]***Severity*** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
[7]***Spatial scope*** refers to the geographical scale of the impact.
[8]***Duration*** refers to the length of time over which the stressor will cause a change in the resource or receptor.
[9]***Frequency of activity*** refers to how often the proposed activity will take place.
[10]***Frequency of impact*** refers to the frequency with which a stressor (aspect) will impact on the receptor.

Table 5-11.

This matrix thus provides a rating on a scale of 1 to 150 (low, medium low, medium high or high) based on the consequence and likelihood of an environmental impact occurring.

Natural and existing mitigation measures, including built-in engineering designs, are included in the pre-mitigation assessment of significance. Measures such as demolishing of infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

Table 5-10: Criteria for Assessing Significance of Impacts

SEVERITY OF IMPACT	RATING
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful	5

SPATIAL SCOPE OF IMPACT	RATING
Activity specific	1
Mine specific (within the mine boundary)	2
Local area (within 5 km of the mine boundary)	3
Regional (Local Municipality)	4
National	5

DURATION OF IMPACT	RATING
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post closure / permanent	5

CONSEQUENCE

FREQUENCY OF ACTIVITY / DURATION OF ASPECT	RATING
Annually or less / low	1
6 monthly / temporary	2
Monthly / infrequent	3
Weekly / life of operation / regularly / likely	4
Daily / permanent / high	5

FREQUENCY OF IMPACT	RATING
Almost never / almost impossible	1
Very seldom / highly unlikely	2
Infrequent / unlikely / seldom	3
Often / regularly / likely / possible	4
Daily / highly likely / definitely	5

LIKELIHOOD

Table 5-11: Interpretation of Impact Rating

Likelihood \ Consequence															
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
3	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
4	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
5	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
6	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
7	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
8	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
9	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
10	10	20	30	40	50	60	70	80	90	100	110	120	1	140	150

	High	76 to 150	Improve current management
	Medium High	40 to 75	Maintain current management
	Medium Low	26 to 39	
	Low	1 to 25	No management required

SIGNIFICANCE = CONSEQUENCE x LIKELIHOOD

Results

A summary of the water related impacts over the different phases of the project is presented in the following sections, indicating the most significant impacts that were determined with their respective control measures.

Pre-Construction Phase

During the pre-construction phase, the following main activities will take place:

- Site clearing and grubbing of the footprint areas affected by Pit 1 extension and pipeline route;
- Site surveillance for any RDL species;
- Surveillance and marking of graves and cultural artefacts;
- Conduct a Phase 2 Heritage assessment and grave relocation;
- Removal of vegetation (shrubs and trees) to be relocated, monitored and maintained;
- Stripping and stockpiling of soils on a topsoil stockpile area;
- Preparation of the contractor's yard. All equipment and vehicles to be used during the pre-construction and construction phases will be stored at this facility;
- Possible grave relocation and application for destruction permits from SAHRA.

The following water and waste management impacts are envisaged during the pre-construction phase.

Groundwater Impacts

The Pit 1 extension and pipeline construction may possible result in the following impacts on the geo-hydrology of the area during the pre-construction phase are as follows:

- Machinery and equipment used for the construction of the contractor's camps and local earthworks pose a risk of local spillages of oils which may leach to groundwater. Clearing of clay soils and vegetation could involve the use of machinery. The clearing of the vegetation and stripping of clay top soil could potentially result in slightly higher infiltration rate to the unsaturated zone. The removal of vegetation could furthermore lower the evapotranspiration rates, thereby allowing a greater volume of potentially contaminated water to percolate to the underlying aquifer in the event of an accidental spill from the machinery;

- Monitoring borehole on the border of the Pit 1 extension area may be a conduit of flow to the groundwater unless sealed;
- Site clearing and grubbing is unlikely to materially affect the groundwater within the project area. However, care should be taken during the utilisation and storage of hydrocarbons and chemicals, which may impact on groundwater as a result of spillages and uncontrolled release.

Surface Water Impacts

The potential impacts on surface water during the pre-construction phase of the proposed project are as follows:

- Direct Impact as a result of an increase in erosion from cleared areas, topsoil stockpiles or any other area where there are exposed soils can occur during storm events;
- Indirect impact due to Increased erosion can result in an increase in turbidity, suspended solids and sedimentation of nearby water resources (unnamed tributary);
- Accidental hazardous substances spillage during site establishment.

Some level of sedimentation is expected to occur in the unnamed tributary pre-development as runoff is naturally anticipated to pick up environmental debris as it crosses natural areas. Increased turbidity is reversible and surface water should return to pre-impact turbidity levels once sediment levels entering the watercourse are reduced. Settled sediments should naturally move downstream during periods of high flow flowing storm events.

Wetland and Aquatic Environmental Impacts

The Pit 1 extension and water pipeline construction may result on the following envisaged impacts during the pre-construction phase:

- Placement of infrastructure in sensitive wetland habitat areas resulting in the loss of ecological structure;
- Potential poor planning, resulting in the placement of the linear development within wetland habitat, leading to altered habitat;
- Increased anthropogenic activity within the wetland feature leading to an increased impact on the biological structure of the wetland features and the associated effects that this will have on service provision;
- Bush clearing and erosion may cause localised impacts on water quality which may affect the aquatic habitats and ecology within the area;
- Failure to initiate a rehabilitation plan and alien control plan during the pre-construction phase may lead to further impacts during the construction and operation phase.

Where significance ratings differ between alternatives, these are indicated in the assessment tables. The impact assessment for the pre-construction phase can be found in Table 5-12.

Table 5-12: Potential Impacts and mitigation measures associated with the pre-construction phase of the proposed Pit 1 extension and water pipeline

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							Impact Management Objective	IMPACT MANAGEMENT ACTIONS (PROPOSED MITIGATION MEASURES)		IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)						
		Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating		Management and Mitigation Measures	Timeframe	Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating
		Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact						Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact		
Groundwater Impacts																		
Direct	Local spillages of hydrocarbons and chemicals which may leach to groundwater.	3	2	2	2	2	**28**	**ML Maintain Current Management**	To prevent a significant increase in alien invasive species abundance and spread	• All spillages will need to be cleaned up as soon as practically possible; • Proper management of stormwater drainage infrastructure should be ensured; • Vehicles and machinery will be maintained in good order to minimise leakages; • Employees will report spillages as soon as they are discovered and the spillages will be cleaned up immediately.	1 month to 1 year	2	2	2	2	2	**24**	**L No Management Required**
Indirect	Monitoring borehole on the border of the Pit 1 extension area may be a conduit of flow to the groundwater unless sealed.	4	2	3	3	3	**54**	**MH Maintain Current Management**	To prevent habitat fragmentation with specific reference to the proposed pipeline	• Grouting and capping of boreholes located within the footprint of construction camps be required prior to construction activities.	1 month to 1 year	2	1	2	3	2	**25**	**L No Management Required**
Surface Water Impacts																		
Direct	Increase in erosion from cleared areas	4	3	3	3	3	**60**	**MH Maintain Current Management**	Prevent erosion and sedimentation.	• Construct in the dry season and install silt bunds; • Erosion control measures will be implemented as soon as erosion has become evident. Water velocity will be reduced as far as feasible.	1 month to 1 year	1	2	2	2	2	**20**	**L No Management Required**
Indirect	Increase in turbidity, suspended solids and sedimentation of nearby water resources	4	3	3	3	3	**60**	**MH Maintain Current Management**		• Limit disturbed footprint and install retardation structures	1 month to 1 year	1	2	2	2	2	**20**	**L No Management Required**
Direct	Accidental hazardous substances spillage during site establishment	4	3	3	3	3	**60**	**MH Maintain Current Management**	Prevent surface water contamination and reduction in water quality.	• Operate using best practises by storing hazardous substances in an adequately sized bunded area, with appropriate safety equipment; • Place spill kits on site which are operated by trained staff members for the *adhoc* remediation of minor chemical and hydrocarbon spillages.	1 month to 1 year	1	2	2	2	2	**20**	**L No Management Required**
Wetland and Aquatic Environmental Impacts																		
Direct	Placement of infrastructure in sensitive wetland habitat areas resulting in the loss of ecological structure.	3	3	3	4	4	**72**	**MH Maintain Current Management**	Conserve ecological structure.	• Access roads for support vehicles, and vehicles used in the construction of the crossings, should not encroach into the freshwater features	1 month to 1 year	1	2	3	2	2	**24**	**L No Management Required**
Direct	Potential poor planning, resulting in the placement of the linear development within wetland habitat, leading to altered habitat.	4	3	4	3	3	**66**	**MH Maintain Current Management**	Prevent the destruction of wetland habitats.	• Wetland areas other than the immediate areas of crossing are to be demarcated as no-go areas for vehicles and construction personnel; • Vegetation removal should be kept at a minimum to avoid loss of freshwater features' assimilation and attenuation abilities	1 month to 1 year	1	2	2	2	2	**20**	**L No Management Required**
Direct	Increased anthropogenic activity within the wetland feature leading to an increased impact on the biological structure of the wetland features and the associated effects that this will have on service provision.	2	3	4	4	3	**63**	**MH Maintain Current Management**	Conserve the biological structure of wetlands	• Rehabilitation should be conducted in a manner that ensures that the wetland features' conditions are reinstated to as natural a state as possible	1 month to 1 year	1	1	2	3	3	**24**	**L No Management Required**

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							Impact Management Objective	IMPACT MANAGEMENT ACTIONS (PROPOSED MITIGATION MEASURES)		IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)						
		Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating		Management and Mitigation Measures	Timeframe	Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating
		Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact						Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact		
Direct	Bush clearing and erosion may cause localised impacts on water quality which may affect the aquatic habitats and ecology within the area	1	1	2	4	4	**32**	**ML Maintain Current Management**	Minimise the impact on water quality.	• All construction must be done in such a manner so as to ensure species migration will take place by ensuring a suitable structure height to allow species to move under or over the pipelines and roads.	1 month to 1 year	1	1	2	3	3	**24**	**L No Management Required**
Direct	Failure to initiate a rehabilitation plan and alien control plan during the pre-construction phase may lead to further impacts during the construction and operation phase	4	3	3	3	4	**70**	**MH Maintain Current Management**	Reduce impacts following closure.	• Any storage facilities and all other non-essential activities should be located away from the identified wetlands in order to avoid water and soil contamination.	1 month to 1 year	1	2	2	2	3	**25**	**L No Management Required**

Construction Phase

During the construction phase, the following main activities will take place:

- Construction and ground preparation for the planned Pit 1 extension and water pipeline;
- Construction and maintenance of stormwater control measures;
- Stockpiling of topsoil for the pipeline construction as well as for the Pit 1 extension;
- Trench excavations for the pipeline;
- Laying of the pipeline;
- Backfilling of trenches associated with the pipeline;
- Preparation of mining activities associated with the Pit 1 Extension;
- Vegetation clearing of the construction footprint;
- Demarcating no-go areas;

The following impacts are envisaged during the construction phase.

Groundwater Impacts

The Pit 1 extension and pipeline construction may possible result in the following impacts on the geo-hydrology of the area during the construction phase are as follows:

- Accidental spillages or leaks of hydrocarbons from construction machinery may occur during construction of the planned infrastructure. The hydrocarbons may infiltrate to the underlying groundwater system reducing the groundwater quality;
- Monitoring borehole on the border of the Pit 1 extension area may be a conduit of flow to the groundwater unless sealed;
- Site clearing and grubbing is unlikely to materially affect the groundwater within the project area. However, care should be taken during the utilisation and storage of hydrocarbons and chemicals, which may impact on groundwater as a result of spillages and uncontrolled release.

The assessment of the groundwater impacts during the construction phase, has illustrated that there is no preferable alternative to the mining methodology or pipeline route alternative. Minimal groundwater impacts are envisaged as a result of the construction phase.

Surface Water Impacts

The potential impacts on surface water during the construction phase of the proposed project are as follows:

- Impeding flow while under construction of the pipeline over the non-perennial streams. During the construction of the stream crossings surface water will need to be diverted in order assist in construction of the pipeline in a dry environment;
- Accidental spillages of hazardous substances from construction vehicles used during construction of the crossings, as well as from hazardous storage areas;
- Contamination of runoff by poor materials/waste handling practices;
- Debris from poor handling of materials and/or waste blocking watercourses;
- Contaminated dirty water runoff to surrounding areas resulting in the impact on local surface water quality;
- Increase in turbidity of the local water streams as a result of runoff of cleared areas;

- Increase of surface runoff and potentially contaminated water that needs to be maintained in the areas where site clearing occurred;
- Construction of possible river diversion may temporarily disturb the water course affecting the hydrology of the water courses;
- Increase of erosion potential during construction activities associated with the river crossings and Pit 1 extension;
- Removal of MAR from the catchment, as this runoff will now be considered dirty water and will need to be contained within the mining area.

Some level of sedimentation is expected to occur in the unnamed tributary pre-development as runoff is naturally anticipated to pick up environmental debris as it crosses natural areas. Increased turbidity is reversible and surface water should return to pre-impact turbidity levels once sediment levels entering the watercourse are reduced. Settled sediments should naturally move downstream during periods of high flow flowing storm events.

The assessment of the surface water impacts during the construction phase has illustrated that there is no preferable alternative to the mining methodology or pipeline route alternative. Surface water impacts experienced will be experienced across all alternatives.

Wetland and Aquatic Environmental Impacts

The Pit 1 extension and water pipeline construction may result on the following envisaged impacts during the pre-construction phase:

- Loss of habitat and wetland ecological structure as a result of site clearance activities and uncontrolled wetland degradation;
- Impact on the wetlands systems as a result of changes to the sociocultural service provisions though site clearance. Waste management and wetland disturbance;
- Potential poor planning, resulting in the placement of the linear development within wetland habitat, leading to altered habitat;
- Impact on the hydrological functioning of the wetland systems;
- Soil compaction and levelling as a result of construction activities and vehicle movement leading to loss of wetland and riparian habitat;
- Increased runoff due to topsoil removal and vegetation clearance leading to possible erosion and sedimentation of wetland and riparian resources.

The wetland assessment has concluded that the most preferable option for the pipeline is the proposed alternative. Alternative 2 and Alternative 3 cross sensitive ecological services, resulting in a significant impact on the sociocultural service provision and hydrological functioning.

Where significance ratings differ between alternatives, these are indicated in the assessment tables. The impact assessment for the construction phase can be found in Table 5-13.

Table 5-13: Potential Impacts and mitigation measures associated with the construction phase of the proposed Pit 1 extension and water pipeline

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							Impact Management Objective	IMPACT MANAGEMENT ACTIONS (PROPOSED MITIGATION MEASURES)		IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)						
		Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating		Management and Mitigation Measures	Timeframe	Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating
		Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact						Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact		
Groundwater Impacts																		
Direct	Impact on groundwater quality because of hydrocarbon spillages from machinery.	2	2	2	3	3	**36**	**ML Maintain Current Management**	Prevent groundwater contamination.	• All spillages will need to be cleaned up as soon as practically possible; • Proper management of stormwater drainage infrastructure should be ensured; • Maintain construction vehicles and encourage contractors to report, react and manage all spills and leaks so that action can be taken to immediately minimise contamination to the groundwater; • Groundwater monitoring of boreholes should continue as per the WUL and approved monitoring programme. • Spill kits will be made available in areas of likely spillage; • All hydrocarbon storage containers will be stored within a bunded areas which are water tight and able to contain 110% of the stored volume; and • All equipment utilising hydrocarbons will be stored on a hard standing surface.	1 month to 1 year	1	2	2	2	2	**20**	**L No Management Required**
Direct	Storage of hydrocarbons and chemicals, which may impact on groundwater as a result of spillages and uncontrolled release	2	2	2	3	3	**36**	**ML Maintain Current Management**		• Grouting and capping of boreholes located within the footprint of construction camps be required prior to construction activities.	1 month to 1 year	1	2	2	2	2	**20**	**L No Management Required**
Indirect	Monitoring borehole on the border of the Pit 1 extension area may be a conduit of flow to the groundwater unless sealed	3	3	4	3	3	**60**	**MH Maintain Current Management**			1 month to 1 year	1	2	2	2	3	**25**	**L No Management Required**
Surface Water Impacts																		
Direct	Impact on surface water flow as a result of impeding flow while under construction of the pipeline over the non-perennial streams	3	3	2	3	3	**48**	**MH Maintain Current Management**	Protect surface water flow and associated pollution.	• Construction must take place within the dry season as far as possible; • Gabions and mattresses will be used to protect the river banks; and • All litter and debris will be continuously removed during construction.	1 month to 1 year	1	1	1	1	1	**6**	**L No Management Required**
Direct	Impact on surface water quality as a result of accidental spillages of hazardous substances from construction vehicles used during construction of the crossings, as well as from hazardous storage areas	3	3	3	2	3	**45**	**MH Maintain Current Management**	Protect surface water quality.	• Access to the construction site will be controlled; • Refuelling areas will be bunded and nozzles protected from spillage during refuelling; • Vehicular access to the stream will be restricted; • All spillages will need to be cleaned up as soon as practically possible; • Proper management of stormwater drainage infrastructure should be ensured; • Hazardous substances stored on site will be stored within a designated bunded areas fitted with a sump and value. Collection of water within the bunded areas will be deemed hazardous and disposed of as such; • Bunded areas will be water tight and inspected for leaks on a frequent basis; • Leaks to the bunded areas will be rectified as soon as possible; • Drip trays will be utilised for the collection of leaks from vehicles and machinery parked for long period of time; • Should a spill occur, this will be handled at the source of the leak and prevented from transpiring to nearby watercourse; • Ensure that routine maintenance on all vehicles is undertaken as per maintenance schedule and records are kept; and • Sewage spillages will be seen as hazardous waste and will be handled as such.	1 month to 1 year	1	1	1	1	1	**6**	**L No Management Required**
Direct	Debris from poor handling of materials and/or waste blocking watercourses, resulting in flow	2	1	1	1	1	**8**	**L No Management Required**	Protect surface water quality.	• Operate using best practises in separating waste streams and disposing of the waste correctly.	1 month to 1 year	1	1	1	1	1	**6**	**L No Management Required**

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							Impact Management Objective	IMPACT MANAGEMENT ACTIONS (PROPOSED MITIGATION MEASURES)		IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)						
		Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating		Management and Mitigation Measures	Timeframe	Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating
		Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact						Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact		
	impediment and pollution.																	
Direct	Contaminated dirty water runoff to surrounding areas resulting in the impact on local surface water quality	4	4	3	4	3	**77**	**H Improve Current Management**	Ensure adequacy clean and dirty water separation.	• Construct diversion drains around the site timeously prior to operation; and • Ensure adherence to GNR 704 of the NWA;	1 month to 1 year	3	2	3	2	3	**40**	**MH Maintain Current Management**
Direct	Increase in turbidity of the local water streams as a result of runoff of cleared areas	2	3	2	4	2	**42**	**MH Maintain Current Management**	Protection of Surface water	• Where necessary, and as defined when the final detailed project design is confirmed, construct sediment collection paddocks downstream of the working activities to minimise uncontrolled runoff from the site; • Minimise the areas that are to be stripped of vegetation; • Adequate storm water management should be considered in the detailed design of the proposed infrastructure in order to minimize undue erosion; • Erosion can also be limited by ensuring that mine vehicles and human movement is limited to project specific dedicated access ways; • Stormwater culverts and clean water diversions will be designed and constructed to accommodate the 1:50 year storm event around the mining areas; • Stormwater runoff will be directed towards natural watercourses; • Construction will be undertaken during the dry season, where possible, to minimise the potential for stormwater runoff; • Routine surface water quality monitoring up and down stream of construction activities and position of infrastructure and activities associated with the Project will be undertaken on a monthly basis.	1 month to 1 year	1	2	2	2	1	**15**	**L No Management Required**
Direct	Increase of surface runoff and potentially contaminated water that needs to be maintained in the areas where site clearing occurred.	2	2	3	3	3	**42**	**MH Maintain Current Management**	Protection of Surface water	• Adequate protection measures at river crossings will be included in the pipeline designs.	1 month to 1 year	1	2	1	1	1	**8**	**L No Management Required**
Direct	Construction of possible river diversion may temporarily disturb the water course affecting the hydrology of the water courses	3	2	2	3	4	**49**	**MH Maintain Current Management**	Protection of water resources and prevention of erosion.	• The point where the diversion re-enters the natural system must enter the system at the same elevation as the receiving aquatic environment as well as consist of an energy dissipation structures thereby preventing erosion and incision of the natural watercourse; and • The point where the diversion re-enters the natural watercourse must enter the system where possible at an acute angle to prevent the creation of turbulent flow, erosion and incision.	1 month to 1 year	2	2	2	2	2	**24**	**L No Management Required**
Direct	Increase of erosion potential during construction activities associated with the river crossings and Pit 1 extension	1	2	4	3	2	**35**	**ML Maintain Current Management**	Prevention of sedimentation as a result of erosion.	• Adequate storm water management should be considered in the detailed design of the proposed infrastructure in order to minimize undue erosion; • Ensure erosion protection measures are adequately implemented and monitored; and • Erosion can also be limited by ensuring that mine vehicles and human movement is limited to project specific dedicated access ways.	1 month to 1 year	1	2	2	2	1	**15**	**L No Management Required**
Indirect	Removal of MAR from the catchment, as this runoff will now be considered dirty water and will need to be contained within the mining area.	2	2	1	2	2	**20**	**L No Management Required**	Minimise loss of water to the catchment.	• The stormwater will be diverted into the natural environment which further mitigates the impact; • Stormwater dams need to be assessed to ensure that the capacity of water pumped during construction will be adequately catered for; • Recycle waste water as far as feasible.	1 month to 1 year	1	1	1	1	1	**6**	**L No Management Required**

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							Impact Management Objective	IMPACT MANAGEMENT ACTIONS (PROPOSED MITIGATION MEASURES)		IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)						
		Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating		Management and Mitigation Measures	Timeframe	Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating
		Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact						Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact		
Indirect	Contamination of runoff by poor materials/waste handling practices, impacting on surface water quality.	3	3	3	2	3	**45**	**MH Maintain Current Management**		• Waste will be disposed of in accordance to the waste management procedure; • Housekeeping will be kept up to standard. Housekeeping should be done after every shift.	1 month to 1 year	1	1	1	1	1	**6**	**L No Management Required**
Wetland and Aquatic Impacts																		
Direct	Loss of habitat and wetland ecological structure as a result of site clearance activities and uncontrolled wetland degradation	2	3	3	3	3	**48**	**MH Maintain Current Management**	Protection of Wetland Habitat and wetland ecological structure.	• The wetland features must be rehabilitated immediately after the construction phase; • During the construction phase of the development, all wetland areas other than the immediate areas of crossing are to be demarcated as no-go areas for vehicles and construction personnel; • Access roads for support vehicles, and vehicles used in the construction of the crossings, should not encroach into the freshwater features; • Activities that lead to elevated levels of sedimentation in the freshwater features should be minimised. Increased runoff due to vegetation clearance and/or soil compaction must be managed. Where necessary, access roads should have erosion berms installed in order to reduce the speed of any surface runoff, which could initiate erosion; • Implement alien vegetation control program within the wetland features; • Ensure that all activities impacting on the wetland features are managed according to the relevant DWS Licensing regulations (where applicable)	1 month to 1 year	2	2	2	2	2	**24**	**L No Management Required**
	Alternative 2	2	3	3	3	3	**48**	**MH Maintain Current Management**				2	2	2	2	2	**24**	**L No Management Required**
	Alternative 3	2	3	3	3	3	**48**	**MH Maintain Current Management**				3	2	2	2	2	**28**	**ML Maintain Current Management**
Direct	Impact on the wetlands systems as a result of changes to the sociocultural service provisions	2	3	3	3	3	**48**	**MH Maintain Current Management**	Minimise change and effectiveness of wetland service provision	• In a case where it is impossible to avoid development within the watercourse, it is advisable to minimise the extent and duration of the activities (i.e. during construction and rehabilitation and the use of less invasive methods such as directional drilling techniques) within the watercourse in order to reduce impacts on the biodiversity and Eco services provision; • Any storage facilities and all other non-essential activities should be located away from the identified wetlands in order to avoid water and soil contamination, which would affect the structure and function of these resources; • During construction use techniques which support the hydrology and sediment control functions of the freshwater features; • 4. Limit excavations to a limited extent to ensure that drainage patterns within the features returns to normal as soon as possible after construction.	1 month to 1 year	2	2	2	2	2	**24**	**L No Management Required**
	Alternative 2	2	3	3	3	3	**48**	**MH Maintain Current Management**				2	2	2	2	2	**24**	**L No Management Required**
	Alternative 3	2	3	3	3	3	**48**	**MH Maintain Current Management**				2	2	2	2	2	**24**	**L No Management Required**
Direct	Impact on the hydrological functioning and sediment balance of the wetland systems	2	3	2	2	2	**28**	**ML Maintain Current Management**	Protect hydrological functioning of the wetland systems.	• Avoid encroachment of activities into the watercourse where feasible; • Rehabilitation should be conducted in a manner that ensures that the wetland features' conditions are reinstated to as natural a state as possible; • As much vegetation growth as possible should be promoted within the wetland features in order to protect soils. In this regard, special mention is made of the need to prevent the loss of large areas of the freshwater features' vegetation and the use of indigenous vegetation species' where hydro seeding and rehabilitation planting (where applicable) are to be implemented; • Any construction-related waste must not be placed in the vicinity of the wetland features; • Stockpiled soil must be removed and the area must be levelled to avoid sedimentation of the wetland features from runoff.	1 month to 1 year	1	2	2	2	2	**20**	**L No Management Required**
	Alternative 2	2	3	3	3	3	**48**	**MH Maintain Current Management**				1	2	2	2	2	**20**	**L No Management Required**
	Alternative 3	2	3	3	3	3	**48**	**MH Maintain Current Management**				1	2	2	2	2	**20**	**L No Management Required**

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							Impact Management Objective	IMPACT MANAGEMENT ACTIONS (PROPOSED MITIGATION MEASURES)		IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)						
		Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating		Management and Mitigation Measures	Timeframe	Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating
		Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact						Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact		
Indirect	Increased runoff due to topsoil removal and vegetation clearance leading to possible erosion and sedimentation of wetland and riparian resources	3	3	2	3	2	**40**	**MH Maintain Current Management**	Reduce impact of sedimentation on wetland and riparian resources.	• Restrict construction to the drier winter months if possible, to avoid increased water inputs and sedimentation within the wetland; • Adequate storm water management must be incorporated into the design of the proposed development throughout all phases in order to prevent erosion of topsoil and the loss of floral and faunal habitat. In this regard, special mention is made of: • Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed; • Runoff from paved surfaces should be slowed down by the strategic placement of berms; and • All topsoil and waste stockpiles must have berms and catchment paddocks at their toe to contain runoff of the facilities.	1 month to 1 year	2	2	2	2	3	**30**	**ML Maintain Current Management**
Indirect	Soil compaction and levelling as a result of construction activities and vehicle movement leading to loss of wetland and riparian habitat	4	3	3	4	3	**70**	**MH Maintain Current Management**	Minimise impact on wetland and riparian habitat	• No construction of infrastructure may take place within riparian and wetland areas and associated buffer zones unless authorisation is granted by the DWS; • As far as possible all mining activity and infrastructure should be excluded from the wetland and riparian areas and associated 100 m buffer zone; • If this is not possible, pipelines should be designed to cross drainage lines at right angles and be placed outside of the active channels; • All areas of increased ecological sensitivity should be designated as No-Go areas and be off limits to all unauthorised construction vehicles and personnel; • All development footprint areas and areas affected by the proposed mining development should remain as small as possible and any disturbance of sensitive habitat must be actively avoided; • Construction vehicles must remain on demarcated roads and should not encroach into the wetland areas or their associated buffer zones; • It must be ensured that contractor laydown areas are located outside of wetland and riparian areas and associated 100 m buffer zones and excluded from clearing activities in order to minimise vegetation loss and resultant erosion and sedimentation.	1 month to 1 year	2	2	3	2	2	**28**	**ML Maintain Current Management**

Operational Phase

During the operational phase, the following main activities will take place:

- Mining of Pit 1 extension area;
- Water and stormwater management;
- Maintenance of existing and new infrastructure;
- Pumping of water from Dorstfontein East to Dorstfontein West;
- Maintenance of topsoil stockpiles;
- Machinery movement during mining activities;
- Blasting as part of the mining methodology.

The following impacts are envisaged during the operational phase.

Groundwater Impacts

The Pit 1 extension and pipeline construction may possible result in the following impacts on the geo-hydrology of the area during the construction phase are as follows:

- Opencast and underground mining impacting on water quality as a result of groundwater inflows into the workings which needs to be pumped out for mine safety and the resultant dewatering (water level decrease) of the groundwater system in the immediate vicinity of the working;
- Analyses showed that acid mine drainage (AMD) formation is expected and poor quality leachate can occur based on the leach potential of the material, leading to impacted water quality;
- The co-disposal facility receives coal containing materials from the underground workings being exposed to water and oxygen, resulting in ARD. Contamination of the groundwater system may occur through seepage from the co-disposal facility.
- Stockpiling of coal will expose coal to water and oxygen, resulting in ARD from stockpiles. Contamination of the groundwater system may occur from these sites;
- Handling of waste and transport of materials cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and cause contamination of the groundwater system.

The assessment of the groundwater impacts during the construction phase, has illustrated that there is no preferable alternative to the mining methodology or pipeline route alternative. Minimal groundwater impacts are envisaged as a result of the construction phase.

Surface Water Impacts

The potential impacts on surface water during the construction phase of the proposed project are as follows:

- Impact on water quality and erosion as a result of the pipeline breaking and spillage to non-perennial streams;
- Pump failure will result in dirty water accumulation in the pit, leading to uncontrolled dirty water management and associated pollution;
- Impact on water quality and availability as a result in ineffective dirty water separation, and dirty water entering into the wetland;
- High rate of ground water ingress causing flooding of the pit;

- The rainfall water within the designated dirty water area of the pit 1 extension area that forms part of the MAR to the local water courses will be removed from the catchment. This will result in a lower intensity potential on the local surface water resource;
- Increase in volume of contaminated water that needs to be managed within the footprint;
- Erosion of stream banks as a result of crossings and diversions leading to siltation of the streams;
- Impacts on surface water resources quality as a result of incorrect waste management practises and pollution.

Some level of sedimentation is expected to occur in the unnamed tributary pre-development as runoff is naturally anticipated to pick up environmental debris as it crosses natural areas. Increased turbidity is reversible and surface water should return to pre-impact turbidity levels once sediment levels entering the watercourse are reduced. Settled sediments should naturally move downstream during periods of high flow flowing storm events.

The assessment of the surface water impacts during the construction phase, has illustrated that there is no preferable alternative to the mining methodology or pipeline route alternative. Surface water impacts experienced will be experienced across all alternatives.

Wetland and Aquatic Environmental Impacts

The Pit 1 extension and water pipeline operation may result on the following envisaged impacts during the operation phase: Most of the impacts are directly related to the maintenance of the pipeline:

- Loss of habitat and wetland ecological structure as a result of continual wetland disturbance and uncontrolled wetland degradation;
- Impact on the wetlands systems as a result of changes to the sociocultural service provisions through uncontrolled vegetation clearance, waste management and wetland disturbance;
- Potential poor planning, resulting in the placement of the linear development within wetland habitat, leading to altered habitat;
- Impact on the hydrological functioning of the wetland systems as a result of reduce wetland footprints and uncontrolled disturbance during maintenance activities;
- Impacts on the hydrological functioning of the wetland as a result of the pit 1 extension.

The wetland assessment has concluded that the most preferable option for the pipeline is the proposed alternative. Alternative 2 and Alternative 3 cross sensitive ecological services, resulting in a significant impact on the sociocultural service provision and hydrological functioning.

Where significance ratings differ between alternatives, these are indicated in the assessment tables. The impact assessment for the construction phase can be found in Table 5-13.

Table 5-14: Potential Impacts and mitigation measures associated with the operational phase of the proposed Pit 1 extension and water pipeline

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							Impact Management Objective	IMPACT MANAGEMENT ACTIONS (PROPOSED MITIGATION MEASURES)		IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)						
		Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating		Management and Mitigation Measures	Timeframe	Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating
		Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact						Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact		
Groundwater Impacts																		
Direct	Impact on groundwater quality as a result of hydrocarbon spillages from machinery.	2	2	2	3	3	**36**	**ML Maintain Current Management**	Prevent groundwater contamination.	• All spillages will need to be cleaned up as soon as practically possible; • Proper management of stormwater drainage infrastructure should be ensured; • Maintain construction vehicles and encourage contractors to report, react and manage all spills and leaks so that action can be taken to immediately minimise contamination to the groundwater; • Groundwater monitoring of boreholes should continue as per the WUL and approved monitoring programme. • Spill kits will be made available in areas of likely spillage; • All hydrocarbon storage containers will be stored within a bunded areas which are water tight and able to contain 110% of the stored volume; • All equipment utilising hydrocarbons will be stored on a hard standing surface.	Life of Operation	1	2	2	2	2	**20**	**L No Management Required**
Direct	Storage of hydrocarbons and chemicals, which may impact on groundwater as a result of spillages and uncontrolled release.	2	2	2	3	3	**36**	**ML Maintain Current Management**			Life of Operation	1	2	2	2	2	**20**	**L No Management Required**
Indirect	Monitoring borehole on the border of the Pit 1 extension area may be a conduit of flow to the groundwater unless sealed.	3	3	4	3	3	**60**	**MH Maintain Current Management**		• Grouting and capping of boreholes located within the footprint of construction camps be required prior to construction activities; • Treat the water emanating for the opencasts to increase the decant water quality	Life of Operation	1	2	2	2	3	**25**	**L No Management Required**
Surface Water Impacts																		
Direct	Impact on water quality and erosion as a result of the pipeline breaking and spillage to non-perennial streams.	2	2	1	2	1	**15**	**L No Management Required**	Reduce the impact on water quality	• Operation of the pipeline should be based on best practises; • Frequent monitoring of the pipeline should be done to ensure leakages are identified and repaired timeously.	Life of Operation	1	1	1	1	1	**6**	**L No Management Required**
Direct	Pump failure will result in dirty water accumulation in the pit, leading to uncontrolled dirty water management and associated pollution.	2	2	2	2	2	**24**	**L No Management Required**	Protect surface water flow and associated pollution.	• Undertake regular structural inspections of pumps and pipes of exiting pit; • Ensure groundwater investigation is done to understand groundwater levels; and • Stormwater culverts and clean water diversions will be designed and constructed to accommodate the 1:50 year storm event.	Life of Operation	1	1	1	1	1	**6**	**L No Management Required**
Direct	Impact on water quality and availability as a result in ineffective dirty water separation, and dirty water entering into the wetland.	2	1	1	1	1	**8**	**L No Management Required**	Ensure effective and reliable clean and dirty water separation.	• Monitor the effective usage and functioning of the upstream bunds constructed upstream of the affected site; • Monitor and maintain good vegetation cover, to reduce runoff; • Develop and implement controls to clean up oil/diesel leaks and spillages of any designated hazardous waste.	Life of Operation	1	1	1	1	1	**6**	**L No Management Required**
Direct	High rate of ground water ingress causing flooding of the pit	4	4	3	4	3	**77**	**H Improve Current Management**	Prevent water wastage and impact on water resources.		Life of Operation	3	2	3	2	3	**40**	**MH Maintain Current Management**
Direct	The rainfall water within the designated dirty water area of the pit 1 extension area that forms part of the MAR to the local water courses will be removed from the catchment. This will result in a lower intensity potential on the local surface water resource	2	3	2	4	2	**42**	**MH Maintain Current Management**	Recue the loss of water to the catchment.	• The clean stormwater will be diverted which further mitigates the impact.	Life of Operation	1	2	2	2	1	**15**	**L No Management Required**
Direct	Increase in volume of contaminated water that needs to be managed within the footprint	2	2	3	3	3	**42**	**MH Maintain Current Management**	Ensure effective and reliable clean and dirty water separation.	• Monitor the effective usage and functioning of the upstream bunds constructed upstream of the affected site; • Monitor and maintain good vegetation cover, to reduce runoff; • Develop and implement controls to pick up oil/diesel leaks and spillages of any designated hazardous waste.	Life of Operation	1	2	1	1	1	**8**	**L No Management Required**

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							Impact Management Objective	IMPACT MANAGEMENT ACTIONS (PROPOSED MITIGATION MEASURES)		IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)						
		Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating		Management and Mitigation Measures	Timeframe	Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating
		Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact						Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact		
Indirect	Erosion of stream banks as a result of crossings and diversions leading to siltation of the streams	3	2	2	3	4	**49**	**MH Maintain Current Management**	Prevent siltation of water courses.	• River crossings and diversions will be inspected monthly; • Erosion control measures will be implemented should it be evident that erosion has occurred; • Establish vegetation around disturbed areas to prevent any erosion; • Stormwater runoff will be handled on surface and directed towards natural watercourses.	Life of Operation	2	2	2	2	2	**24**	**L No Management Required**
Indirect	Impacts on surface water resources quality as a result of incorrect waste management practises and pollution.	2	3	3	2	2	**32**	**ML Maintain Current Management**	Prevent water pollution as a result of waste management practises.	• A waste management plan will be compiled and approved for implementation of site. This management plant should focus on the waste hierarchy of the NEM:WA; • No waste may be disposed of to land without the necessary legal permits; • Waste will be removed from site by an accredited waste removal company and legally disposed of. Disposal certificates will be kept on site for audit purposes; • Sufficient waste receptacles will be placed around the site allowing the separation of waste as source.	Life of Operation	1	2	2	2	2	**20**	**L No Management Required**
Wetland and Aquatic Impacts																		
Direct	Loss of habitat and wetland ecological structure as a result of continual wetland disturbance and uncontrolled wetland degradation.	2	3	3	3	3	**48**	**MH Maintain Current Management**	Protection of Wetland Habitat and wetland ecological structure.	• Operational vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities; • It must be ensured that contractor laydown areas are located outside of wetland and riparian areas and associated 100 m buffer zones and excluded from clearing activities in order to minimise vegetation loss and resultant erosion and sedimentation where not approved by DWS; • Compacted areas are to be ripped, re-profiled and revegetation as soon as areas becomes available; • Any areas where active erosion within the wetland features are observed must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible; • Cutting/ clearing of the herbaceous layer within the wetland areas along the linear development should be avoided so as to retain soil stability provided by the grass root structures.	Life of Operation	1	2	2	2	2	**20**	**L No Management Required**
	Alternative 2	2	3	3	3	3	**48**	**MH Maintain Current Management**				1	2	2	2	2	**20**	**L No Management Required**
	Alternative 3	2	3	3	3	3	**48**	**MH Maintain Current Management**				3	2	2	2	2	**28**	**ML Maintain Current Management**
Direct	Impact on the wetlands systems as a result of changes to the sociocultural service provisions through uncontrolled vegetation clearance, waste management and wetland disturbance	2	3	3	3	3	**48**	**MH Maintain Current Management**	Minimise change and effectiveness of wetland service provision	• As much vegetation growth as possible should be promoted within the wetland features in order to protect soils. In this regard, special mention is made of the need to prevent the loss of large areas of the freshwater features' vegetation and the use of indigenous vegetation species' where hydro seeding and rehabilitation planting (where applicable) are to be implemented; • No dumping of waste should take place within wetland and riparian areas or their buffer zones. If any spills occur, they should be immediately cleaned up; • It must be ensured that mining related waste or spillage and effluent do not affect the sensitive habitat boundaries, wetland resources and associated buffer zones. All waste and rubble must be removed from site and disposed of according to relevant SABS standards; • Implement an alien vegetation control program within the wetland features and ensure establishment of indigenous species within areas previously dominated by alien vegetation; • Maintain the REC for each of the wetland features, as stated within the wetland report during the life of the development.	Life of Operation	2	2	2	2	2	**24**	**L No Management Required**
	Alternative 2	2	3	3	3	3	**48**	**MH Maintain Current Management**				2	2	2	2	2	**24**	**L No Management Required**
	Alternative 3	2	3	3	3	3	**48**	**MH Maintain Current Management**				2	2	2	2	2	**24**	**L No Management Required**

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							Impact Management Objective	IMPACT MANAGEMENT ACTIONS (PROPOSED MITIGATION MEASURES)		IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)						
		Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating		Management and Mitigation Measures	Timeframe	Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating
		Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact						Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact		
Direct	Potential poor planning, resulting in the placement of the linear development within wetland habitat, leading to altered habitat	2	3	2	2	2	**28**	**ML Maintain Current Management**	Protect hydrological functioning of the wetland systems.	• Rehabilitation should be conducted in a manner that ensures that the wetland features' conditions are reinstated to as natural a state as possible.	Life of Operation	1	2	2	2	2	**20**	**L No Management Required**
Indirect	Impact on the hydrological functioning of the wetland systems as a result of reduce wetland footprints and uncontrolled disturbance during maintenance activities	2	3	3	3	2	**40**	**MH Maintain Current Management**	Conserve the hydrological function of the surrounding wetlands.	• Flow continuity and connectivity of the freshwater features must be reinstated post- construction activities; • Regular monitoring of water quality must be implemented in order to ensure the impacts of runoff and decant of water into wetland resources is prevented or minimised; • Adequate storm water management must be incorporated into the design of the proposed development throughout all phases in order to prevent erosion of topsoil and the loss of floral and faunal habitat. In this regard, special mention is made of: ○ Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed; ○ Runoff from paved surfaces should be slowed down by the strategic placement of berms; ○ All topsoil and waste stockpiles must have berms and catchment paddocks at their toe to contain runoff of the facilities.	Life of Operation	1	2	2	2	3	**25**	**L No Management Required**
Indirect	Impacts on the hydrological functioning of the wetland as a result of the pit 1 extension	4	3	3	4	3	**70**	**MH Maintain Current Management**	Minimise impact on wetland and riparian habitat	• Dirty water must be recycled back into the mining system; • All wetland areas adjacent to the operational footprint will demarcated as no-go areas.	Life of Operation	2	2	3	2	2	**28**	**ML Maintain Current Management**

5.15.2 Section 21 (c) and (i) Risk Assessment

A risk assessment in terms of the DWS Risk Assessment Methodology contained in GNR509 was conducted by Ms Ndomupei Masawi, who is a qualified and SACNASP Registered (400045/14) Environmental Scientist. Ms Masawi has more than 13 years' experience in environmental management, with experience in water resources and water quality assessments.

The matrix provided by the DWS was used for the risk assessment. The risk assessment takes into account the following:

Table 5-15: Severity (How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat).

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland. The score of 5 is only compulsory for the significance rating.	

Table 5-16: Spatial Scale (How big is the area that the aspect is impacting on).

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

Table 5-17: Duration (How long does the aspect impact on the resource quality).

One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, a E or F	5
PES and EIS (sensitivity) must be considered.	

Table 5-18: Frequency of the activity (How often do you do the specific activity).

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

Table 5-19: The frequency of the incident or impact (How often does the activity impact on the resource quality).

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table 5-20: Legal issues (How is the activity governed by legislation)

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
Located within the regulated areas	

Table 5-21: Detection (How quickly or easily can the impacts/risks of the activity be observed on the resource quality, people and resource)

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

Table 5-22: Rating Classes

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

Results

The results from the risk assessment are provided in Appendix B.

5.16 Issues and responses from public consultation process

The Water Use Licence Application formed part of the public consultation process for an application for an Environmental Authorisation. Stakeholder notification of the application was done through notification letters, on-site notices and newspaper advertisements placed in the Witbank News on 5 May 2017. Copies of the Public Participation Process (PPP) documentations are included in Appendix C, D, E, F, G and H of the attached EIR.

No major water and waste related issues were received from the stakeholders. A copy of the public participation report is attached as Appendix D of the attached EIR.

5.17 Matters requiring attention/problem statement

None.

5.18 Assessment of level and confidence of information

All information contained in this IWWMP was sourced from the specialist studies conducted for the project area and the approved IWWMP. The specialists appointed to undertake the various investigations are considered to be competent in their particular fields. In light of the above, the level of confidence with regards to the information and reports used to compile this document is high.

6 Water and Waste management

6.1 Water and Waste Management Philosophy

The general principle of water management is the recognition that water is a scarce resource. This in turn leads to the other principles such as water use minimisation (water conservation) or re-use of water and pollution prevention or the limitation of pollution of water. Water that exceeds the quality, as set by the National Authority shall not be released from site, with the exception of emergency conditions, but re-used in the mining process and plant, thus reducing the quantity of water extracted from the water resources.

ECC recognises that coal mining and associated operations can have detrimental environmental impacts, such as potential environmental pollution of water reserves, air and the consumption of energy and other natural resources. ECC is therefore committed to the implementation of an Environmental Management System that will minimise pollution and resource consumption and comply with the international standard ISO 14001.

The mine has a policy of zero discharge and this is geared towards ensuring that source impacts to the water resources are prevented. The beneficiation of coal off-site to an existing plant at a sister mine indicates ECC's seriousness on conserving and reducing raw water intake or use. Furthermore, the footprint of the company is also reduced.

6.1.1 Process Water

The philosophy with respect to process water management is to:

- Minimise the amount of process water produced;
- Contain all process water to ensure zero discharge to the environment;
- Re-use process water for dust suppression and in the process, if this water is suitable for the particular use; and
- Investigate alternative uses of process water from time to time.

6.1.2 Storm Water Management

The philosophy for storm water management on site is in keeping with the GN704 principles:

- To keep clean and dirty water separated;
- To contain any dirty water within a system;

- To prevent contamination of clean water; and
- To return clean water to the catchment.

6.1.3 Groundwater

The philosophy for waste management at DCM East is to:

- Ensure that all potential groundwater impacts are identified;
- Ensure that groundwater monitoring is conducted quarterly; and
- That records are kept to identify trends over time.

6.1.4 Waste Management

The philosophy for the management of the various waste streams on site is:

- Minimisation of waste;
- Monitoring of waste management practises;
- Best practise storage and disposal of waste; and
- Consideration of alternative, cost effective technologies with regards to waste Management.

6.2 Strategies (surface water, groundwater, storm water and waste)

6.2.1 Process Water

Process water management will consist of:

- Investigating new alternatives for process water treatment and re-use; and
- Continued and regular monitoring of dirty water dams which contain process water to ensure that the water quality is appropriate for re-use.

6.2.2 Storm Water Management

Storm water management will comprise of:

- Regular monitoring of surface water quality;
- Regular monitoring and maintenance of storm water control structures; and
- Update the Storm Water Management Plan (SWMP) for DCM East as often as necessary.

6.2.3 Groundwater

Groundwater management strategies will comprise of:

- Proper design and construction of any future dirty water or waste management facilities;
- Obtaining input and authorization;
- Continued, regular monitoring of groundwater levels and quality; and
- Annual compliance audits to ensure compliance with the IWUL conditions.

6.2.4 Waste Management

The environmental objectives associated with the generation of waste are:

- To enforce policies in terms of the removal of domestic and hazardous waste;

- To ensure an effective surface run-off control system is in order to deal with the separation of clean and dirty water; and
- To prevent, contain and clean up any spillages during the life of mine.

Waste management strategies will consist of:

- The updating of the waste management system as activities at DCM East change;
- Implementation of good housekeeping and best practises;
- Investigating new, cleaner and more cost effective technologies to reduce and manage waste;
- Monitor compliance with best practises; and
- Creating environmental awareness and sensitivity through improvements to the induction programme for employees.

6.3 Performance objectives / goals (Table)

The following objectives and strategies are implemented at DCM East in order to achieve the Safety, Health, Environment and Quality Policy:

Table 6-1: Performance objectives to achieve Safety, Health and Quality Policy

Aspect	Objectives
Compliance:	Identify all applicable legislation and other applicable requirements to the identified environmental aspects and will ensure that the operations remain in compliance with such legislation and requirements.
Pollution Prevention:	Identify the impacts that all operations, processes and products have on the environment and will ensure that pollution on the environment is prevented or minimised.
Improvement:	Set objectives and targets to improve environmental performance and the Environmental Management System and will continually strive to find even better sustainable solutions to problems.
Competence:	Ensure that all people who perform work for or on behalf of ECC are competent and understand the impact of their activities on the environment, and their role in the prevention of pollution and the maintenance of the Environmental Management System.
Communication:	Actively communicate this policy to persons working for and on behalf of ECC to ensure that they understand the content intent, and will make it available to the public.
Review:	Review the continued sustainability and adequacy of this IWWMP at least annually to ensure it remains valid at all times.

Performance objectives and strategies for the management of water and waste are provided in Table 6-2

Table 6-2: Environmental Performance Objectives

Aspect	Objectives
Stormwater and leachate	Management of stormwater and leachate aims to achieve the following objectives

	• Separate clean and contaminated storm water and manage these separately; • Collect and contain contaminated stormwater and leachate in suitable facilities; • Re-use dirty water where possible; and • Ensure that surface water quality remains unaffected by the activities on the site by avoiding the discharge of polluted water.
Groundwater	Activities that could potentially impact on the groundwater resource should be managed to prevent deterioration in current groundwater quality.
Waste	The management of waste at the DCM East site should aim to achieve the following objectives: • Minimise the amount of waste generated; • Re-use and recycle waste as much as possible where practicable; • Ensure that the facility provides appropriate protection to the environment; and • Minimise the contact of waste with water.

6.4 Measures to achieve and sustain performance objectives

The IWWMP must clearly demonstrate that they have incorporated all of the above objectives/principles or, alternatively, must clearly motivate why any of the above principles are not relevant.

The water resource can be protected in the following ways by applying water conservation, pollution prevention & minimisation of impacts principles:

- Reduction in the amount of contaminated water that requires treatment by reducing the amount of water used and brought onto the site and by employing pollution prevention strategies;
- Reduction in the level of contamination of water through implementation of pollution prevention strategies thereby increasing the economic reuse of the water without treatment; and
- Minimisation of impacts through capture, containment, reuse & reclamation of contaminated water thereby preventing discharges/releases.

6.4.1 Storm water

DCM East will implement the stormwater management strategy (Section 5.4) to ensure that dirty water and clean water are kept separate.

6.4.2 Groundwater

The mitigation strategy for the storage of dirty water in the pollution control dams is addressed by lining the dams to prevent seepage. The mine engineer will continue to monitor the liner system to ensure that the integrity of the system is not compromised, to avoid groundwater contamination.

6.4.3 Waste and wastewater

All the general waste will be sorted and separated into recyclable and non-recyclable waste. DCM East will implement the waste management hierarchy (reduce, reuse and recycle).

The DCM East mine engineer will continue to monitor the pollution control dams' liner systems to minimize leachate.

6.5 Options analyses and motivation for implementation of preferred option (Optional)

Currently, only opencast mining is practiced and in future undermining will be undertaken. Two opencast pit are currently mined on the eastern side and western side of the resource area with mining taking place in both the 2 and 4 seams. Dorstfontein Mines is now planning to extend its operations on the western side of the mine referred to as Pit 1 extension. The area is part of the current approved mining right area but it has not been included in the current Environmental Management Programme Report and Life of Mine. Additionally, a water pipeline is to be constructed.

Although there is little difference between the proposed opencast methods between Option 1 and Option 2, the decision to go with either has apparent negligible socio-economic impacts. However, the continuation and assumed extension of employment of workers currently working on the Dorstfontein East operations suggests that Option 2 is the preferred option. This is because the livelihoods and employment status of those workers will be maintained, resulting in job security and sustainable livelihood outcomes for both workers and their dependants. This is of particular importance to those employed form the local area because of the low socio-economic base and vulnerability to poverty and unemployment.

6.5.1 Alternative 1

In Alternative 1, the opencast method of mining will continue as normal from the existing Pit 1 until the planned pit is depleted. The Pit 1 Extension will follow with a slight change in the mining direction until the complete Reserve is depleted. The production rates may be adjusted from time to time during the life of Pit 1 extension. The planned production rates at the time of compiling the depending on the strip lengths. Mining Work Program was to mine the opencast at a RoM production of ± 180 Kt per month mining both the No. 4 Seam Upper and Lower and the No. 2 Upper and Lower seam in a roll over method of opencast mining. Production is planned to ramp up from 500 Kt to 1.3 Mt per annum over a 10-year period. Current estimates indicate a LoM of 10 years for the Pit 1 NW Extension. The Life of Mine (LOM) for the Pit 1 Extension was determined using a scheduled production rate of 180 Kt per month (2.16 Mt per annum) for the extraction of the Coal Resource.

6.5.2 Alternative 2

Opencast and Underground Mining Phases

Option 2 is to mine the Pit 1 Extension by means of opencast methods on the right hand side (right hand side of the igneous intrusion-sill break through) North Eastern side of the Pit 1 Extension and to mine the left hand side North West of the Pit 1 Extension by means of conventional mechanised underground mining using continuous miners.

Opencast Mining for the Area to the East

Earth moving mining equipment will be used to conduct the Open Cast (OC) mining on the right hand side of the igneous intrusion (sill break through), that will be a combination of excavators, front-end-loaders as well as in-pit coal drilling machines, haul trucks and track bulldozers (as in option 1). Underground operations will commence once the OC operation has been completed. The production will be at a reduced rate of ~40 Kt per month (480 Kt per annum). This reduction in tonnes is due to limited pit length. The estimated LoM for the opencast mine will be ~7 years.

Underground Phase of Alternative 2

The Underground (UG) construction phase in Option 2 will commence at the end of 2021 with first production planned for April 2022 ramping up to full production by June 2022. The second section will be introduced in Mach 2023 as pit room is opened up by the first section. Estimates show that the UG LOM for No. 4 Seam Lower mining is two years. No UG mining for the No. 2 Seam is planned.

Table 6-3: Summary of Proposed Alternatives

Option 1	Option 2 Opencast Phase	Option 2 Underground Phase
Mining Method		
• Opencast method of mining will continue as normal from the existing Pit 1 until the planned pit is depleted; • Pit 1 Extension will follow with a slight change in the mining direction; and • Roll over method suggested. The roll over method involves the removal of a long strip of overburden. This method is favoured where coal is located close to the surface.	• Pit 1 Extension will follow existing pits depletion; and • Mining of Pit 1 Extension by means of opencast methods on the right hand side of the North Eastern side of the Pit 1 Extension and to mine the left hand side North West of the Pit 1 Extension.	• Underground construction phase in Option 2 will commence at the end of 2021; • First production is planned for April 2022 ramping up to full production by June 2022; • The second phase will be introduced in March 2023 as pit room is opened up by the first section; and • Will be mining the No. 4 seam only.
Equipment Used		
• Combination of excavators, front-end-loaders as well as in-pit coal drilling machines, haul trucks and track bulldozers.	• Opencast mining for the area to the east through the use of earth moving mining equipment to conduct the opencast mining on the right hand side of the igneous intrusion (sheet of newer rock that has “intruded” between older layers of rock); and • Here, the addition of a combination of excavators, front-end-loaders as well as in-pit coal drilling machines, haul trucks and track bulldozers (as in Option 1).	• Conventional mechanized underground mining using continuous miners.
Estimated Production		
• Production rates may be adjusted during the life of the Pit 1 Extension; • Opencast will be mined at a run of mine production of ± 180 Kilotons per month mining both the No. 4 and No. 2 seam; and • Production is planned to ramp up from 500 Kilotons to 1.3 Megatons per annum over a 10 year period.	• Production at a reduced rate of estimated 40 Kilotons per month (480 Kilotons per annum); and • Reduction due to limited pit length.	• 1 191 630 tons in 2022, reducing to 688 908 tonnes in 2023.
Life of Mine		
• Estimated LOM: 10 years.	• Estimated LOM: 7 years.	• Estimated LOM: 2 years.

6.5.3 Pipeline Routes

There are three alternative pipeline routes that were identified for the proposed Dorstfontein Extension Project. All three routes, to some extent, use existing roads and infrastructure corridors. This is particularly true of Route 1, which makes use of existing farm and mine roads and crosses the R544. As such, Route 1 is the preferred route, as it does not dissect as many of the surrounding cultivated farms, which is the case for both Routes 2 and 3. Importantly, all three routes are in close proximity to or dissect agricultural areas; however, it has been assumed that the majority of the pipeline infrastructure will be buried. As such, the real interruptions to everyday access and farm activity will occur at construction as the pipes are excavated and installed on agriculture lands. Following this, farmers would be able to continue their activities, if the pipelines largely run underground.

srk consulting	PIT EXTENSION AND PIPE CONSTRUCTION Photographs along the Pipeline Routes	Project No. 499507

Figure 6-1: Photographs along the Proposed Pipeline Routes

6.5.4 No-Go Alternative

If the project does not go ahead, then the economic benefits of expanding Pit 1 will not be realised through Exxaro. If Exxaro were not to proceed with the proposed operation, mining of these reserves will not necessarily be avoided, as another application in terms of the MPRDA and NEMA can be made by another company.

The proposed project will lengthen the LoM, which directly affects job opportunities in the area, through lengthening their terms of employment. Should the project not go ahead the identified biophysical, social and cultural impacts will not be experienced and the Dorstfontein Mines will be forced to close down prematurely?

Although a number of biophysical, social and cultural impacts have been identified, these can be mitigated and managed in accordance through the implementation of the EMPr and monitoring recommendations.

6.6 IWWMP Action Plan (Priority actions and other short, medium and long term actions)

Provision has been made for the operational, as well as the decommissioning, closure and post closure phases. Due to the expected life of the landfill site, the measures and action plan for the decommissioning and post closure phase are broad and generic, and should be revised once these phases are imminent.

The action plan for the implementation of the measures described above is provided in Table 6-4

Table 6-4: IWWMP action plan for Dorstfontein East Extension

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	Timeframe	Executing Party	Monitoring Party	
Prevent groundwater contamination.	All spillages will need to be cleaned up as soon as practically possible.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Proper management of stormwater drainage infrastructure should be ensured.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Maintain construction vehicles and encourage contractors to report, react and manage all spills and leaks so that action can be taken to immediately minimise contamination to the groundwater.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Employees will report spillages as soon as they are discovered and the spillages will be cleaned up immediately.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Grouting and capping of boreholes located within the footprint of construction activities be required prior to construction activities	Prior to construction	Contractor	ECO / SHE Representative	Pre-Construction
	Groundwater monitoring of boreholes should continue as per the WUL and approved monitoring programme	Monthly	Contractor	ECO / SHE Representative	All Phases
	Spill kits will be made available in areas of likely spillage.	Monthly	Contractor	ECO / SHE Representative	All Phases
	All hydrocarbon storage containers will be stored within a bunded areas which are water tight and able to contain 110% of the stored volume.	Monthly	Contractor	ECO / SHE Representative	All Phases
	All equipment utilising hydrocarbons will be stored on a hard standing surface.	Monthly	Contractor	ECO / SHE Representative	All Phases
Rehabilitate mining areas.	All mined areas should be flooded as soon as possible to bar oxygen from reacting with remaining pyrite.	As soon as possible following operation.	Contractor	ECO / SHE Representative	Decommissioning
	The final backfilled opencast topography should be engineered such that runoff is directed away from the opencast areas.	Following operation	Exxaro	SHE Representative	Decommissioning
	The final layer (just below the topsoil cover) should be as clayey as possible and compacted if feasible, to reduce recharge to the opencasts.	Following operation	Exxaro	SHE Representative	Decommissioning
	Surface water monitoring of the streams will be essential.	Following operation	Exxaro	SHE Representative	Decommissioning

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	**Timeframe**	**Executing Party**	**Monitoring Party**	
	Quarterly groundwater sampling should be done to establish a database of plume movement trends, to aid eventual mine closure.	Following operation	Exxaro	SHE Representative	Decommissioning
	The drilling of boreholes into mining areas is recommended so that recovery of water in mining areas can be monitored.	Following operation	Exxaro	SHE Representative	Decommissioning
Minimise AMD potential.	Limiting the amount of water entering the voids left by the mined out areas can be achieved by replacing spoils in such a manner as to be free-draining and preventing the collection and pooling of water on rehabilitated mined land and thus reducing the volumes of water infiltrating into the old box cut.	Following operation	Exxaro	SHE Representative	Decommissioning
	An impermeable or partially permeable layer should be recreated at variable depth within the rehabilitated landscape.	Following operation	Exxaro	SHE Representative	Decommissioning
	Treating of decanting mine water to acceptable water quality levels can be achieved by the installation of a treatment plant. Exxaro must continue with the investigations to the most effective way to possibly treat water on site if needed at the end of LoM.	Following operation	Exxaro	SHE Representative	Decommissioning
Prevent erosion and sedimentation.	Construct in the dry season and install silt bunds.	Monthly	Contractor	ECO	Pre-Construction and Construction
	Erosion control measures will be implemented as soon as erosion has become evident. Water velocity will be reduced as far as feasible.	Monthly	Contractor	ECO	Pre-Construction and Construction
	All litter and debris will be continuously removed during construction.	Monthly	Contractor	ECO	Pre-Construction and Construction
	Erosion can be limited by ensuring that mine vehicles and human movement is limited to project specific dedicated access ways.	Monthly	Contractor	ECO	All Phases
	To prevent the erosion of top soils, management measures may include berms, soil traps, hessian curtains and stormwater diversion away from areas susceptible to erosion. It must be ensured that topsoil stockpiles are located outside of any wetland and riparian areas and areas susceptible to erosion. Stockpiles should be placed away from areas known to contain hazardous substances such as fuel and if any soils are contaminated, it should be stripped and disposed of at a registered hazardous waste dumping site.	Monthly	Contractor	ECO	All Phases

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	**Timeframe**	**Executing Party**	**Monitoring Party**	
Prevent surface water contamination and reduction in water quality.	Operate using best practises by storing hazardous substances in an adequately sized bunded area, with appropriate safety equipment.	Monthly	Contractor	ECO	Construction
	Place spill kits on site which are operated by trained staff members for the *adhoc* remediation of minor chemical and hydrocarbon spillages.	Monthly	Contractor	ECO / SHE Representative	Construction and Decommissioning
	Access to the construction site will be controlled.	Daily	Contractor	ECO / SHE Representative	All Phases
	Refuelling areas will be bunded and nozzles protected from spillage during refuelling.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Vehicular access to the stream will be restricted.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Proper management of stormwater drainage infrastructure should be ensured.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Hazardous substances stored on site will be stored within a designated bunded areas fitted with a sump and value. Collection of water within the bunded areas will be deemed hazardous and disposed of as such..	Monthly	Contractor	ECO / SHE Representative	All Phases
	Bunded areas will be water tight and inspected for leaks on a frequent basis. Leaks to the bunded areas will be rectified as soon as possible.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Drip trays will be utilised for the collection of leaks from vehicles and machinery parked for long period of time.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Should a spill occur, this will be handled at the source of the leak and prevented from transpiring to nearby watercourse.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Ensure that routine maintenance on all vehicles is undertaken as per maintenance schedule and records are kept.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Sewage spillages will be seen as hazardous waste and will be handled as such.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Frequent monitoring of the pipeline should be done to ensure leakages are identified and repaired timeously.	Monthly	Exxaro	SHE Representative	Operation
	Runoff from compacted and built-up surfaces should be slowed down by the strategic placement of berms.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	Timeframe	Executing Party	Monitoring Party	
Ensure adequate clean and dirty water separation.	Construct diversion drains around the site timeously prior to operation.	Prior to Construction	Contractor	ECO / SHE Representative	Construction and Operation
	Ensure adherence to GNR 704 of the NWA.	Prior to Construction	Exxaro	ECO / SHE Representative	Construction and Operation
Minimise Turbidity of local streams.	Construct sediment collection paddocks downstream of the working activities to minimise uncontrolled runoff from the site.	Prior to Construction	Exxaro	ECO / SHE Representative	Construction, Operation, and Decommissioning
	Minimise the areas that are to be stripped of vegetation.	Monthly	Exxaro	ECO / SHE Representative	Construction, Operation, and Decommissioning
	Adequate storm water management should be considered in the detailed design of the proposed infrastructure in order to minimize undue erosion.	Prior to Construction	Exxaro	ECO / SHE Representative	Construction and Operation
	Stormwater runoff will be directed towards natural watercourses.	Weekly	Exxaro	ECO / SHE Representative	Construction and Operation
	The point where the diversion re-enters the natural system must enter the system at the same elevation as the receiving aquatic environment as well as consist of an energy dissipation structures thereby preventing erosion and incision of the natural watercourse.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
	The point where the diversion re-enters the natural watercourse must enter the system where possible at an acute angle to prevent the creation of turbulent flow, erosion and incision.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
Prevent surface water contamination through ineffective waste management and housekeeping.	Waste will be disposed of in accordance to the waste management procedure.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	Housekeeping will be kept up to standard. Housekeeping should be done after every shift.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	A waste management plan will be compiled and approved for implementation of site. This management plant should focus on the waste hierarchy of the NEM:WA.	Prior to Operation	ECO / SHE Representative	ECO / SHE Representative	Pre-Construction, Construction, and Operation
	No waste may be disposed of to land without the necessary legal permits.	Monthly	Contractor	ECO / SHE Representative	All Phases

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	Timeframe	Executing Party	Monitoring Party	
	Waste will be removed from site by an accredited waste removal company and legally disposed of. Disposal certificates will be kept on site for audit purposes.	Monthly	Contractor	ECO / SHE Representative	All Phases
	Sufficient waste receptacles will be placed around the site allowing the separation of waste at source.	Monthly	Contractor	ECO / SHE Representative	All Phases
Minimise proliferation of Alien Vegetation.	Implement an alien plant management and eradication program.	Quarterly	Exxaro	ECO / SHE Representative	Construction and Operation
	Removal of alien vegetation should commence during the construction phase and continue during the operational and decommissioning phases.	Quarterly	Exxaro	ECO / SHE Representative	Construction and Operation
	Care should be taken with the choice of herbicide to ensure that no additional impact or loss of indigenous plant species occur due to the use of the herbicides.	Quarterly	Contractor	ECO / SHE Representative	Construction and Operation
	No vehicles should be allowed to drive through riparian areas during the eradication of alien and weed species.	Quarterly	Contractor	ECO / SHE Representative	Construction and Operation
	Removal of alien and weed species must take place in accordance with existing legislation process and procedures.	Quarterly	Exxaro	ECO / SHE Representative	Construction and Operation
Minimise impact on faunal and floral habitats as a result of waste management.	No dumping of waste should take place. If any spills occur, they should be immediately cleaned up.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	It must be ensured that mining related waste or spillage and effluent do not affect the sensitive habitat boundaries and associated buffer zones or any other surrounding natural habitat.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	No construction-related waste material is to enter wetland or other natural habitats.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
Conserve the ecological and biological structure of wetland habitats.	Access roads for support vehicles, and vehicles used in the construction of the crossings, should not encroach into the freshwater features	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
	Rehabilitation should be conducted in a manner that ensures that the wetland features' conditions are reinstated to as natural a state as possible.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	**Timeframe**	**Executing Party**	**Monitoring Party**	
	The wetland features must be rehabilitated immediately after the construction phase.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
	During the construction phase of the development, all wetland areas other than the immediate areas of crossing are to be demarcated as no-go areas for vehicles and construction personnel.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
Minimise Wetland Destruction.	Wetland areas other than the immediate areas of crossing are to be demarcated as no-go areas for vehicles and construction personnel.	Monthly	Contractor	ECO / SHE Representative	Construction and Operation
	Vegetation removal should be kept at a minimum to avoid loss of freshwater features' assimilation and attenuation abilities.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
Minimise Change and effectiveness of Wetland Service Provision.	In a case where it is impossible to avoid development within the watercourse, it is advisable to minimise the extent and duration of the activities (i.e. during construction and rehabilitation and the use of less invasive methods such as directional drilling techniques) within the watercourse in order to reduce impacts on the biodiversity and Eco services provision.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	Any storage facilities and all other non-essential activities should be located away from the identified wetlands in order to avoid water and soil contamination, which would affect the structure and function of these resources.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	An annual alien vegetation management plan should be implemented throughout the operational phase of the project.	Annually.	Exxaro	SHE Representative	Operation and Decommissioning
Protect the wetlands hydrological functioning	Rehabilitation should be conducted in a manner that ensures that the wetland features' conditions are reinstated to as natural a state as possible.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	As much vegetation growth as possible should be promoted within the wetland features in order to protect soils. In this regard, special mention is made of the need to prevent the loss of large areas of the freshwater features' vegetation and the use of indigenous vegetation species' where hydro seeding and rehabilitation planting (where applicable) are to be implemented.	Monthly	Contractor	ECO / SHE Representative	Construction, Operation, and Decommissioning
	Flow continuity and connectivity of the freshwater features must be reinstated post- construction activities.	Monthly	Contractor	SHE Representative	Operation

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	**Timeframe**	**Executing Party**	**Monitoring Party**	
	Regular monitoring of water quality must be implemented in order to ensure the impacts of runoff and decant of water into wetland resources is prevented or minimised.	Monthly	Contractor	SHE Representative	Operation
Minimise the impact on wetland and riparian habitats.	No construction of infrastructure may take place within riparian and wetland areas and associated buffer zones unless authorisation is granted by the DWS.	Monthly	Contractor	ECO	Construction
	As far as possible all mining activity and infrastructure should be excluded from the wetland and riparian areas and associated 100 m buffer zone.	Monthly	Contractor	ECO	Construction
	If this is not possible, pipelines should be designed to cross drainage lines at right angles and be placed outside of the active channels.	Monthly	Contractor	ECO	Construction
	All areas of increased ecological sensitivity should be designated as No-Go areas and be off limits to all unauthorised construction vehicles and personnel.	Monthly	Contractor	ECO	Construction
	All development footprint areas and areas affected by the proposed mining development should remain as small as possible and any disturbance of sensitive habitat must be actively avoided.	Monthly	Contractor	ECO	Construction
	Construction vehicles must remain on demarcated roads and should not encroach into the wetland areas or their associated buffer zones.	Monthly	Contractor	ECO	Construction
	It must be ensured that contractor laydown areas are located outside of wetland and riparian areas and associated 100 m buffer zones and excluded from clearing activities in order to minimise vegetation loss and resultant erosion and sedimentation.	Monthly	Contractor	ECO	Construction
Minimise soil erosion.	Protect the existing topsoil stockpile area from impacts of erosion, compaction and contamination. If necessary, vegetate and/or cover with appropriate and suitable indigenous grass species.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	Maintain vegetation cover on rehabilitated land and topsoil stockpiles.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	Construct soil erosion protection measures should erosion be identified.	Monthly	Contractor	ECO/ SHE Representative	Construction and Operation

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	Timeframe	Executing Party	Monitoring Party	
Reduce soil sterilisation	All vehicles should be serviced on a regular basis at the specific demarcated areas.	Monthly	Contractor	ECO/ SHE Representative	Construction and Operation
	Any spillage from vehicles should be cleaned up as soon as possible.	Monthly	Contractor	ECO/ SHE Representative	Construction and Operation
	Rehabilitate areas where the planned tasks have been completed.	Monthly	Contractor	ECO/ SHE Representative	Construction and Operation
	Topsoil stockpiles should be protected from contamination of waste, waste water and hazardous materials.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	Waste piles should be placed on impervious layer to prevent direct soil contact.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	Excavate and dispose of any contaminated soil at the appropriate landfill as per waste classification.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
Prevent soil contamination and ensure rehabilitation.	Existing established roads should be used wherever possible.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	Access roads should be designed with a camber to avoid ponding and to encourage drainage to side drains. where necessary, culverts should be installed to permit free drainage of existing water courses.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	The side drains of the roads can be protected with sediment traps and/or gabions to reduce the erosive velocity of water during storm events and where necessary geo-membrane lining can be used.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	Losses of fuel and lubricants from the oil sumps and steering racks of vehicles and equipment should be contained using a drip tray with plastic sheeting filled with absorbent material.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
	Using biodegradable drilling fluids, using lined sumps for collection of drilling fluids, recovering drilling muds and treating them off-site, and securely storing dried waste mud by burying it in a purpose-built containment area.	Monthly	Contractor	ECO/ SHE Representative	Construction, Operation, and Decommissioning
Minimise loss of soil resources.	Instructions must be included in contracts that will restrict construction work and construction workers to the clearly defined limits of the construction site	Monthly	Contractor	ECO	Construction

Objective	Monitoring				Project Stage
	Mitigation Measure and Management Measures	**Timeframe**	**Executing Party**	**Monitoring Party**	
	Locate all topsoil stockpiles in areas where they will not have to be relocated prior to replacement for final rehabilitation	Monthly	Contractor	ECO	Construction
	Map all stockpile locations	Monthly	Exxaro	ECO/ SHE Representative	Construction and Operation
	Topsoil should never be used as a filling material for roads	Monthly	Exxaro	ECO/ SHE Representative	Construction and Operation
	Height of stockpiles be restricted between of 4 – 5 metres maximum. For extra stability and erosion protection, the stockpiles may be benched	Monthly	Exxaro	ECO/ SHE Representative	Construction and Operation
	Reducing slope gradients as far as possible along road cuts and disturbed areas to gradients at or below the angle of repose of those disturbed surfaces.	Monthly	Exxaro	ECO/ SHE Representative	Construction and Operation
	Use drainage control measures and culverts to manage the natural flow of surface runoff.	Monthly	Contractor	ECO	Construction
	Soils should be loosely packed during stockpiling	Monthly	Contractor	ECO	Construction
	Use recycled grey water from washing facilities to spray un-vegetated areas to combat dust	Monthly	Exxaro	ECO/ SHE Representative	Construction and Operation
Minimise mining waste.	Mining will be conducted strictly according to the mine plan submitted to the DMR.	Monthly	Exxaro	SHE Representative	Construction and Operation
	Optimally exploit this resource in terms of tonnage of rock mined and cost as provided for in the mine plan.	Monthly	Exxaro	SHE Representative	Construction and Operation
Minimise cumulative impacts	Through the implementation of all the above mentioned mitigation measures, the overall significance of the activity's impact can be lowered to LOW.	Monthly	Exxaro	ECO/ SHE Representative	Construction, Operation, and Decommissioning

6.7 Control and Monitoring

On-going monitoring will be undertaken throughout the landfill site's lifespan and water related and/or pollution findings will be reported to the DWS.

6.7.1 Monitoring of change in baseline (environment) information (surface water-, groundwater- and bio-monitoring)

Continued monitoring will be undertaken throughout the LoM and findings will be reported to the DWS as follows:

- Surface Water: DCM East will continue with the current surface water monitoring programme as provided in Section5.11.
- Groundwater: DCM East will expand the groundwater monitoring network for the existing and future mining activities as provided in the Hydrogeological Investigation Report (Section 13).
- Bio-Monitoring: DCM East will continue with the current surface water monitoring programme as provided in Section 5.13
- Waste: DCM East will continue with the current surface water monitoring programme as provided in Section5.14

6.7.2 Audit and report on performance of measures

Annual review and auditing is important to ensure systems are up to date and still relevant for current situations and to verify appropriateness and suitability by comparing performance to objectives set. Changes or adjustments to systems are required where review/auditing highlights shortcomings, or gaps occur. Performance should be measured against objectives. Auditing will thus be done:

- Internally (annually);
- Externally (annually); and
- Reporting to the DWS (annually).

6.7.3 Audit and report on relevance of action plan

All existing and new systems need to be reviewed and modified to ensure continual improvement. It is considered good practice to review or audit all systems at least annually and to update the IWWMP as required in the IWUL.

7 Conclusion

7.1 Regulatory status of activity

DCM East was issued with an Integrated Water Use License (IWUL) No. 04/B11B/ACGIJ/957 by the Department of Water and Sanitation (DWS) on 17 December 2014. Refer to section 3.5 above for details of the amendment required. In addition to the IWUL, several IWUL amendments have been issued to ECC.

An application for an Environmental Authorisation for the extension of Pit 1 and the construction of the associated pipeline was accepted by the DMR on 18 July 2017, and the Scoping Report was accepted on 2 August 2017. The Draft EIA/EMPr was submitted to the DMR on 25 October 2017 for comment.

A copy of the EIA/EMPr is attached as Appendix C.

7.2 Statement on water uses requiring authorization, dispensing with the requirement for a licence and possible exemption from Regulations

Water resources in South Africa belong to the people of South Africa and are regulated under the NWA. The Minister of Water and Sanitation is the custodian of all water resources in South Africa on behalf of the people in South Africa.

The extension of Pit 1 and construction of the pipeline require a water use licence as follows:

NWA Section 21	Description of the water use
21 (c) and (i)	Impeding, diverting and altering the flow of water in a watercourse. The development of a maintenance road along the pipeline route, which includes a 10m servitude of approximately 12.5km. This will include surface and ground water management, erosion and soil controls and stormwater management. All three pipeline route options traverse various perennial, non-perennial, channelled valley bottom wetlands and floodplain wetlands. All activities taking place within 500 m of a wetland or watercourse will be licensed under Section 21 (c).
21 (e)	Engaging in a controlled activity identified as such in Section 37 (1) or declared under Section 38 (1). As a result of the proposed mining activities, dust suppression activities will be undertaken using process water.
21 (g)	Disposing of waste in a manner which may detrimentally impact on a water resource. Because of the proposed mining activities, dust suppression activities will be undertaken using process water.
21(j)	Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people: The dewatering process associated with the continuation of mining activities in the Pit 1 extension.

7.3 Motivation in terms of Section 27(1) of the NWA

In terms of section 27 of the National Water Act, 1998 (Act 36 of 1998), a responsible authority must take into account all the relevant factors including:

7.3.1 Section 27 (a): Existing Lawful Water Use

There are no existing lawful water uses applicable to the DCM East mining operation. All water uses have been authorised in terms of the IWUL issued.

7.3.2 Section 27 (b): The need to redress the Results of Past Racial and Gender Discrimination

Black Economic Empowerment:

Effective ownership/ partnership is a requisite instrument to effect meaningful integration of Historically Disadvantaged South Africans (HDSA) into the mainstream economy. ECC aims to achieve a substantial change in racial and gender disparities prevailing in ownership/partnership of mining assets and to pave the way for meaningful participation of HDSA for attainment of sustainable growth of the mining industry.

ECC is part of the multinational French-based energy company, which holds a 50.1% interest in the local operation. The remaining shares are held by BEE partner TOSACO (25%) and Remgro (24.9%).

While DCM's Mineral Rights are held by ECC, DCM is owned by ECC (74%) and Mmakau Mining (26%), its Black Economic Empowerment Partner. ECC and Mmakau have entered into a Joint

Venture (JV) to mine the deposit thereby promoting the newly established mining charter's Broad Based Black Economic Empowerment (BBBEE) requirements.

By maintaining the aims of the mining charter the operation will prepare the workforce, through its training program, to become skilled operators in underground coal mining. This in turn will enable the workforce to become more employable upon closure of the operation. The multiplier effect from the newly created positions will have an immense effect on the local economic region.

Through the JV, ECC and Mmakau plan to participate in a skills transfer exercise. Newly employed graduates from Mmakau will attain the skills which will enable them to become future leaders in the South African coal industry. Although the project is small in comparison to other mining projects, the project is large enough to repay its capital expenditure, and in so doing train the future employees of the mining industry.

As per the social and labour plan, the total labour force (including supervisory staff, skilled, semi-skilled and unskilled workers) associated with the DCM complex is presented in Table 7.1.

Table 7-1: Employment categories and number of employees (December 2013)

Category	African		Coloured		Indian		White	Subtotals (A)	White	Grand totals (B)
	Male	Female	Male	Female	Male	Female	Female		Male	
Top management										
Senior management									1	1
Middle Management	1						1	2	1	3
Junior Management		1						2		2
Core & Critical Skills (1)	2	3						5	1	6
Total of the above	3	4						6		11

Procurement Policy:

An aggressive procurement policy to enhance Black Economic Empowerment (BEE) has been adopted by ECC. The initiative is intended to address the economic imbalances in South Africa by bringing black entrepreneurs into the mainstream of the South African economy.

BEE companies which are considered as suppliers to ECC, are companies with:

- Majority shareholding;
- An effective controlling shareholding; and
- A majority of the board of directors.

Potential suppliers, when applying for registration or wishing to tender, must provide a statement of their ownership/control and internal BEE Programme for assessment. Areas to be covered by such a statement are:

- Black ownership;
- Black management;
- Skills transferred to Blacks using existing suppliers; and
- Commitment to purchasing from Black economic suppliers.

In accordance with the policy adopted, a BEE supplier to ECC will include benefits such as conducting supplier forums annually, providing guidance and training with regard to financial management, marketing and procurement among others, a shared database of equity partners and an enabling and positive environment for those contracted to ECC.

Since 2001, ECC has made much progress in promoting BEE as part of its procurement policy. The transport and security functions were outsourced putting some R30 million into BEE companies. In 2001 the money spent with BEE suppliers was 16% of the company's total expenditure.

Employment Equity (EE):

In line with its vision of 'unlocking the potential of all its employees' and in compliance with the Employment Equity Act, the MPRDA and the Mining Charter, DCM is committed to the process of transforming its operations to reflect the demographic tendencies of our country. This will be achieved by:

- Creating a working environment that is conducive for the recruitment, selection and retention of forty percent (40%) HDSAs in managerial positions and a ten percent (10%) workforce of women in mining;
- Providing development opportunities to all employees with a particular focus on those who have been excluded from the main stream of economic activity as a direct result of unfair discrimination;
- Identifying a talent pool from existing HDSA employees to be fast-tracked;
- If it is not possible to fill posts from within the mine, the mine will recruit HDSAs outside of the company;
- Publishing employment equity statistics on an annual basis and submitting this report to the DME and other relevant stakeholders; and
- The mine will continue to develop a gender specific programme that will:
    - Integrate objectives relating to the attraction of more women into non- traditional mining occupations at the mine into the Human Resource Development Programme;
    - Identify occupations where women particularly excel and target women for employment in such occupations; and
    - Develop the talents of women employed at the mine so that they can take advantage of promotion opportunities.

The mine has an employment equity forum which is made up of representatives from the employees as well as management. The sole purpose of the forum is to ensure that appropriate consultation takes place and that decision making is well considered and coherent.

In keeping with its policy of fair and equitable employment practices, DCM is committed to full compliance with the spirit and requirements of the Mineral & Petroleum Resources Development Act (MPRDA) (Act 28 of 2002) and Employment Equity Act, (Act 55 of 1998).

The EE Plan is endorsed and driven by top management who consider it essential for all employees to be involved, committed and dedicated to ensure that DCM extends its efforts to go "beyond" mere compliance.

The following goals are ascribed in pursuit of the EE plan:

- Maintain the rights and dignity of all employees through fair and non-discriminatory practices;
- Ensure that an environment where employees can realise their full potential is created;
- Transform the demographic profile of the workforce to better reflect the regional and national profiles and achieve the targets set out in the Mining Charter;

- Ensure that a culture where diverse groups can work together in harmony is developed
- and maintained;
- Monitor and maintain EE performance standards at all times;
- Ensure that compliance with EE legislation will not result in the unilateral termination of employee contracts;
- Support will be provided to employees recruited into or placed on accelerated training programmes (talent pool identification with reasonable coaching, mentorship, time, advice and guidance);
- Promotions and other employment opportunities will be dependent on an applicant being suitably qualified to satisfy the inherent requirements of the job;
- Identification and encouragement of HDSA employees with the potential for development, should future vacancies be available; and
- Whilst subscribing to the above, it is important to note that circumstances may require the appointment of external applicants from HDSA and non-HDSA groups.

DCM currently employs 46% women, but has a plan to increase the number of women in mining. To enable DCM to improve the percentage of women in mining and to reach the targets as set out in the Mining Charter, DCM will embark upon the implementation of the following strategy:

- Preferential treatment and consideration will continue to be given to women when filling certain vacant positions;
- Women will be appropriately represented amongst those chosen for accelerated development;
- Women will be appropriately represented amongst the persons to whom bursaries are offered;
- Women will be appropriately represented amongst learnerships;
- Women will be appropriately represented amongst Internships;
- Steps will be taken to address a crèche, to make the working environment more conducive to female employees;
- Annual induction training will contain a module relating to sexual harassment to create an environment which is not prejudicial to women;
- Risk assessments will be undertaken to ensure that the physical, ergonomic, chemical and biological hazards identified in the Code of Good Practice on Pregnancy and Childbirth are present in each position;
- Women in mining issues will be addressed in the employment equity forum, and DCM will ensure that women are represented in the forum; and
- Safety equipment and clothing will be adapted to take account of the ergonomic requirements of women.

Retail Empowerment:

Since 1992 alone, ECC invested more than R70 million in 63 black-owned businesses of which 27 were new projects costing R55 million. ECC's black-owned businesses provide employment to at least 2 200 people who in turn support some 6 500 dependants.

In every new project or routine operation where goods or services are to be bought the ECC policy is to give preference to local/affirmative action parties

For more than 10 years ECC has had strong ties with organised black business, ranging from the Black Management Forum, Nafcoc and all its affiliations to the taxi industry. SABTA, SALDTA and RSM (Retail Service Management) are subsidised on a monthly basis and a ECC employee has been seconded to NAFU on a full-time basis.

At a local level, numerous financial grants and material assistance from the company have helped promote black business in general, for instance:

- Financial support of Johannesburg's Business Opportunity Centre, run by the National Economic Initiative;
- Financial support of several Western Cape organisations: Black & Tan Association, SA National Business Union, Mitchell's Plain Taxi Association, Mitchell's Plain RDP Forum, Western Cape Taxi Task Team, George Taxi Association;
- The Joint Management Development Programme (JDMP), run by ECC in association with the Paris Chamber of Commerce, prepares black candidates for management positions;
- The National African Farmers' Union (NAFU) gets a large annual grant to cover its administrative costs; and
- Financial and other forms of support for numerous seminars, workshops and courses for disadvantaged secretaries, admin-assistants and business people.

7.3.3 Section 27 (c): Efficient and Beneficial Use of Water in the Public Interest

ECC contributes to the efficient and beneficial use of water by adhering to the regulatory provisions as contained in the IWUL and the provisions of the NWA. Water use activities may not commence without an approved water use authorisation.

Furthermore, ECC is committed to responsible management of its approved water uses and strives to adhere to the principles of water conservation and demand management will benefit the community in terms of employment. Monitoring of water resources has been implemented to detect any impacts during the early stages and to mitigate these as soon as practically possible.

ECC has a zero discharge policy and operates a closed water system, i.e. all contaminated effluent is isolated to not impact on the clean catchment area. Dirty water is channelled to a PCD where it is re-used as process water.

The concept of “public interest” is a very complex one. Under the Water Act of 1956, permits were issued to users provided that they used the water beneficially. The use was considered beneficial if the applicant was going to make a profit. Under the National Water Act, Act 36 of 1998, public interest goes much wider. The fact that the applicant has to undertake a public participation process, and the public’s opinion is to be elicited, means that, at least, the public opinion can be gauged by the response and the comments and concerns received.

As public trustee of the water resources, the DWS must ensure that the water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all users. The Minister, through the department has to ensure that the water is allocated equitably and used beneficially in the public interest, while promoting environmental values.

A detailed public participation process for the proposed project was undertaken and all the identified impacts were able to be mitigated taking the other water users into consideration.

7.3.4 Section 27 (d) (i): The Socio-Economic Impact of the water use or uses if authorised

If the water use is authorised, LoM of DCM East will be extended, resulting in the continuation and extension of employment of workers currently working on the Dorstfontein East operations. This is because the livelihoods and employment status of those workers will be maintained, resulting in job security and sustainable livelihood outcomes for both workers and their dependants. This is of

particular importance to those employed form the local area because of the low socio-economic base and vulnerability to poverty and unemployment

The Social Impact:

The authorisation of the proposed water use enables ECC to continue with their initiatives which include, but are not limited to:

- Black ownership and management;
- BEE policy;
- Skills transfer;
- Training initiatives;
- Scholarship opportunities; and
- Other financial contributions made by ECC.
- Skills Development Plan: The Skills development plan addresses improving the accessibility of Adult Basic Education & Training (ABET), and the development and implementation of a Career Progression Plan, a Mentorship Plan and an Internship and Bursary Plan. Broadly, the skills development plan details the respective training that is being provided in terms of the requirements of the operation's business plans and articulates the measures that are in force to ensure the continued career progression of HDSA and women. In terms of the Mining Qualifications Authority (MQA), DCM provides skills training to mine workers during their employment at the operation. All other training, short courses and tertiary studies will adhere to similar criteria and will be guided and aligned to affiliate processes inherent of managing downscaling and Local Economic Development (LED). The income-generating skills will be informed by the relative LED priorities of the ELM.
- Career Progression: In line with the EE target of achieving 40% HDSA in management, a Career Progression Plan has been developed to ensure talent management. The numerical goals that included in the Career Progression Plan are extrapolated from the operation's EE Plan, with the focus on talent pools. The focus is on the management level of Engineering, the aim of talent management is to create 'feedstock' for management positions. The Succession Plan states the numerical targets to be achieved and specifically refers to those candidates from the talent pool 'earmarked' to assume specific senior management positions. Each identified candidate will have an Individual Development Plan (IDP) aligned to his or her career path that will detail experiential and technical development interventions with timeframes assigned. IDP's will be regularly reviewed and aligned with DCM operation's Career Progression principles and objectives and the operation's developmental/competence requirements.
- Mentorship Programme: A mentorship plan is being developed and will be implemented to assist with the identification, training and assessment of mentors. Each succession plan candidate, HDSA and others, will be assigned a mentor. This provides for the facilitation of developmental needs and specifically where relevant the transfer of skills, knowledge and competence to HDSA's in an effort to ensure that their development is fast tracked.
- Internship and Bursary Plan: As a consequence of natural attrition, 'hard to fill' positions may become available. It is in this context that an internship and bursary plan ensures that these critical roles are easily succeeded. More specifically it is DCM operations attempt, through the facilitation of an internship and bursary programme, that interns and bursars will receive the necessary support and assistance they need to complete their qualifications. Although not the sole intention of this plan, interns and bursars are classified as within the talent pool. In cases where DCM

operations have financially supported the incumbent through a bursary etc. a performance review system applicable to academic as well as on-the-job performance will be adhered to. If the incumbent demonstrates interest and commitment to furthering the relationship with the organisation upon completion of their qualification, preference in terms of the offer for employment will be given to them. At this point the incumbent will be in the developmental mainstream and included in the fast tracking talent management programme.

- Job Creation: The benefit of increased jobs can also be translated into economic terms. The additional jobs, in essence, result in additional income creation. This increase in income in the area can be translated into a specific impact ranging from Broad Based Black Economic Empowerment (BBBEE) to poverty alleviation depending on the procurement policy and the construction technology applied. It is anticipated that an increased income can place HDSA in the financial position to acquire all the goods and services that are required to maintain a basic level of living. The DCM East mine is currently mined by a mining contractor. All employees for contractors for the DCM complex are sourced from the Mpumalanga Province, predominantly within the Nkangala and Gert Sibande Municipalities.

Economic Impact

The extension of the DCM East Pit 1 operations is expected to have a positive impact on the economy, which will lead to increased business sales and increased standards of living in the greater community. Increased employment is associated with increased income and consequently with increased buying power in the area, thus leading to new business sales. The economic benefits mostly include an increase in trade such as local shops, accommodation and transport services.

With the increased employment and a subsequent increase in monthly income, increased business opportunities can be experienced within the local environment. The economic benefits that could be generated include an increase in trade, and the development of new trade such as local spaza shops, stalls, etc. as a result of the patronage of construction staff.

ECC contributes towards mine community economic development by using available BEE compliant companies for the provision of goods and services to the mine. ECC is committed to awarding procurement contracts to companies which demonstrate suitable HDSAs participation in Management (and general employment) as well as local companies in order to sustain the local economy of the area.

ECC have also implemented social investment programmes that strive to support various projects aimed at developing human resources and conserving natural resources. ECC is committed to being a responsible corporate citizen and has supported various local initiatives ranging from supporting local schools to providing Health Awareness training to the local communities.

7.3.5 Section 27 (d) (ii): The Socio-Economic Impact of the failure to authorise the water use or uses:

Failure to authorise the water use will mean that LoM will not be extended and the socio-economic benefits that would otherwise be derived from the extension will not be realized.

7.3.6 Section 27 (e): Any Catchment Management Strategy Applicable to the Relevant Water Resource

The DWS, in the spirit of the NWA, recognises the past imbalances relating to water allocation and seeks to regulate water use by enforcing better sharing of water and water related benefits between the whites who have historically been the “high volume water users” and the historically disadvantaged and mostly poor black population.

Catchment Management Agencies (CMAs) are recognised in the NWA as operational institutions to actively support the implementation of integrated catchment (watershed) management policies and strategies at a local level. The agencies are tasked with ensuring that the nation's water resources are protected, used, developed, conserved, managed and controlled in an equitable manner. The CMA is responsible inter alia for: (a) developing and implementing a catchment management strategy that reflects the needs and concerns of all role-players, and coordinating the activities of water users and water. The Olifants River Basin is one of 19 catchment-based water management areas in the country to be managed by a Catchment Management Agency (CMA).

The Olifants River Basin Catchment Management Agency (CMA) is in the process of being established. It will take over direct water resource management responsibilities in the basin currently being performed by DWS. The CMA co-ordinates water-related activities in the basin and provides an effective mechanism for stakeholder participation in water management

7.3.7 Section 27 (f): The Likely Effect of the Water Use to be authorised on the Water Resource and on Other Water Users

Refer to Section 5.5 of this report for the impacts on ground and surface water resources as a result of mining activities.

7.3.8 Section 27 (g): The Class and the Resource Quality Objectives of the Water Resource

An Intermediate Reserve Determination was done for the whole Olifants River Water Management Area (WMA) in July 2001. The full report was attached as an annexure to the original IWWMP submitted to the DWS.

The In stream Flow Requirements to cater for the basic human needs and the ecological environment were first determined for certain reference points (IFR sites) in the Olifants River WMA.

The water quantity reserve for the IFR sites was used to determine the water quality reserve for the basic human needs and the ecological environment. The water quality reserve is termed the resource quality objectives. DCM falls within the River Reach Segments 1-8 of the Upper Olifants River.

The Olifants River is currently a Class C River in terms of the Present Ecological Status, (PES).

7.3.9 Section 27 (h): Investments Already made and to be made by the Water User in Respect to the Water Use in Question

The estimated environmental cost forecast is R 1.254m. The total budget for technical skills and services required to operate the mine are estimated to be R 43.2 m.

7.3.10 Section 27 (i): The Strategic Importance of the Water Uses to be authorised

In strict economic terms, the overall mining industry is paramount to South Africa’s current and future prosperity. The primary value chain alone accounts for 500 000 jobs directly and indirectly creates another 500 000 jobs giving a total contribution of 1 000 000 jobs created for the economy. It produces almost a fifth of GDP and pays a similar percentage of corporate tax. It accounts for half of all traffic moved by Transnet and 94% of the power generated in this country. The value of mining companies listed on the JSE is R1.9 trillion, which represents 43% of the total market capitalisation of the exchange and therefore helps create wealth for millions of South African pension fund holders and investors, while at the same time attracting significant foreign capital flows that help unlock our mineral potential. And, perhaps most critically, more than half of our export earnings are derived from mining and mineral products.

With specific reference to coal mining, just over two thirds (by mass) of domestic coal consumption is utilised for electricity generation by Eskom, the national power utility. Coal- to-liquid-fuel plants, operated by Sasol, account for another fifth of coal consumption. Small merchants, who supply mainly

residential users and small businesses, account for about 2%, metallurgical industries about 3% and cement, chemical and other industries consume the remaining 5% (DMR, 2009). Coal therefore plays a vital role in South Africa's energy-economy: it accounts for 70% of primary energy consumption, 93% of electricity generation and 30% of petroleum liquid fuels.

7.3.11 Section 27 (j): The Quality of Water in the Water Resource which may be required for the Reserve and for meeting International Agreements

The Olifants WMA falls within the Limpopo River Basin, which is shared by South Africa, Botswana, Zimbabwe and Mozambique. The Olifants River flows directly from South Africa into Mozambique, where it joins the Limpopo River. Developments in South Africa can therefore directly impact upon Mozambique.

Of particular importance in this respect is Massingire Dam in Mozambique, located immediately downstream of the border with South Africa, and with the total catchment area of the dam falling within South Africa. Issues related to the management of the Limpopo River below the Olifants confluence, can have a bearing on all the basin States of the Limpopo.

Joint utilisation of the water resources of the Olifants River is facilitated through the bilateral Joint Water Commission between South Africa and Mozambique.

International cooperation with respect to the use and management of the watercourses in the Limpopo River Basin is overseen by the Limpopo Permanent Technical Committee with membership by South Africa, Botswana, Zimbabwe and Mozambique.

A joint hydrometric study of the Limpopo River Basin by the basin countries has recently been completed, and a full basin study has been agreed upon in principle. It is foreseen that a "Limpopo River Basin Commission" may be established in the foreseeable future.

7.3.12 Section 27 (k): The Probable Duration of any undertaking or which a Water use is to be authorised

All the water uses being applied for will be permanent and are as follows, throughout the LoM of Pit 1. Current estimates indicate a LOM of 10 years for the Pit 1 NW Extension.

7.4 Key commitments

In summary, the following key commitments are made in the management of water and waste at DCM East:

- ECC is committed to the implementation of the IWWMP action plan contained in this document and water use licence conditions that will be stipulated in the WUL once issued.
- The IWWMP will be revised and updated as required in this IWWMP;
- DCM East mine engineer will continue to monitor the liner systems to ensure that their integrity has not been compromised;
- Storm water management practices will be maintained throughout the LoM;
- Disposal of wastewater and the operation and maintenance of the systems will be done according to the provisions of this report;
- Water quality monitoring (surface, stormwater and groundwater) and waste and wastewater monitoring, which are legal requirements, will be carried out according to the provisions of this report and/or monitoring proposed in future reviews by independent parties;
- The numerical model shall be updated once every three years or after significant changes in mine schedules or plans by using the measured water ingress and water levels to re-calibrate and refine

the impact predictive scenario. Updates to the model should be carried out more frequently if significant changes are made to the mine schedule or plan;

- ECC shall investigate various treatment options on how to handle the decant water before the closure of the mine.
- The mine closure plan will be reviewed at least once every two years or as specified in the EMPr for the duration of the mine operation period.
- Proper management of the site will be exercised at all times to ensure that no nuisance or health hazards are created.
- Upon occurrence of incidences, the incidence register will be completed (date, time, detail of incident, potential impact, mitigation or management, prevention of incident recurring) to document the incident and management measures and ensure that they are put in place with the necessary equipment and personnel on standby to management such situations.

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendices

Appendix A: IWUL No. 04/B11B/ACGIJ/957

Appendix B: Section 21 (c) and (i) Risk Assessment Results

Appendix C: EIA/EMPr

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